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FOREWORD

Welcome to the Tech-Insight Volume 1, Issue 1 for Academic Year 2020-2021!

This issue showcases a diverse range of research projects, all united by their innovative approach to addressing challenges and opportunities in the digital age. From enhancing educational experiences to streamlining business processes, these studies offer valuable insights and practical solutions.

Here's a glimpse into what you'll find:

- **Education:** Delve into the impact of parental engagement on children's learning during the pandemic, and explore the use of ICT tools in the classroom.
- **Transportation:** Discover how Ant Colony Optimization can optimize routes for small network transport services.
- **Business Management:** Learn about the development of web-based systems for loan management, bakery inventory, rental house management, and sales performance monitoring.
- **Technology Development:** Explore innovative applications like the Class Observation and Monitoring System, the Reinforcement Hub for educational resources, and an enhanced Subject Advising System.

We invite you to delve deeper into these research projects and discover their potential to inspire progress in various fields. We believe their findings will benefit researchers, practitioners, and policymakers alike.

Happy reading!

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Parental Engagement on Edukasyong Pantahanan at Pangkabuhayan: ICT Skills and Availability of ICT Equipment in Children's Learning Amidst Pandemic

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ABSTRACT

One way to address the need of support for continuous education especially during the new normal is thru capacitating parents in using Information Communication Technology. The CoVid-19 pandemic has brought about changes in educational setting worldwide, including public schools in the province of Marinduque, one those is Balimbing Elementary School. The school is currently using learning modules as their teaching-learning modality, with parents as "tutors" at home. One of the domain of Edukasyong Pantahanan at Pangkabuhayan is ICT, having computer basics, internet, and the use of productivity tools in creating knowledge products as its learning competencies for grades 4,5 and 6.

This research opts to understand the relationship between ICT skills of parents/guardians whose children are engaged in modular learning, the type of ICT equipment available to them, and their parental engagement in guiding their children in their lessons in Edukasyong Pantahanan at Pangkabuhayan (EPP).

The study used descriptive correlational study design with stratified random sampling to determine the relationship of ICT skills and availability of ICT equipment to parental engagement. Mean, percentage and ETA correlation was used as statistical.

This study revealed the needs of the parents in capacitating themselves of basic ICT skills to help them guide their children in Edukasyong Pantahanan at Pangkabuhayan. Majority of the respondents are full-time mothers who graduated in the secondary level, comprising almost 38%. Respondents cited "inadequate knowledge and skills on ICT" as their primary concern. In addition, lack of access to ICT equipment and limited time spent with their children in doing their modules makes it difficult for parents to perform their role as "teachers" during pandemic.

It is recommended that the parents be given ICT skills training inline with the learning competencies in EPP learning.

Keywords—parental engagement, ICT skills, ICT equipment, module, pandemic,

I. INTRODUCTION

The United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2020, reported more than 1.5 billion youth around the globe experiencing the effects COVID-19 pandemic on their academic-related activities [1]. With the hope to prevent the introduction and spread of COVID-19 in schools and into the community, the World Health Organization (WHO) suggests prevention and control measures be prepared to ensure the safety of children. School closure or re-opening may affect the safety and security of students. [2]

In the Philippines, the Department of Education (DepEd) reported 21,344,915 enrollees in basic education, both from public and private schools, for School Year 2020-2021 at the end of the enrollment period. [3]

By DepEd Order (DO) No. 12, s. 2020, " *Adoption of the Basic Education Learning Continuity Plan (BE-LCO) for School Year 2020-2021 in the light of the COVID-19 Public Health Emergency*," DepEd will employ multiple learning delivery modalities (LDMs) to guarantee the continued provision of learning opportunities to its learners through blended learning, distance learning, and homeschooling while safeguarding the health of personnel and students.[4]

Balimbing Elementary School is one of the public schools in the province of Marinduque offering basic education not only in Balimbing but to neighboring barangays as well. Balimbing Elementary School implements the use of learning modules as a learning delivery modality. Students receive modules and have their accomplishments be picked up every week. This has also become a weekly routinary activity for parents.

It is regarded that parents (biological/adopted mother/father of the child) and guardians (a person who looks after and is legally responsible for the child other than the

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parents) become the "tutors" inside the house. The study of Carunungan and Robles in 1986 revealed that from the children's viewpoint, mothers are more nurturant, more powerful in giving directives, and better organize the child's activities. [5] Strong academic support from parents contributes to students' success.[6] Moreso, parents were in the process of involving themselves in their children's academic activities. This also revealed that the students performed well in class during online learning modalities[7]. There is a positive and convincing relationship between family involvement and student success.[8]

Social Structure	Grade Level		
	Grade 3	*Grade 4*	*Grade 5*
No. of Students	30	32	32
No. of Participants	13	17	17
No. of Males	0	5	9
No. of Females	13	12	8

Edukasyong Pantahanan at Pangkabuhayan (EPP) is one of the subjects under the K to 12 Basic Education Curriculum. Among the domain/component of EPP is entrepreneurship & ICT, incorporating computer basics, internet, and the use of productivity tools in creating knowledge products in its learning competencies. [9] Students under grades 4, 5, and 6 take EPP as one of their subjects, with entrepreneurship and ICT discussed on a quarter school year.

In the school setting, teachers are equipped with ICT skills and there is a facility with ICT equipment where students can do their activities. Now, with the current situation due to the pandemic, the students do modules at home, parents/guardians have embraced the role of being the teacher of their children.

This study seeks to understand the relationship between the ICT skills of parents and ICT equipment to their engagement in their child's studies in EPP (entrepreneurship & ICT) thru the following:

1. The ICT skills of the parents/guardians;
2. The profile of parents/guardians in terms of parental engagement;
3. The available ICT equipment used by parents/guardians;
4. The relationship between ICT skills of parents and guardians and the parental engagement; and
5. The relationship between the availability of ICT equipment's and parental engagement.

II. METHODOLOGY

The study used descriptive correlational study design with stratified random sampling to determine the relationship of ICT skills and availability of ICT equipment to parental engagement. A descriptive-correlational study determines the degree of relationship between two or more variables [10]. Futhermore, this research design was also used to examine differences among the respondents in terms of their demographic data. This study employed stratified random sampling - a sampling technique applied on studies whose population is distributed into subgroup from which the samples were randomly selected [11]. The said sampling method is usually used on surveys such on this study having grade levels as the strata. The number of samples for this study was identified using the Slovin's formula: n= N / (1+Ne2), n= the number of sample (47), and N=the total population (94).

TABLE I. SOCIAL STRUCTURE, NUMBER OF STUDENTS AND PARTICIPANTS OF THE STUDY.

The study used a self-developed instrument that was crafted through query with the stakeholders – parents, barangay officials, school administrators, and faculty members of Balimbing Elementary School, and with the use of the K to 12 Curriculum Guide for EPP of grade levels 4, 5, and 6. The concerns and ideas shared by the stakeholders during the conversations were considered in constructing the survey questionnaire. Limited number of students who submitted module outputs on ICT related subjects is one of the concerns raised by one of the faculty members. In addition, lack of ICT equipment in households and limited ICT skills and knowledge of the parents and guardians that serve as tutors were also identified as main reasons that hurdle the submission of outputs for ICT related subjects specifically on EPP. Curriculum Guides are documents used as manuals that outline the content, content standard, performance standard, learning competencies, and learning materials of all the subjects. The K to 12 Curriculum Guide for EPP of grade levels 4, 5, and 6 served as reference in identifying necessary ICT skills that the parents must possess. The survey questionnaire was then validated by experts from the field of ICT.

The data gathering of the study was made in June 2021. Minimum health protocols were observed during the data gathering of the study. The researchers asked permission to the principal of Balimbing Elementary School, then to the Barangay Chairperson of barangay Balimbing, Boac, Marinduque to administer the data collection the study. After the approval, letters of consent were given to the respondents and assured them that their data will be treated with utmost confidentiality and with anonymity that their identity will be protected and that their participation in the study completely voluntary: therefore, the participation of each respondents may be discontinued at any time without penalty.

Data for this study were obtained from the survey questionnaire answered through an interview with the parent or guardian. Reference [12] defined survey as series of

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questions asked to individuals to obtain statistically useful information about a given topic. The data were completed voluntarily and returned to the researchers. The questionnaires were then collected, organized, presented, analyzed and interpreted.

The data gathered was subjected to various statistical methods through the use of SPSS.

The following statistical tools were used in this study:

- **Mean** – this was employed to compare the ICT skills, availability of ICT equipment, and parental engagement scores among parents and guardians.
- **Percentage** – this was used to describe ICT skills, availability of ICT equipment, and parental engagement profile of the parents and guardians.
- **Eta Correlation** – this was utilized to know the relationship and association of ICT skills and availability of ICT equipment to parental engagement.

III. Results and Discussion

A. Parents and Guardians ICT Skills

ICT skills include the learning competencies set in the EPP K 12 Curriculum. They were classified into three (3) groups according to how complicated they were when executed. They are categorized as a) Beginner; b) Intermediate; and c) Advance.

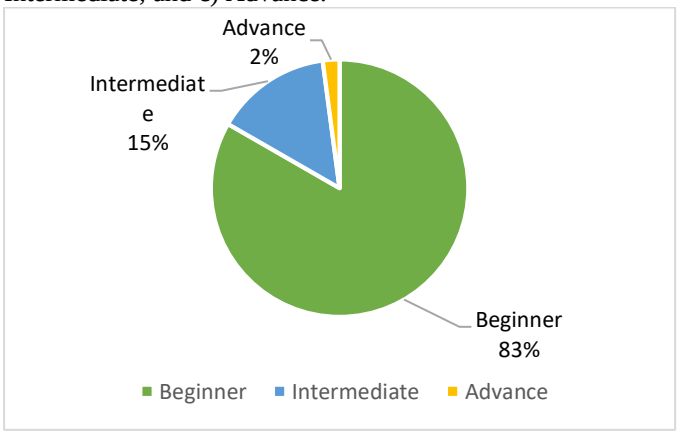

Figure 1 Parents/Guardian ICT Skills

ICT skills of the parents/guardians contributes to the learning of their child as they mentored them in studying; this is found in most respondents as shown in Fig. 1. More than half of the respondents are in the beginner's level (83%), folder creation, add/rename/delete, basic keyboard and mouse operations, web search, copy and download, tables and charts, sort and filter and send/answer email are the learning competencies included. It will be helpful if the parents/guardians develops their ICT skills.

ICT Skills of the parents/guardians according to profile

Table 1. ICT skill according to Age

AGE GROUP	ICT SKILLS			
	Beginner	Intermediate	Advance	
Adolescent (13-18)	0.0%	2.1%	0.0%	
Adult (19-59)	75.0%	12.5%	2.1%	
Senior (60 and above)	8.3%	0.0%	0.0%	
TOTAL	**83.3%**	**14.6%**	**2.1%**	**100 %**

There are three age groups in which the parents/guardians belong: adolescent (13-18 yrs. old), adult (19-59 yrs. old) and senior (60 and above). As shown in Table 1 age group, it is observed that among to the 83.3% in beginner level belongs to the adult group 35 (75%) and 4 (8.3%) to the senior group of the parents/guardians. While under intermediate skills, adolescent group has 1 (2.1%) and 6 (12.5%) adults of the parents/guardians. However, 1 (2.1%) adult possess advance skills. It is found that most of the parents/guardians are in the adult regardless of their ICT skills.

Table 2. ICT skill according to Sex

SEX	ICT SKILLS			
	Beginner	Intermediate	Advance	
Male	27.1%	2.1%	0.0%	
Female	56.3%	12.5%	2.1%	
TOTAL	**83.3%**	**14.6%**	**2.1%**	**100%**

On the other hand, Table 2 shows that most of the parents/guardians are female. Out of the 83.3% of parents/guardians in the beginner level, 26 (56.3%) are female and 13 (27.1) are male. 14.6% of the Intermediate level has 6 (12.5%) female and 1 (2.1%) male parents/guardians. Lastly, in the advance level in which 1 (2.1%) female parents/guardians.

Table 3. Work of Parent/Guardian

	ICT SKILLS

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WORK OF PARENT/ GUARDIAN	Beginner	Intermediate	Advance	
Fulltime Mother	50.0%	2.1%	2.1%	
Fulltime Father	14.6%	0.0%	0.0%	
Barangay Health Worker	2.1%	0.0%	0.0%	
Barangay Secretary	0.0%	2.1%	0.0%	
Barangay Tanod	4.2%	0.0%	0.0%	
Warehouse Man	4.2%	0.0%	0.0%	
Online Seller	2.1%	4.2%	0.0%	
Dishwasher	2.1%	0.0%	0.0%	
Vendor	2.1%	0.0%	0.0%	
Teacher	0.0%	2.1%	0.0%	
Retired	2.1%	0.0%	0.0%	
Not Applicable	0.0%	4.2%	0.0%	
TOTAL	**83.3%**	**14.6%**	**2.1%**	**100%**

Table 4. Educational Attainment of Parent/Guardian

HIGHEST EDUCATIONAL ATTAINMENT	ICT SKILLS			
	Beginner	Intermediate	Advance	
Elementary	20.8%	2.1%	0.0%	
High School	37.5%	0.0%	0.0%	
College	16.7%	10.4%	2.1%	
Master's Degree	0.0%	2.1%	0.0%	
Vocational Course	8.3%	0.0%	0.0%	
TOTAL	**83.3%**	**14.6%**	**2.1%**	**100 %**

It is also found in Table 3 that the parent/guardian in the beginner ICT skills level has (83.3%) most of them are full time mothers. Intermediate level has (14.6%) and advance with (2.1%). Education attainment of a parent/guardian also plays an important role in determining their ICT skills. Their acquired learnings in their educational background contributes to their skills. The Table 4 shows that most in the beginner level attained high school and elementary level. This pertains that basic competencies are being acquired in the low level of education. Those parents/guardians who acquired intermediate and advance ICT skills have been able to acquire college level education. It only means that acquiring ICT skills level has something to do with the educational background of a parent/guardian may have.

B. Parental Engagement

Parental engagement helps children to understand the needed competencies. Parents spent time in supervising their child in doing modules in a week. ffering education support to children from their parents, concerning issues such as homework, would help children to create an everyday routine of learning [13].

Table 5. Hours Spent by the Parent/ Guardian in Guiding the Child when grouped according to ICT Skills

ICT Skills	Mean	Mode	Min	Max
Beginner	2.68 hours/ week	2 hours/ week	1 hour/ week	10 hours/ week
Intermediate	2.29 hours/ week	1 hour/ week	1 hour/ week	5 hours/ week
Advance	1 hour/ week	1 hour/ week	1 hour/ week	1 hour/ week
Total	**2.58 hours/ week**	**2 hours/ week (37% of the parents/ guardian)**	**1 hour/ week**	**10 hours/ week**

Table 5 shows that the more advanced the parents are in ICT skills, the lesser they spend hours with their children guiding them in their lessons in EPP. Capacitating the parents/guardians more will make them more competent and will takes them fewer hours in guiding their child.

C. Availability of ICT equipment used by Parents/Guardians

Table 6. Hours Spent by the Parent/ Guardian in Guiding the Child when grouped according to Available ICT Equipment

ICT Equipment	Mean	Mode	Minimum	Maximum
None	1.63 hours/ week	2 hours/ week	1 hour/ week	2 hours/ week
Smart Phone/ Tablet	2.82 hours/ week	2 hours/ week	1 hour/ week	10 hours/ week
Desktop/ Laptop	None	None	None	None

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Smart Phone/ Tablet and Desktop/ Laptop	2.67 hours/ week	3 hours/ week	1 hour/ week	5 hours/ week
Total	**2.58 hours / week**	**2 hours/ week (37% of the parents/ guardian)**	**1 hour/ week**	**10 hours/ week**

ICT equipment are communication and computing devices owned and used by parents/guardians as a tool to aid their children in learning. The study of Ghavifekr and Rosdy revealed the positive outcome of ICT integration for educators and learners. One of the main factors in the success of technology-based teaching and learning is teachers' having a well-equipped preparation with ICT tools and facilities. [14]

Table 6 presents the availability of ICT equipment to parents/guardians. They were categorized as a) Not Available; b) Handheld Devices such as Smartphones and Tablets; c) Computing Devices such as Desktop and Laptop; and d) both Computing Devices and Handheld Devices. Parents/guardians with handheld devices such as Smartphones and Tablets spend longer time supervising their children in a weekly basis while the parents/guardians who does not use any ICT equipment has the least number of hours spent with their children in doing activities in EPP.

D. ICT skills of parents/ guardians and the Parental engagement

Table 6. Relationship between ICT skills of parents/ guardians and the parental engagement

Correlation	Interpretation	Eta-squared	Interpretation
0.141	Weak Relationship	0.019881	ICT skills of parents/ guardians have 1.9881% effect on the parental engagement.

The table shows that there is an association between ICT skills of parents/ guardians and the parental engagement with a correlation of 0.141, but it is weak. This reveals that ICT skills of parents/ guardians have 1.9881% effect on parental engagement.

This indicates that for the parent/ guardian to be more engaged in teaching their child, mostly on ICT related subjects, they shall have a better ICT skills to be used in guiding their children.

E. The availability of ICT equipment and Parental engagement

Table 7. Relationship between the availability of ICT equipment and parental engagement

Correlation	Interpretation	Eta-squared	Interpretation
0.228	Moderate Relationship	0.051984	Availability of ICT equipment have 5.1984% effect on the parental engagement.

The result shows that there is an association between available ICT equipment of parents/ guardians and the parental engagement with a correlation of 0.228, and it is moderate relationship. This reveals that available ICT equipment of parents/ guardians have 5.1984% effect on parental engagement.

This indicates that for the parent/ guardian to be more engaged in teaching their child, mostly on ICT related subjects, they shall have the needed equipment. Availability of equipment may help the parent/ guardian to learn the needed ICT skills, or improve their beginner ICT skills.

IV. Summary, Conclusion and Recommendations

A. Summary

The CoVid-19 pandemic has brought about changes in educational setting worldwide, including public schools in the province of Marinduque, one those is Balimbing Elementary School. The school is currently using learning modules as their teaching-learning modality, with parents as "tutors" at home. One of the domain of Edukasyong Pantahanan at Pangkabuhayan is ICT, having computer basics, internet, and the use of productivity tools in creating knowledge products as its learning competencies for grades 4,5 and 6.

The study used descriptive correlational study design with stratified random sampling to determine the relationship of ICT skills and availability of ICT equipment to parental engagement. Mean, percentage and ETA correlation was used as statistical.

Result of the study shows that:

1. Almost 83%of the parents/guardian have beginner ICT skills in ICT while almost 2% of the respondents have advanced skills in ICT.
2. The parents and guardians with advanced ICT skills spend less time with their children in guiding them with their lessons in EPP.

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3. More than half (58%) of the respondents have available smart phones and tables while almost17% have no access to any ICT equipment.
4. There is a weak relationship between ICT skills of parents and guardians and the parental engagement; and
5. The moderate relationship between the availability of ICT equipment's and parental engagement.

B. Conclusions

With results of the study, it is there concluded that:

1. Majority of the parents/guardians are beginners in terms of their ICT skills.
2. Parents with advanced ICT skills are spending less time with their children, since they are capable in guiding them in their lesson.
3. Most of the parents/guarding has handheld devices such as smartphones and tables. However, based on the k 12 Curriculum Guide for EPP, the learning competencies requires computer based knowledge that can only be performed through the use of computers.
4. ICT skills of parents/guardians somehow affects and parental engagement.
5. The availability of ICT equipment's moderately affects the parental engagement.

C. Recommendations

With the conclusions given, here are the recommendations:

1. For the parent/ guardian to be more engaged in teaching their child, mostly on ICT related subjects, they shall have a better ICT skills to be used in guiding their children.
2. This indicates that for the parent/ guardian to be more engaged in teaching their child, mostly on ICT related subjects, they shall have the needed equipment. Availability of equipment may help the parent/ guardian to learn the needed ICT skills, or improve their beginner ICT skills.
3. There should be an ICT Skills Training designed for parents/guardians to help them guide their children in EPP and ICT related courses.

This indicates that for the parent/ guardian to be more engaged in teaching their child, mostly on ICT related subjects, they shall have the needed equipment. Availability of equipment may help the parent/ guardian to learn the needed ICT skills, or improve their beginner ICT skills.

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ANT COLONY OPTIMIZATION (ACO) FOR SHORT ROUTE CALCULATION IMPLEMENTED TO TRANSPORT MOBILE APPLICATION FOR SMALL NETWORK TRANSPORT SERVICES IN MARINDUQUE

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Marinduque State College

Abstract

Ant Colony Optimization algorithm (ACO) is a probabilistic technique for solving computational problems in finding good paths through graphs. Combinations of artificial ants and local search algorithms are method of choice for numerous optimization tasks primarily in vehicle and internet routing. The rise of transport network services in urban areas of the country brought efficiency in transport commodity. Despite that, transport services in rural areas still rely on manual calculation for short route. While this challenge has not yet been given solution, transport groups struggle in calculating shortest path distances to reduce road travels, fuel and time consumptions. This study aims to design and develop a transport network application integrated with Ant Colony Optimization (ACO) algorithm for quality best route calculation. Thus, assess its performance efficiency using Test Quality Best Route (TQBR) and the software quality characteristic using International Organization Standards (ISO) 20510. The researcher adopted the developmental research as its fact-finding through sufficient and precise interpretation of data and their findings. Thirty (30) individuals composed of transport operators and passengers participated in evaluating the developed transport application. Through thorough analysis and evaluation of the data gathered from the participants through the initial testing and their evaluation, the results of the TQBR simulation and ISO 25010 evaluation shows the integration of Ant Colony Optimization has improved "the user's travel comfort", provides better optimization ability and user comfort than the baseline algorithms. Moreover, ACO's pheromones show that the shortest the path, the stronger is the concentration as proven through the simulation of the application. Based from the results, this developed network application is recommended to small transport services group, logistics companies performing delivery services, travelers and general population.

Keywords: Ant Colony Optimization, Transport Network Application, Small Transport Services, Short Route Calculation

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INTRODUCTION

Transport services possibly play a big role in everyday life to people; transferring people to their places of work, homes, and as well the other destinations. While public transports can be used first for commercial purposes in moving people to different locations, this service may also be in form of courier baggage and others. Relatively, the development of mobile Internet technology, user travel information is becoming more and more diversified whereas travel notes, strategies, short videos, and so on have become the main basis for the user route planning (Liang, et al 2021).

As transportation in the Philippines is relatively underdeveloped, partly due to the country's mountainous areas and scattered islands, and partly as a result of the government's persistent under investment in the nation's infrastructure. In recent years, the Philippine government has been pushing to improve the transportation system in the country through various projects (Ibid).

The existence of Transport Network Services in urban areas of the country, rural areas relay to small transport groups, commonly classified as Door-to-Door services, Public Utility Jeepneys (PUJs), tricycle and motorcycles transport services. This however is the most common and convenient means for transportation. These small transport groups do not employ data-enabled application for route optimization to reduce travels and fuel consumptions in providing transport services. Instead, these relay in their experienced drivers to manually estimate or calculate the shortest path distance from point of location to its end-point locations. While these issues have not been given a solution yet in rural areas specifically in the locale of Marinduque, these transport groups still struggle in calculating shortest path distances to reduce road travels, fuel and time consumptions (Rural Health Information Hub, 2021).

Additionally, the above-mentioned dilemma is identified as one of the Vehicle Routing Problem (VRP) in the business logistics. VRP is one of the most significant subjects for logistic activities. To simply expound, VRP involves the time which the vehicle travels from one point to another point of location or simply from start point to end point (Cattaruzza, 2017). One key issue from VRP as subject is that the time spent on the road from point A to B is usually not a constant value in actual life due to factors such as dynamic road congestion, different fatigue degree of driver, vehicle condition and the like. Consonant to that, the time consumed on the road is always expressed through probability, such as the probability of passing from point A to B within 10 minutes is 0.65 for example, while the probability of passing from point A to B within 20 minutes is 0.95. Therefore, the more time spend on the road means the greater the passing probability is (Ibid).

Comparatively to those transport services in urban areas, transport companies service its customers with non-homogeneous fleets of vehicles. Similarly, all transport groups regardless of scale

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fleet have one common problem often traced to as VRP. This is to find a set of routes minimizing the number of travelled kilometers and the number of used vehicles while satisfying customer demand. Commonly, transport network services in urban areas apply software applications; say for example Grab Company in Manila. These software applications are integrated with algorithms to automatically calculate short paths, best route, distance and time etc.

This research aimed to develop a mobile application for small transport groups in Marinduque that features short-path calculation using Ant Colony Optimization (ACO) algorithm. This study was devoted to solving transportation problems with ant colony algorithms. Hence, the specifically aimed to design and develop a transport network application integrated with Ant Colony Optimization (ACO) algorithm for short path calculation, test its efficiency in route calculation and assessed the quality of the developed software using software quality characteristic of the developed application using the ISO 25010.

LITERATURE REVIEW

In the existence of Transport Network Companies and Applications like Grab and other ride hailing group that uses mobile applications, transport groups in Marinduque does not. Familiarity of the driver for each vehicle plays a very important role in this service since short path or route calculation for this group is manually depending on the knowledge of the drive to lessen travel length and time on road while picking up book passenger in different geological areas around the province while no interventions are recorded and made for this transport group ever since.

In connection to the gap in transport condition, the vehicle routing problem (VRP) is an important problem that has been extensively studied by logisticians, operations researchers and mathematicians for the last several decades. This problem is economically important due to the costs associated with providing and operating delivery vehicles to transport products to a set of geographically dispersed customers. When an organization is able to minimize the length of its routes or decrease the number of its vehicles, it is, in theory, able to provide better service to its customers and thereby obtain a more profitable and competitive position. The classic vehicle routing problem typically involves minimizing costs of the combined routes for a number of vehicles. Quite often distance traveled by the vehicles is used as a surrogate for the objective of cost. In the past, the majority of research on the vehicle routing problem has used demand sets with randomly generated customer locations.

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As recognized by logistics researchers (Lee, 2018) that, within the logistics domain, patterns tend to exist in the spatial dispersion of customers. Researches have been conducted to test these spatial dispersion problems and found that that these spatial depressions are more representative in logistics distribution when it comes to products in real-world markets comparatively that the classic operations research problem sets employing more uniform distributions (Pourhejazy, 2016).

Saud, (2018) explains that traveler salesman problem is a routing problem that deals with a fictitious salesman who needs to travel in cities. In the problem, the salesman needs to visit all cities at least once in his route. The salesman will have a starting city, where he will begin his route, and would return to the said city once he has accomplished traversing the selected route. The order of which cities he first visits would affect the total distance travelled. The problem arises in determining the combination of which cities are to be prioritized first, so that the salesman would meet the minimum cost of travel. This combinatorial nature of the problem classifies the TSP as a combinatorial optimization problem and formulates the problem on which order of cities should the salesman take to meet the most cost efficient route.

Chowdhury (2019) presented the Travelling Salesman Problem (TSP) and the application of heuristics in ant colony optimization algorithms. The TSP as one of VRP is commonly solved in using ant colony system by applying the Ant Colony Optimization (ACO) algorithm and comparing it to other traditional algorithm in a form of experiment or simulations. Accordingly to the study of Chowdhury (2019), Ant Colony Optimization (ACO) was useful in solving complex logistic problems. It was found that a change of heuristic causes changes of efficiency and quality of identified solution of an algorithm. Pheromone update heuristics showed high effectiveness, however, it neither shows satisfactory when operated alone. In overall results, ACO is proven to be useful tool in solving problem that are complex for many transportation problems whereas no algorithm may be used for optimal solution due to time needed in identifying them.

Research on the vehicle routing problem (Granada, 2016) has also been of interest within the logistics literature. Cheung (2017) considers the impact of dynamic changes in routes and the effect of newer heuristic techniques on efficiency. Previous research has introduced advanced Metaheuristic approaches such as Tabu Search (Ali, 2018) and Simulated Annealing (Brownlee, 2021), and Ant Colony Optimization (Liang, 2021) to the vehicle routing problem.

As supported International Journal of Science and Research (2019), mass transit network was simulated with Ant Colony Optimization (ACO) algorithm and found to have the same accuracy with other traditional algorithm used in stochastic traffic assignment. It was also highlighted that ACO tends to have less time in simulation. Moreover, there is perfect equivalence in hyper path choice behavior

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between ACO and traditional assignment algorithm obtained in its utilization in addressing VRP.

Route selection for an individual vehicle allows any combination of customers, the vehicle routing problem which is considered a combinatorial optimization problem and the number of feasible solutions for the problem increases exponentially with the number of customers. Additionally, VRP which is directly related to the TSP where an out and back tour from a central location is determined for each vehicle. Since there is no-known algorithm that will find the optimal solution in every instance (Lenstra and Kan 1981), the vehicle routing problem is considered hard. Therefore, the use of heuristics or more advanced Metaheuristics is a reasonable approach for finding solutions to the vehicle routing problem. This advance approach is considered and suggested as the Ant Colony Optimization (ACO), a new modern algorithm test for many contexts in the VRP's.

Ant Colony Algorithm simulates the natural behavior of swarming insects, ant colonies, as they find the most efficient routes between their nests and food sources. The ant's decision-making process is simulated with a search algorithm used by a group of virtual ants that are then used to find improved solutions to the vehicle routing problem. This method is more time consuming than a deterministic algorithm, such as Savings, but has the ability to generate a variety of solutions for each problem.

In other definitions of the Ant Colony Algorithm (ACO) further explain that is a Metaheuristic technique that models the seemingly intelligent behavior of ant colonies, and it models artificial ants to find solutions to combinatorial optimization problems such as the VRP. Ant colonies have the ability to solve complex problems like finding and collecting food and have been shown to do this through the use of the chemical substance pheromone. As an individual ant travels between its nest and a food source, it deposits a trail of pheromone as it moves over the route it takes. This pheromone trail communicates to the other ants previously discovered paths. As a trail is transited more frequently the pheromone trail becomes stronger, and therefore more attractive to following ants. Ants in nature usually, though not always, follow the trails that have the highest concentration of pheromone, where more of their fellow ants are traveling. However, over time, the pheromone deposited on a trail evaporates, causing the trails to become less desirable to later ants. Those trails that are traversed (to the food and back) most quickly, soon become the trails with the highest level of pheromones, thereby encouraging following ants to choose them while further strengthening the trail. However, ants will occasionally branch out and ignore the current best-known-shortest path (the most heavily scented pheromone trail) and search for food on other paths. If they find a shorter route to a food source more quickly, then pheromone accumulation on the new route would over time cause the current solution to be replaced with the new shorter path. As

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newer shorter trails are discovered, older trails' pheromones evaporate, thereby causing the trails to be less desirable to the ants and causing longer paths to be abandoned over time.

In addition to above cited studies, fast traversal algorithm in identifying a path from source to destination with minimum cost is needed (Charde, 2017) in the modern traveling salesmen problem. It was also expounded that cost can be in a form of time, distance or energy. It was further insisted that many efforts in the past to provide time efficient solutions for the traveling salesmen problem has been conducted for obtaining both exact and approximate solution for TSP, whereas Ant Colony Optimization (ACO) has been applied in more complex problem and found to be a useful method and tool for solving shortest path in navigating and path planning. This process of route selection by ants is described as a pseudo-random proportional process (Huang, 2016) and is a primary element of ACO. A more detailed description of ant behavior as it relates to ACO is provided by Dorigo, and Ahmed (2020). Additional descriptions of ACO related to management decision-making can be found in the work of (Li, 2019).

Most recent study in the application of Ant Colony Optimization (ACO) by Ekayanake (2020), ACO tends to be primary aid algorithm in solving transportation problems as such for finding the shortest and can be integrated with Map Editor for converting real models into graph ones; router for routing using a map with roads and Google Map Router for vehicle routing all over the world using Google Maps API as applied to transport software application. This further suggests that ACO can solve that vehicle routing problem in almost context.

Although many techniques and variations of ant colony optimization exist, the general features of the algorithm typically include methods for route construction, pheromone trail updating and final route improvement. The present study focused primarily to development of mobile application intended for transportation commodity and performance observation of the integrated Ant Colony Optimization (ACO) algorithm for short route calculation for small transport service groups in Marinduque. Relevant information pertinent to this study was gathered from different sources. The related literature and studies discussed have greatly widened and deepened the researcher insights into the development of the proposed transport mobile application. Based from the literature gathered pertinent to the current transportation context, such recipient transport groups has no existing mobile application used in their operation in solving short path or route calculation.

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METHODOLOGY

The researcher adopted the developmental type of research to achieve the purpose of the study. This method is a fact-finding study that encompasses sufficient and precise interpretation of data and their findings. This approach is appropriate wherever the object of a class varies among themselves and one is interested in knowing the extent to which different conditions obtain among objects. The data from a descriptive survey was used as basis for influence that may aid in solving practical complications.

For software development, Agile methodology was used or employed to conceptualize the application. This method is mainly used for software development, where demands and solutions evolve through the collaborative effort of self-organizing and cross-functional teams and their customers.

Agile Software development is one of the methodologies in the development of software. Scrum implements the scientific method of empiricism that replaces a programmed algorithmic approach with a heuristic one, with respect for people and self-organization to deal with unpredictability and solving complex problems. One highlight in the Agile Scrum methodology is the Software Development Life Cycle (SDLC). It is a process that produces software with the highest quality and lowest cost in the shortest time. SDLC includes a detailed plan for how to develop, alter, maintain, and replace a software system. SDLC involves several distinct stages, including planning, design, building, testing, and deployment.

Additionally, Ant System (AS) was also employed in the integration of the algorithm in the software. Ant System (AS) Ant System is the first ACO algorithm proposed in the literature. Its main characteristic is that, at each iteration (Birattari & Stutzle (2006). The pheromone values are updated by *all* the *m* ants that have built a solution in the iteration itself. The pheromone τ_{ij}, associated with the edge joining cities*i* and *j*, is updated as follows:

$$\tau ij \leftarrow (1-\rho)\cdot \tau ij + \sum k=1 m \Delta \tau kij \ ;$$

where ρ is the evaporation rate, *m* is the number of ants, and τ k i j is the quantity of pheromone laid on edge (i, j) by ant k:

τ k i j = Q/L k if ant k used edge (i, j)in its tour, 0 otherwise,

where *Q* is a constant, and L_k is the length of the tour constructed by ant k. In the construction of a solution, ants select the following city to be visited through a stochastic mechanism.

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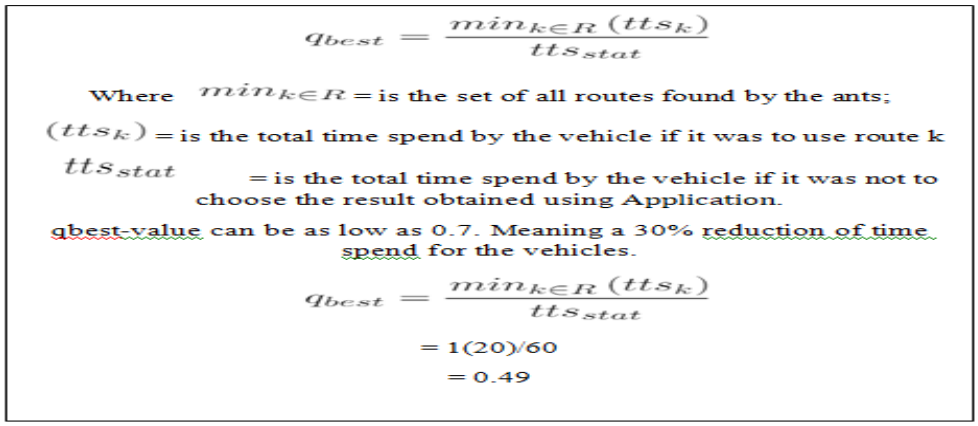

Fig. 1: ACO Best Route Calculation Formula

Figure 1 shows the process of computing the Test Quality Best Route of Ant Colony Optimization. The computed result of the test quality best route is 0.49, which means that the use of the application is efficient for the computed value is less than .70.

In the full-scale testing of the system, thirty (30) individuals as the sample coordinated to participate in the evaluation of the mobile application. Samples were composed of 25 passengers and 5 driver-operators. These samples were considered primary end-users of the mobile applications. The passenger-participants used the passenger side application with its distinct features different from the application that were used by driver/operator participants.

In the collecting the needed data, a standardized survey instrument based on the ISO 25010 Software Quality Characteristics was used to gather the needed data, this instrument was designed and abided by most international universities and companies in computer sciences. The standard instrument was divided into four parts which addresses, respectively, the following subjects: quality model; external metrics; internal metrics; and quality in use metrics. ISO 25010 represents the latest (and ongoing) research into characterizing software for the purposes of software quality control, software quality assurance and software process improvement (SPI).

In gathering the data, the researcher conducted an orientation to the participants who are set to be commuter or passengers for the flow of system testing in the actual travel on road then distribute personally the survey questionnaire to the participants before the testing or the simulation proper began. The participants were allowed to answer the evaluation form at the time set or scheduled testing, this allowed synchronized start point for the testing phase for both users of the system (Passengers and drivers). Continuation of evaluation for other segments of the ISO 25010 survey instrument was carried during the travel on road to better observe the performance of developed system. After the accomplishing

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the evaluation via instrument, the researcher determined all possible path for each travel from depot to end point including the shortest path produced by the algorithm of the system and then measured and compared all the distance for each travel to confirm the internal accuracy data produced by the system using simulation tool. After obtaining all the needed data for the proposed study, it was then treated and analyzed via selected statistical treatments to draw results and conclusions.

When the questionnaires were retrieved, the data were presented in accordance to the sequence of the Objectives of the Study in tabular forms for ease of comprehension. Measure of central tendency i.e. the mean and weighted mean were used in the interpretation of data. Additionally 4-point scale used in order to determine the rank of or the adjectival description of the weighted mean of the responses on the observed characteristic of the transport network system.

RESULTS AND DISCUSSION

In this section, the following results are presented based from the gathered data from the evaluation and simulation of the developed transport network application software.

Table 2: *Functional Suitability of the System*

Characteristic	Rating					Mean	Interpretation
Functional Suitability	5	4	3	2	1		
➢ Completeness	21	8	1			4.67	SA
➢ Correctness	16	14				4.53	SA
➢ Appropriateness	18	12				4.60	SA

The table above shows that the respondents are in agreement with the functional stability as to completeness, correctness, and appropriateness of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.67, 4.53, and 4.60 are interpreted as “Strongly Agree”, which means that the system suits to what are being required by the respondents.

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Table 3: *Performance Efficiency of the System*

Characteristic	Rating					Mean	Interpretation
Performance Efficiency	5	4	3	2	1		
➢ Time Behavior	19	10	1			4.60	SA
➢ Resource Utilization	19	10	1			4.60	SA
➢ Capacity	19	11				4.63	SA

Table 3 shows that the respondents are in agreement with the performance efficiency as to time behavior, resource utilization and capacity of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.60, 4.60, and 4.63 are interpreted as "Strongly Agree", which means that the system performs efficiently.

Table 4: *Compatibility of the System*

Characteristic	Rating					Mean	Interpretation
Compatibility	5	4	3	2	1		
➢ Co-existence	17	10	3			4.59	SA
➢ Interoperability	17	10	3			4.59	SA

The table above shows that the respondents are in agreement with compatibility of the system as to co-existence and interoperability of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.59, and 4.59 are interpreted as "Strongly Agree", which means that the system is compatible to where it would be installed.

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Table 5: *Usability of the System*

Characteristic	Rating					Mean	Interpretation
Usability	5	4	3	2	1		
➢ Appropriateness and Recognition Ability	22	8				4.73	SA
➢ Learnability	20	10				4.72	SA
➢ Operability	18	11	1			4.57	SA
➢ User Error Protection ➢ User Interface Aesthetics ➢ Accessibility	14	13	3			4.48	SA
	18	12				4.60	SA
	19	10	1			4.75	SA

The table above shows that the usability aspect of the system which is being elaborated further by its characteristics is agreed by the respondents. The computed mean, 4.73, 4.72, 4.57, 4.48, 4.60, 4.75, where all have an interpretation of Strongly Agree, would say that the system is really usable.

Table 6: *Reliability of the System*

Characteristic	Rating					Mean	Interpretation
Reliability	5	4	3	2	1		
➢ Completeness	21	8	1			4.67	SA
➢ Correctness	16	14				4.53	SA
➢ Appropriateness	18	12				4.60	SA

Table 6 shows that the respondents are in agreement with the reliability as to completeness, correctness, and appropriateness of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.67, 4.53, and 4.60 are interpreted as "Strongly Agree", which means that the system is something you can rely with.

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Table 7: *Security of the System*

Characteristic	Rating					Mean	Interpretation
Security	5	4	3	2	1		
➢ Confidentiality	17	12	1			4.53	SA
➢ Integrity	17	12	1			4.53	SA
➢ Non-repudiation	15	14	1			4.47	SA
➢ Accountability	17	10	3			4.47	SA
➢ Authenticity	11	16	3			4.32	A

The table above shows the results of the evaluation of the security of the system, it is noted that majority of the evaluators favored the system. Almost all of the computed mean, 4.53, 4.53, 4.47, 4.47, and 4.32 of all the characteristics with regards to security, are interpreted as Strongly Agree.

Table 8: *Maintainability of the System*

Characteristic	Rating					Mean	Interpretation
Maintainability	5	4	3	2	1		
➢ Modularity	16	14				4.53	SA
➢ Reusability	19	9	2			4.61	SA
➢ Analyzability	15	13	2			4.43	A
➢ Modifiability	18	11	1			4.57	SA
➢ Testability	18	11	1			4.57	SA

The table above shows that the respondents agreed with the maintainability as to modularity, reusability, analyzability, modifiability, and testability of the system as proven by the results of the evaluation. Furthermore, mostly all the results of the mean, 4.57, 4.61, 4.43, 4.57, and 4.57 are interpreted as “Strongly Agree”, which means that the system is maintainable.

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Table 9: *Portability of the System*

Characteristic	Rating					Mean	Interpretation
Portability	5	4	3	2	1		
➢ Adaptability	15	15				4.54	SA
➢ Installability	19	10	1			4.60	SA
➢ Replaceability	20	7	3			4.57	SA

Table 9 shows that the respondents are in congruence with portability as to adaptability, installability, and replaceability of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.58 4.60, and 4.57 are interpreted as "Strongly Agree", which means that the system has met the portability characteristics.

Table 10: *Effectiveness of the System*

Characteristic	Rating					Mean	Interpretation
	5	4	3	2	1		
➢ Effectiveness	18	12				4.60	SA

The results as reflected in the above table show that the evaluators found out that the system is effective. Furthermore, the computed mean, 4.60 would attest that the system could really function as it was designed

Table 11: *Efficiency of the System*

Characteristic	Rating					Mean	Interpretation
	5	4	3	2	1		
➢ Efficiency	25	4	1			4.80	SA

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The results as reflected in Table 11 show that the evaluators found out that the system is efficient. Furthermore, the computed mean, 4.80 would prove that the system could really function very well and could give results ahead of expected time.

Table 12: *Satisfaction*

Characteristic	Rating					Mean	Interpretation
Satisfaction	5	4	3	2	1		
➢ Usefulness	17	13				4.57	SA
➢ Trust	18	10	2			4.53	SA
➢ Pleasure	21	9				4.70	SA
➢ Comfort	22	8				4.73	SA

The table above shows that the respondents are in agreement with the so-called satisfaction as to usefulness, trust, pleasure, and comfort of the system as proven by the results of the evaluation. Furthermore, the results of the mean, 4.57, 4.53, 4.70, and 4.73 are interpreted as "Strongly Agree", which means that the evaluators were satisfied with the functions of the system.

Table 13: *Freedom from Risk of the System*

Characteristic	Rating					Mean	Interpretation
Freedom from Risk	5	4	3	2	1		
➢ Economic Risk Mitigation	16	10	4			4.40	SA
➢ Health and Safety Risk Mitigation	23	7				4.77	SA
➢ Environmental Risk Mitigation	21	9				4.70	SA

The table above shows that the respondents were not afraid of the risks the system would encounter in case. The computed mean would attest that the system would be able to overcome whatever

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dangers that may occur.

Table 14: *Context Coverage of the System*

Characteristic	Rating					Mean	Interpretation
Context Coverage	5	4	3	2	1		
➢ Context Completeness	23	7				4.77	SA
➢ Flexibility	19	11				4.63	SA

The table above shows that as to context coverage which includes context completeness and flexibility, majority of the respondents are in congruence with the system. The results of the computation of the mean, 4.77 and 4.63 signified that context of the system is being appreciated by the said respondents.

Table 15: *Comparison of Travel Time with the Use and Without Use of the Application*

NON-APPLICATION AND WITH APPLICATION CONTEXT COMPARISON				
TOTAL RESPONDENTS	START-POINT/PICK-UP LOCATION	END POINT/DESTINATION	TIME ESTIMATION OF TRAVEL (W/O APPLICATION)	SIMULATED TRAVEL TIME DURATION BY THE APPLICATION
R1	Santol Boac Marindduque	Balanacan Mogpog Marinduque	60 minutes	29 minutes
R2	Santol Boac Marindduque	Balanacan Mogpog Marinduque	60 minutes	29 minutes
R3	Poblacion, Torrijos	Balanacan Mogpog Marinduque	3 hours	1 hr 51 minutes
R4	Balogo, Boac, Marinduque	Balanacan Mogpog Marinduque	45 minutes	31 minutes
R5	Maligaya, Boac, Marinduque	Balanacan Mogpog Marinduque	45 minutes	23 minutes
R6	Isok I, Boac, Marinduque	Balanacan Mogpog Marinduque	45 minutes	26 minutes
R7	Barangay Uno, Buenavista	Balanacan Mogpog Marinduque	120 minutes	1 hours 15 minutes
R8	Lupac, Boac, Marinduque	Balanacan Mogpog Marinduque	60 minutes	33 minutes
R9	Matuyatuya, Torrijos, Marinduque	Balanacan Mogpog Marinduque	120 minutes	1 hr and 29 minutes
R10	Guisian, Mogpog, Marinduque	Balanacan Mogpog Marinduque	30 minutes	13 minutes
R11	Balimbing, Boac, Marinduque	Balanacan Mogpog Marinduque	60 minutes	32 minutues
R12	Dawis, Gasan, Marinduque	Balanacan Mogpog Marinduque	1hr 45	1 hr and 15 minutes
R13	Pogtoy, Torrijos, Marinduque	Balanacan Mogpog Marinduque	2 hrs 45	1 hr and 45 minutes
R14	Tanza, Boac, Marinduque	Balanacan Mogpog Marinduque	30 minutes	24 minutes
R15	Buyabod Sta. Cruz Marinduque	Balanacan Mogpog Marinduque	150 minutes	1 hr 12 minutes
R16	Agumaymayan Boac Marinduque	Balanacan Mogpog Marinduque	150 minutes	40 minutes
R17	Mercado Boac Marinduque	Balanacan Mogpog Marinduque	60 minutes	29 minutes
R18	Masiga Gasan Marinduque	Balanacan Mogpog Marinduque	90 minutes	58 minutes
R19	Laylay Boac Mariduque	Balanacan Mogpog Marinduque	60 minutes	35 minutes
R20	Poras, Boac, Marinduque	Balanacan Mogpog Marinduque	45 minutes	28 minutes
R21	Sawi, Boac, Marinduque	Balanacan Mogpog Marinduque	40 mintutes	28 minutes
R22	Bachao, Ilaya, Gasan, Marinduque	Balanacan Mogpog Marinduque	1 hr and 45 minutes	1 hr and 11 mins
R23	Barangay Tres, Gasan, Marinduque	Balanacan Mogpog Marinduque	1 hr and 20 minutes	59 minutes
R24	Tabi, Boac, Marinduque	Balanacan Mogpog Marinduque	45 mintues	27 minutes
R25	Poras, Boac, Marinduque	Balanacan Mogpog Marinduque	45 mintues	30 minutes
R26	Malibago, Torrijos, Marinduque	Balanacan Mogpog Marinduque	2 hrs and 30 mins	1 hr and 50 minutes
R27	Tigwi, Torrijos, Marinduque	Balanacan Mogpog Marinduque	2 hrs and 30 mins	1 hr and 59 minutes
R28	Pag-asa, Sta. Cruz, Marinduque	Balanacan Mogpog Marinduque	1 hr and 30 minutes	1 hr and 13 mins
R29	Bunganay, Boac, Marinduque	Balanacan Mogpog Marinduque	1 hr and 15 minutes	43 minutes
R30	Cawit, Boac, Marinduque	Balanacan Mogpog Marinduque	1 hr and 20 minutes	48 minutes

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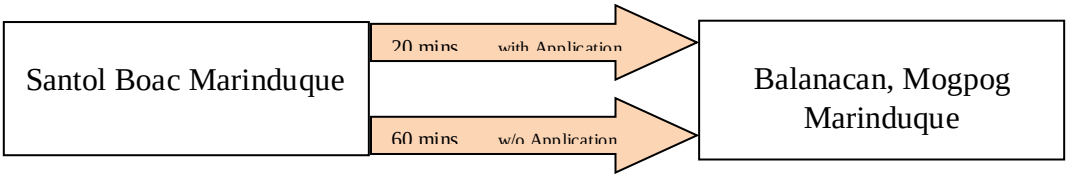
To further expound the above table, the following figures are used to provide direct comparison between non-application and with application among the identified sample routes provided by participants.

Figure 2: *Test of Quality Best Route of Respondent 1*



The figure above shows the quality best travel time from Santol, Boac, Marinduque to Balanacan Mogpog, Marinduque. It is reflected that with the use of the application it took 20 minutes travel time while without the use of application, it took 60 minutes to reach the destination. Since the computed travel time to arrive has a quality best route of 0.49, which is below, 0.70, therefore, the application has the quality best travel route.

Figure 3: *Test of Quality Best Route of Respondent 2*

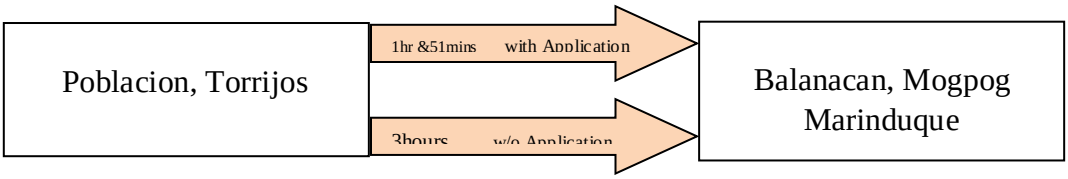
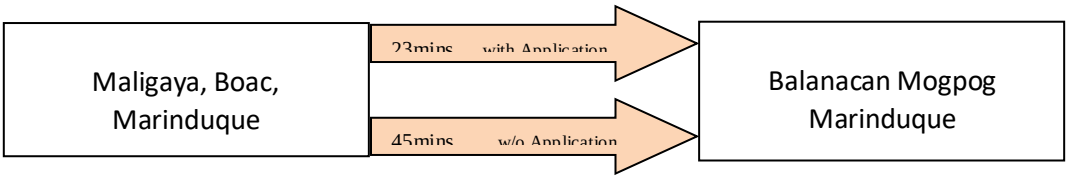


Figure 2 shows quality best travel time from Poblacion, Torrijos to Balanacan, Mogpog, Marinduque. It shows that with the use of the Application it took 1 hour and 51 minutes travel time while without the use of application it took 3 hours to reach the destination. Since the computed travel time to arrive has the quality best route of 0.62, which is below 0.70, it is considered that the application has the quality best travel route.

Figure 4: *Test of Quality Best Route of Respondent 3*



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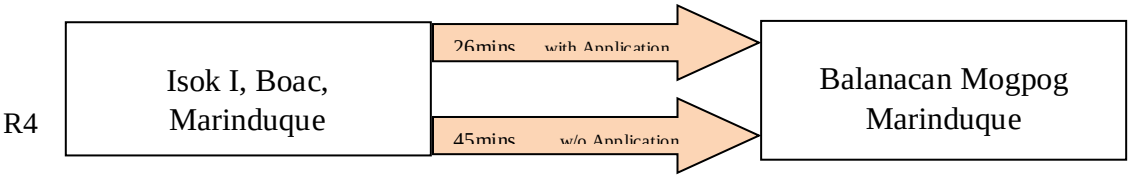
The data in the figure above show quality best travel time from Maligaya, Boac, Marinduque to Balanacan, Mogpog Marinduque. It is reflected that with the use of the application it took 23 minutes travel time while without the use of application it took 45 minutes to reach the destination. Since the computed travel time to arrive has a quality best route of 0.51, which is below to 0.70, the application has the quality best travel route.

Figure 5: *Test of Quality Best Route of Respondent 4*



The figure above shows quality best travel time from Isok I, Boac, Marinduque to Balanacan, Mogpog, Marinduque. It is evident that with the use of the application it took 26 minutes travel time while without the use of application it took 45 minutes to reach the destination. Since the computed travel time to arrive has the quality best route of 0.58, which is below to 0.70, the application has the quality best travel route.

Figure 6: *Test of Quality Best Route of Respondent 5*

Figure 6 shows the quality best travel time from Barangay Uno, Buenavista to Balanacan Mogpog, Marinduque. It shows that with the use of the application it took 1hour and 15 minutes travel time while without the use of application, took 120 minutes to reach the destination. Since the computed travel time to arrive has the quality best route of 0.63, which is below to 0.70, the use of the application has the quality best travel route.

Figure 7: *Test of Quality Best Route of Respondent 6*

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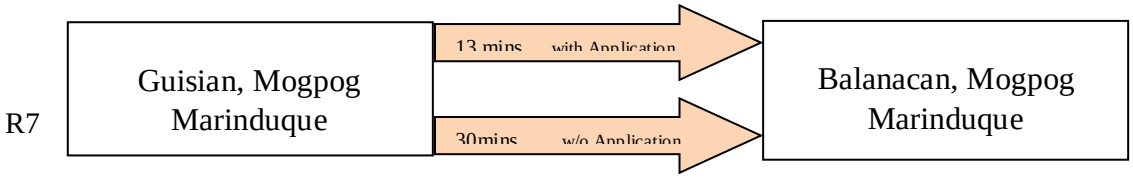
The figure above shows the quality best travel time from Lupac, Boac, Marinduque to Balanacan, Mogpog, Marinduque. It is reflected that with the use of the application it took 33 minutes travel time while without the use of application it took 60 minutes to reach the destination. Since the computed travel time to arrive has the quality best route of 0.55 which is below 0.70, the application has the quality best travel route.

Figure 8: *Test of Quality Best Route of Respondent 7*



The data in the figure above show the quality best travel time from Guisian, Mogpog, Marinduque to Balanacan, Mogpog Marinduque. It states that with the use of the application it took 1hour and 13 minutes travel time while without the use of application, took 30 minutes to reach the destination. Since the computed quality best route is 0.43, which is below to 0.70, the use of the application is recommended.

Figure 9: *Test of Quality Best Route of Respondent 8*

The figure above shows the quality best travel time from Balimbing, Boac, Marinduque to Balanacan, Mogpog, Marinduque. The data show that with the use of the application it took 1hour and 32 minutes travel time while without the use of application, it took 60 minutes to reach the destination. Since the computed travel time to arrive has the quality best route of 0.53 which is below to 0.70, therefore, the use of the application has the quality best travel route.

Figure 10: *Test of Quality Best Route of Respondent 9*

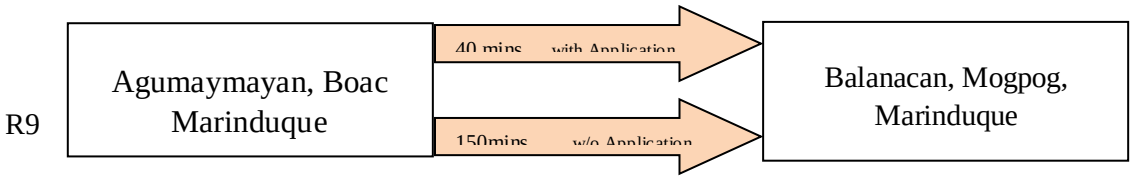


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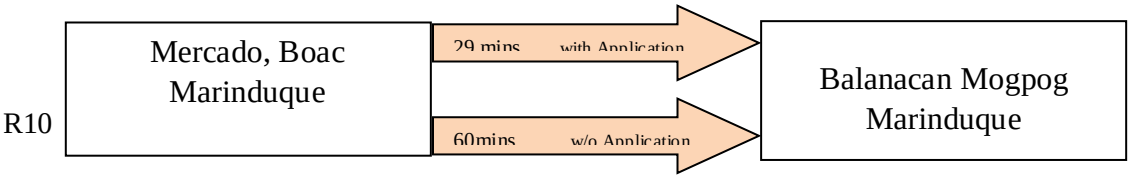
Figure 10 shows the quality best travel time from Agumaymayan, Boac, Marinduque to Balanacan, Mogpog, Marinduque. It is reflected that with the use of the Application it took 1hour and 40 minutes travel time while without the use of application, it took 150 minutes to reach the destination. Since the quality best route is 0.26, which is lower than 0.7, the use of the application is very much accepted.

Figure 11: *Test of Quality Best Route of Respondent 10*



The figure above shows the quality best travel time from Mercado, Boac, Marinduque to Balanacan, Mogpog, Marinduque. With the use of the application, it took 1hour and 29 minutes travel time while without the use of application it took 60 minutes to reach the destination. Since the computed travel time to arrive with the quality best route is 0.48, which is below to 0.7%, therefore the use of the application has the quality best travel route.

CONCLUSIONS AND RECOMMENDATION

After the thorough analysis and evaluation of the data gathered from the participants through the initial testing and their evaluation, the researcher came up with the following conclusions: The use of Test Quality Best Route of Ant Colony Optimization has improved "the user's travel comfort". The Test Quality Best Route of Ant Colony Optimization algorithm has better optimization ability and user comfort than the baseline algorithms. ACO's pheromones show that the shortest the path, the stronger is the concentration as proven through the simulation of the application.

Based on the findings and conclusions, the researcher offers the following recommendations: Travelers especially engaging in door-to-door services should have this kind of application so that they will be guided accordingly on what route to take in order to reduce the travel time. It is also recommended that logistics companies should have this kind of application so that their personnel who are performing delivery services would be steered in performing their duties. It is further recommended that travelers, general population, to have this mobile application so that they will be guided properly wherever they go.

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Analysis about the difficulty level of the different information technology tools during Pandemic 2020

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Abstract. The main objective of this paper is to determine the difficulty level of the 881certificates acquired online by the selected 94 students at the School of Information and Computing Sciences during the time of implementation of enhanced community quarantine as an alternative way to complete the 486-hour requirement of their training. This research paper will answer the following problems: the level of difficulty of the 881 certificates; the provision of basis for the equivalent points/hours per certificates; and the gender of those who got more interest in acquiring certificates. This paper utilized the quantitative research. Gathering of data was done through the utilization of linkedin.com, data gathered was tallied in the spreadsheet, and average function was used in the analysis. Result shows that 100% of the female participants has an excess number of certificates while it is only 97.83% from the male participants. In the final result, CSS and PHP fall under Easy which is 86 or 91.49% divided into male = 51% and female = 49%, which shows that male participants have this level with an equivalent 10 points/hours. A total of 9 certificates fall under the average level in favor of male with an equivalent 20 points/hours and those are the following: HTML, C++, SQL, JAVASCRIPT, C#, C, JAVA, JQUERY, and PYTHON. The result of the difficult level with an equivalent 30 points/hours is consist of 5 certificates namely: SWIFT, RUBY, ORACLE, MACHINELEARNING, and DATASCIENCEWITHPYTHON in favor of female.

Keywords: Difficulty level, e-learning, certificates, programming languages

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1. INTRODUCTION

Revolutionary production of different information technology tools such as programming language is continuously happening to lessen the difficulty on how people will communicate with machine with the utilization of the different information technology tools that makes people more productive and faster when it comes to the development of software such as operating system, application programs, automated systems and other applications that could help different businesses. The boom of technology has positive and negative impact on the business sectors in terms of productivity on their work. According to the Forbes Technology Council (2017)[1], "while some thinks that banning technology can increase focus and productivity, it can also be used to successfully make task simpler and faster". While it is true that there exist too many programming languages and other software development tools, the language that will be chosen by the computer programmer will obviously be the one that is easy to understand, debug, compile, and distribute to make them more productive and enjoy their work. But to determine if the level of difficulty of a programming language if it belongs to easy, average or difficult can be answered only by those who try to use it like the different programmers that actually has utilized the software development tools in their actual job. According to 2U, Inc. (2020)[2], "computer programming languages are not easy to master; learning it is just like learning anything else which might be easier for some people and more difficult to others". This study will answer the difficulty level of the different tools that refer to the certificates acquired by the 94 students at the School of Information and Computing Sciences during the utilization of an online e-learning website for them to acquire their needed certificates as part of their academic requirement for their on-the-job training as an alternative way to fulfill the required 486 hours which was conducted from March to May 2020 during the pandemic time where the country is under the enhanced community quarantine and physical attendance to work and classes are suspended and being done at home (work from home). The result of analyzing the data will be categorized to easy, average and difficult where the bases was derived from the item analysis which is the item difficulty. The higher the number of an item taken and passed by the students means that the item is easy, on the other hand, the lower the number of an item taken and passed by the students means that the item is difficult, and in the middle

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would be the average. In the discussion about the item analysis, to determine the difficulty level of test items, a measure called the Difficulty Index is used. According to the Classroom Assessment (n.d.)[3], this measure asks teachers to calculate the proportion of students who answered the test item accurately. Renner(2018)[4] discuss that when teachers and curriculum writers are developing tests to be given to the students, "they can't just write a test and assume it will measure the standards they wish to assess; the item difficulty index measures how easy a question is by determining the proportion of students who got it right". The University of Washington(2020)[5] defined that item difficulty "is simply the percentage of students who answer an item correctly from which if the item difficulty index ranges from 0 to 100, the higher the value, the easier the question". It is also mentioned that when there is more than one correct alternative per question, the item difficulty is the average score on that item divided by the highest number of points for any one alternative. It was put into emphasis that ScorePak® arbitrarily classifies item difficulty as "easy" if the index is 85% or above; "moderate" if it is between 51 and 84%; and "hard" if it is 50% or below. According to Tobin(n.d.)[6], item difficulty represents the percentage of students who answered a test item correctly which means that low item difficulty values indicate difficult items, since only a small percentage of students got the item correct while conversely, high item difficulty values indicate easier items, as a greater percentage of students got the item correct. In the end, she said that scores from 0 to 20 are very difficult, 21 to 60 are considered difficult, 61 to 90 are moderately difficult and 91 to 100 are easy questions. The University Center for Teaching and Learning (2020)[7] described difficulty percentage of students who answered the questions correctly under the test item analysis where he categorized this according to easy which means greater than 80%, medium which is from 30% to 80%, and hard which is less than 30%. It was also mentioned that difficulty values can range from 0% to 100%, with a high percentage indicating that the question was easy.

Also, this study will answer which according to the gender of participants got more interest in acquiring different certificates online where the basis would be the excess certificates that they have produced.

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2.0 METHODOLOGY

Data gathering method is the hardest and most time-consuming part of any research work that is because of its integrity that will make the research more reliable. The Faculty Development and Instructional Design Center (n.d.)[8], discuss that, "regardless of the field of study or preference for defining data which might be quantitative or qualitative, accurate data collection is essential to maintaining the integrity of research", and as a proof, the following were enumerated as consequences from improperly collected data: inability to answer research questions accurately; inability to repeat and validate the study; distorted findings resulting in wasted resources; misleading other researchers to pursue fruitless avenues of investigation; compromising decisions for public policy; and causing harm to human participants and animal subjects. This paper utilized the quantitative research to analyze the level of difficulty of the 881 certificates through the use of an average function. Data gathering was performed through the help of certificates attached in the linkedin.com account of 94 students that was acquired from the online e-learning website sololearn.com, each with different number of certificates according to requirement. During the validation of certificates, linkedin.com, a social networking website for professional was utilized, that was because this social networking website has the capability of providing link of certificates from the sololearn.com. During the process of verification, there is a link that verifies the credential id provided by the sololearn.com to the students that has satisfy all the requirements of the course. This was actually done to make sure that the certificate really came from the sololearn.com which shows that data collected are reliable. This is the most laborious part of this research, which was done one by one in the linkedin.com where the acquired certificates of each students have a corresponding verifiable identification code from the sololearn.com and can be validated from the link created by the linkedin.com if the certificate is legitimate or not. The time complexity of the proposed technique was not given emphasis because the only internet service provider available in the province were Smart, Talk n Text, Sun Cellular, Globe, and Philippine Long Distance Telephone (PLDT) where connectivity depends upon the location but the deadline of acquiring certificates were announced and strictly followed. Students were given independent time on acquiring certificates that they usually

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do during midnight where the speed of the internet service provider they used were performing well. Aside from that, in the implementation of enhanced community quarantine, only the head of the family is allowed to go outside. In the next step, participants are group according to the number of similar certificates acquired as required, and followed by computing the total number of each certificate titles and averaging it and then arrange the result from highest to lowest and categorized them according to easy which has the range from 90 to 100, average which has the range from 51 to 89% and those certificates with 50% and below belongs to the difficult level with respect to the gender. The different categories of levels of difficulty was based from Table 1.0.

PERCENTAGE	LEVEL OF DIFFICULTY
90% to 100%	EASY
51% to 89%	AVERAGE
50% and below	DIFFICULT

Table 1.0 The Level of Difficulty Table

The percentage with corresponding level of difficulty as shown in Table 1.0 was derived based on the difficulty index as described by the Classroom Assessment(n.d.), Renner(2018), The University of Washington(2020), Tobin(n.d.), and The University Center for Teaching and Learning where they all agree that in the difficulty index, the higher the number of an item taken and passed by the students means that the item is easy, on the other hand, the lower the number of an item taken and passed by the students means that the item is difficult, and in the middle would be the average.

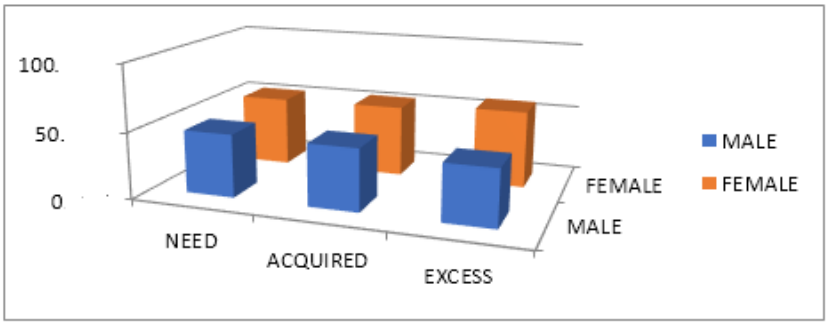

Fig 1.0 The need, acquired, and excess certificates of 94 participants

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3.0 RESULTS AND DISCUSSION

This research has utilized the total number of 94 students consist of 45 male (47.87%) and 49 female (52.13%) that has acquired a total number of 881 certificates, where the total needed certificate is only 739, with an excess of 142 certificates. Surprisingly, 100% of the female that has an excess certificate and only 97.83% from male participants has exceeded their certificates. By looking at the numbers, the female participants lead in all aspect as shown in figure 1.0. Based on the result of analysis, 19.41% of the Certificates belongs to EASY level and those are 2 certificates namely CSS and PHP where in this 2 certificates,51% of this are male and 49% are female which shows that male participants got more than the female; 75.14% belongs to the AVERAGE level and those are the 9 certificates namely: HTML where 52% are male and 48% are female, C++ where 51% are male and 49% are female, SQL where 49% are male and 52% are female, JAVASCRIPT where 55% are male and 45% are female, C# where 49% are male and 51% are female, C where 65% are male and 35% are female, JAVA where 47% are male and 53% are female, JQUERY where 45% are male and 55% are female, and PYTHON where 39% are male and 61% are female. Astonishingly the male participants got a total of 452% with an average of 50.22% while the female participants got a total of 448% with an average of 49.78% which shows that male participants have it despite the fact the number of female participants is greater than the male participants. The result of the difficult level with an equivalent 30 points/hours is consist of 5 certificates namely: SWIFT where 46% are male and 54% are female, RUBY where 43% are male and 57% are female, ORACLE where male got zero and 100% are female, MACHINELEARNING where male got zero and 100% are female, and DATASCIENCEWITHPYTHON where 100% are male and zero for female. In this difficult level, the male participants got a total of 189% with an average of 37.80% while the female participants got a total of 311% with an average of 62.20% which shows that difficult level is in favor of female.

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CERTIFICATES	# OF PARTICIPANTS	PERCENTAGE	MALE	FEMALE	DIFFICULTY LEVEL
CSS	86	91.49%	51%	49%	EASY
PHP	85	90.43%	51%	49%	
HTML	84	89.36%	52%	48%	AVERAGE
C++	80	85.11%	51%	49%	
SQL	78	82.98%	49%	52%	
JAVASCRIPT	77	81.91%	55%	45%	
C#	76	80.85%	49%	51%	
C	75	79.79%	65%	35%	
JAVA	72	76.60%	47%	53%	
JQUERY	64	68.09%	45%	55%	
PYTHON	56	59.57%	39%	61%	
SWIFT	24	25.53%	46%	54%	DIFFICULT
RUBY	21	22.34%	43%	57%	
ORACLE	1	1.06%	0%	100%	
MACHINELEARNING	1	1.06%	0%	100%	
DATASCIEWITHPYTHON	1	1.06%	100%	0%	

Table 2.0 Result of analysis of 881 Certificates

4.0 CONCLUSION AND RECOMMENDATION

Based on the result of analysis of 881 Certificates, their level of difficulty was already determined and can now be categorized into Easy, Average, and Difficult which shows the problem encountered in the level of difficulty of the certificates was alleviated by this study. Aside from that, the basis of assigning points or equivalent number of hours per certificate is now provided with 10 points/hours for Easy, 20 points/hours for Average, and 30 points/hours for Difficult, which also shows that the second problem encountered was provided with solution and lastly, despite the fact that the number of female participants dominates in all aspect in the beginning of the study based on the needs, the acquired, and the excess number of certificates, in the result, the female participants only leads on the difficult category and the male participants leads on the easy and average categories which shows that male participants are more interested in acquiring certificates with easy

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and average difficulty levels while the female participants are more interested in acquiring harder certifications which has the "difficult" levels of difficulty of certificates online. It is therefore recommended that continuous analysis should be perform about the acquisition of certificates online so that the result will be more reliable and consistency about the difficulty level will be tested more. It is also recommended to purchase a license software or subscribe to the online e-learning website so that the full access for the features will be utilized where there might be possible access to the content of the questions in each certificates that would be able to analyze too and will lead to a more dependable assessment of difficulty level not only of the title of acquired certificates but also the contents that refers to the different questions in the different topics provided by the e-learning website as examination or quizzes to be taken by the participants that must be taken and passed that serves as requirement for the e-learning website to release credential certificates. It is also recommended that the result for easy, average, and difficult together with the given points or equivalent number of hours be implemented in different activities in an on-the-job-training and other subjects where conduct of certification thru the utilization of the sololearn.com as online e-learning website will be performed.

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11. Marinduque State College

Student Researches

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WEB-BASED LOAN MANAGEMENT SYSTEM FOR MOGPOG MULTI-PURPOSE COOPERATIVE

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***Abstract*— It has been almost a year since our country battles the COVID-19 pandemic. Most businesses had to change their way of working and adjusted to the new normal. Micro-finance institutions like Mogpog Multi-Purpose Cooperative (MMPC) faced challenges in maintaining their core activities during the government-mandated safety and health protocols. The researchers developed a Web-based Loan Management System to improve the Mogpog Multi-Purpose Cooperative (MMPC) existing process and serve their members better, especially this pandemic. This study is applied research since it aims to provide an automated solution to the organization's problems. A prototyping model is used to develop the system. The developed system allows their clients to apply for loans online, monitor and track their accounts anytime without leaving their homes. Also, the system helps MMPC by reducing tasks; the system can monitor and track client's loans, apply appropriate interest to loans, indicate the member's credit score, and notify the concerned individual about due dates. The evaluation result shows that the system is helpful to MMPC and their members because it speeds up submitting loan requirements and the loan application without visiting the physical office, reduces human tasks, and generates reports accurately. It was recommended for continuous system evaluation and gather user feedback for further improvement.**

Keywords*— *Web based Management, Multi-purpose Cooperative, Loan Management

I. INTRODUCTION

It has been almost a year since our country battles the COVID-19 pandemic. The pandemic has been affecting the entire world as it has spread very fast in the first quarter of 2020. It has a long term-effect and changes the way we live [1]. Most businesses had to change their way of working and adjusted to the new normal. Micro-finance institutions like Mogpog Multi-Purpose Cooperative (MMPC) faced challenges in maintaining their core activities during the government-mandated safety and health protocols.

Providing a loan should be a simple process. First, one should check the client's eligibility to get the loan and then approve or deny the loan [2]. Once approved, the client should receive the funds. However, the manual process of applying and granting loans requires too much time for the lender and the clients.

MMPC encountered problems like; (1) Delay in the processing of loan - because they will check first the credit history and ratings of the member if he/she is a good or bad payer. (2) Consumes too much time - the members repeatedly returning to check the availability of loans. (3) Difficulty in account monitoring - the member cannot quickly check their share capital because it is not updated.

The researchers develop a system based on the problems of the organization that they encountered entitled Development of Web-Based Loan Management System for Mogpog Multi-Purpose Cooperative, which aim to:

(1) Analyze the processes in the existing system present in the organization.

(2) Conduct feasibility analysis to know if the project is economically, operationally, and technically feasible.

(3) Design and develop a Web-based Loan Management that will improve the existing system.

(4) Test the functionality of the developed system.

II. METHODOLOGY

Several interviews conducted using an open-ended questionnaire at Mogpog Multi-Purpose Cooperative, where the loan officer and cashier supplied all the needed information. Then, an analysis of all the gathered data conducted.

The existing system analyzed using the following method: Gantt Chart, Work Breakdown Structure, and Data Flow Diagram. Gantt Chart was used to help the researchers in time management from doing the project until it completed, like other researchers [3]. Work Breakdown Structure (WBS) describes the project activities, milestones, and deliverables of each activity. Finally, the Data Flow Diagram is used to analyze and understand the current process flow quickly.

To conduct the Feasibility analysis, here are the following methods: Economic feasibility, Operational feasibility, Technical feasibility. To show the net benefit of the project, the researcher determines the cost of the supplies and materials used yearly in the business operation to get the Economic feasibility. Also, Cost and Benefit Analysis are one of the tasks conducted by the researcher to ensure that the project will generate revenue to cover the costs spent.

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Operational feasibility analysis determines whether the client can adopt the system by identifying their strengths, weaknesses, opportunities, and threats using the SWOT Analysis. Lastly, a technical feasibility analysis is executed for the researchers to know how to finish the system and determine the technical ICT resources.

The prototyping model [4] is used to develop a solution used to test or validate ideas and design the project so that the researchers can make appropriate refinements or possible changes. Microsoft Visual Studio was used to create PHP and website codes and algorithms similar from the study conducted by the students at Daffodil International University [5]. XAMP Server is used to make the system online, consisting of Apache web server, MySQL for data storage.

To measure the Web-based Loan Management System quality characteristics, Person-in-Charge, three members of the MMPC management, and five (5) information and technology experts evaluated the developed system using a questionnaire based on an adopted [6] ISO 9126 standard. To interpret the evaluation of the respondents, the five-point Likert scale, as shown in Table 1, is used.

TABLE I. LIKERT SCALE

Range	Descriptive Interpretation
4.20 – 5.00	Strongly Agree
3.40 – 4.19	Agree
2.60 – 3.39	Fair
1.80 – 2.59	Disagree
1.00 – 1.79	Strongly Disagree

III. RESULTS AND DISCUSSION

This section presents the result of the study.

A. *Analysis*

The business process of MMPC is depicted in the data flow diagram of the existing system as shown in Fig. 1, Similar to the TUPMMPC Loan Monitoring and Management System [3]:

1. The applicant needs to go to the MMPC office to fill up several forms, like personal information, in applying for membership.
2. Together with additional requirements, the applicant needs to pay a membership fee and capital share.
3. The loan officer will scrutinize the application for membership approval.

In applying for the loan, the members will choose the desired amount (maximum loanable is twice the amount of share capital), loan type (Regular, Production, Emergency), and mode of payment (Daily, Weekly, or Monthly) and fill up the loan application form, then submit to the Loan officer. The Loan officer will check the credit history before recommending the loan approval to the Board of Directors.

In repaying of loan, the cashier looks for the member file, computes fines if applicable, then receives the payment and updates the member ledger. On the other hand, members who have not fulfilled the repayment terms are subject to promissory terms. In terminating members, the Loan Officer and Bookkeeper listed and forwarded to the board members the members' names, and then they will approve the member's termination because of their bad credit history or other valid reasons. Daily collection report is generated by the Cashier and keep by the Bookkeeper every month. Monthly, Quarterly, and Annual reports are also created and submitted to the Board of Directors.

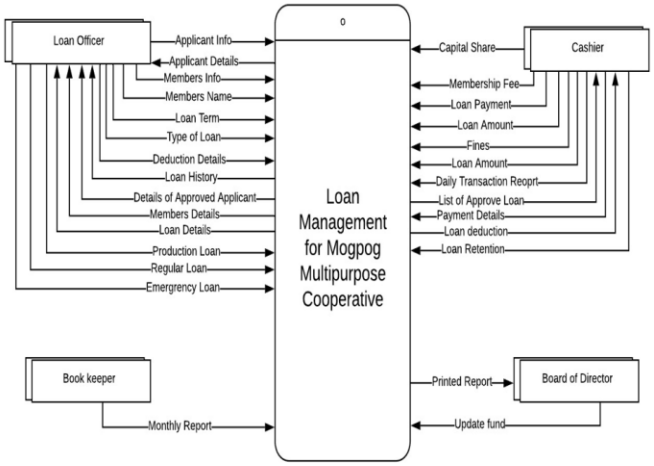

Fig. 1. Data Flow Diagram of the existing system

The processes of the developed system are presented in a Data Flow Diagram of the developed system, as shown in Fig. 2.

In the registration process, the applicant can fill up the online application form through the MMPC Web-based Loan Management system; after submitting the application form, the system will send an email to the applicant. The loan officer will be notified and check the information of the member and verify it. The applicant needs to pay a membership fee, initial share, and the OR# to enter the system. If the applicant is approved, the loan officer will add it to the system and saved it into the database.

The applicant's payment is automatically added to the member's ledger, and it will also be recorded as a cash-in; the system will record it in the organization's cash flow. When the members apply for a loan, they can easily apply for a loan online using the electronic form. Members could see the loanable amount instantly using the online loan calculator. Loan policies were adapted from the existing process. In the end, the member can see the total deduction of their loan and the net proceeds they could receive.

To approve the member's loan request, the loan officer can check the member profile page's credit score. Then, the loan officer will send the loan request to the Board of Directors for recommending approval. The system will notify the Board of directors if there is a loan that needs approval through email. The Board of Directors will check the total fund of the cooperative by just visiting the MMPC Web-based Loan Management system dashboard. The dashboard could be the basis for granting loan requests.

In adding loan, the system will generate and print a voucher that will subtract all the deduction of the loan such as interest, collection fee, service fee, loan retention, annual dues, loan

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insurance, notarial fee, and the loan retention will be adding by the system to the share capital of a member. In addition, the system will also generate the amortization schedule that shows whether the schedule of payment is daily, weekly, or monthly. Then the system will send an email notification that the loan is ready for release.

The Cashier can quickly check the loan balance and fines of a loan. During payment, Cashier will input the payment and saved it in the payment history. An email notification will be automatically sent to the member when the maturity of the loan is near. All payments are saved in the daily collection that can use in tracking cash flow.

In generating the income report, all the deductions from loans such as interest, collection fee, service fee, fines, and other income will be summed up. By the end of the year, the net income of the organization will be divided and will be added to all the member's capital share. The on-hand cash and in-bank cash will automatically be updated based on the cash in and cash out. The user account of the terminated member will be disabled to restrict accessing the system.

In generating reports, the staff will no longer use manual computation and reports because the system will automatically generate reports such as daily collection, loan release reports, expenses, monthly income reports.

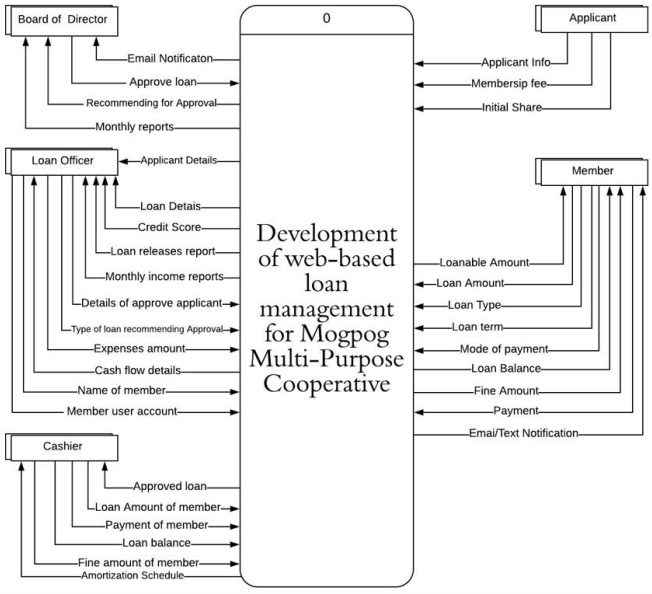

Fig. 2. Data Flow Diagram of the developed system

B. *Feasibility*

The economic feasibility results show the projected cost-benefit analysis as shown in Table 2. Developmental cost amounting ₱14,000.00, The MMPC could have a projected cost-benefit amounting to ₱5,485.95 and cumulative benefit amounting to ₱795.45, a positive value of the cumulative benefit indicates that the developed system is economically feasible. The investment of MMPC will return in 3 years and ten months. A similar result from a system developed by the University of Missouri-St.Louis [4].

TABLE II. COST BENEFIT ANALYSIS

Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Operational cost of the existing system		27,801	28,641	29,565	30,581	31,699
Operational cost of the developed system		23,406	23,726	24,079	24,467	24,893
Development Cost	14,000					
Project Cost Benefit		4,395	4,914	5,485	6,114	6,806
Cumulative benefit	**-14,000**	**-9,605**	**-4,690**	**795**	**6,910**	**13,715**

In terms of operational and technical feasibility, it is found out that the MMPC employees were computer literate enough to understand the developed system. Additionally, the employees are well versed in using a spreadsheet which is an advantage in using the developed system. However, a one-day system training is needed to help the employee learn how to use the system effectively. It is found out that there is an existing computer unit that is suited to the technical requirements to run the system. Table 3 shows the required computer specification to run the system.

TABLE III. REQUIRED COMPUTER SPECIFICATION

Hardware	Specification
Processor	1.60 GHz or higher
Random Access Memory	2GB or higher
Hard Disk Drive Capacity	200GB or higher
Software	**Specification**
Operating System	Windows 8 or higher
Word Processor	Microsoft Office 2010 or higher
Web Browser	Google Chrome 80 or higher
Anti-Virus	Windows Defender 3.0 or higher

C. *Developed System*

To minimize the problem encountered, a Web-based Loan Management System was designed and developed. The system will allow the member to apply for a loan and check their account online and real-time. This study is similar to the system developed by a researcher from the University of the Philippines [3] and students at Daffodil International University [5]. Therefore, the cooperative staff can efficiently process the different transactions like application, credit history check, loan request, and others.

The developed system could be accessed through the log-in page, as shown in Fig. 3. The user will input their unique username and password to perform different transactions.

Fig. 3. Log-in page

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System Dashboard is adequately designed to give MMPC board members a quick overview of the system features. For example, as shown in Fig. 4, the System Dashboard gives analytics view of the total number of members, active members, available loans, collectibles, past-due loans, fines, on-hand cash, and others.

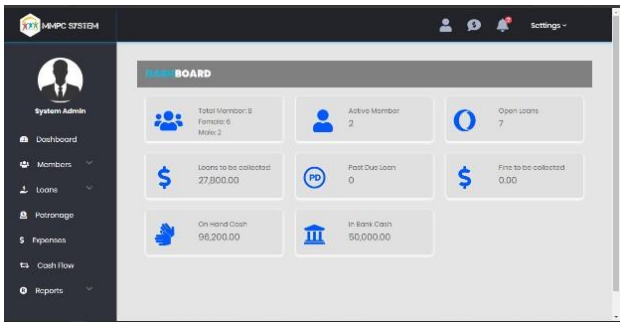

Fig. 4. System Dashboard

Each member could easily view all their transaction through the Member Profile, as shown in Fig. 5. The information listed here includes member's loan history, credit score, member's ledger, loan payment history, and share capital ledger. Additionally, the members could update their basic information and upload a photo.

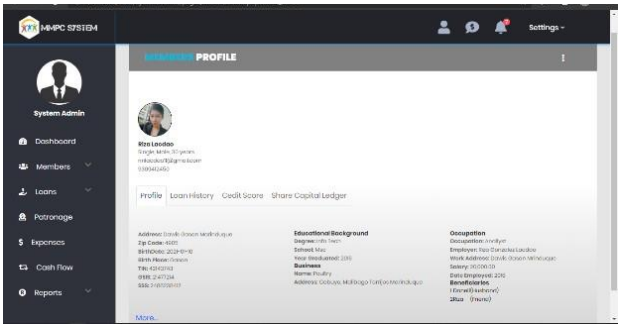

Fig. 5. Member Profile page

One of the best parts of the developed system is the Loan Calculator, as shown in Fig. 6. The calculator feature provides a quick computation of loans and customizes the terms based on member's preferences. Members can view their loan retention, amortization schedule, loan amount, and loan term. Moreover, the loan calculator will automatically deduct all the types of deduction and compute the Net proceeds.

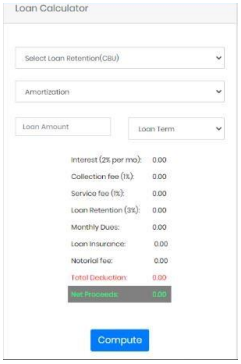

Fig. 6. Loan Calculator

Fig. 7 shows the Payment page where the system admin can add a loan payment or fine amount to a particular loan. It contains the details of the payment such as member name, loan number, official receipt number, their loan balance and fine.

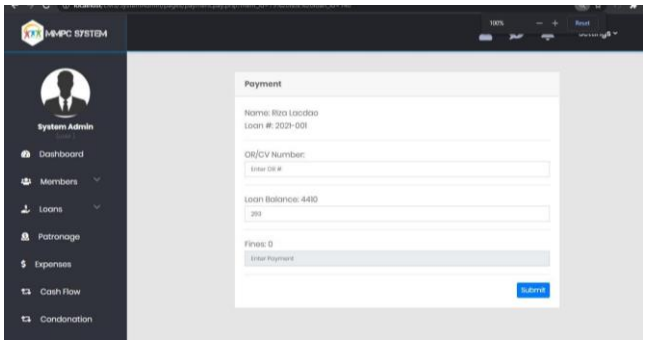

Fig. 7. Payment Page

Cash Flow is one of the essential parts of the system to monitor the income and expenses of an organization. Thus, the Cash Flow Ledger is developed to innovate and lessen the time spent in balancing the accounts.

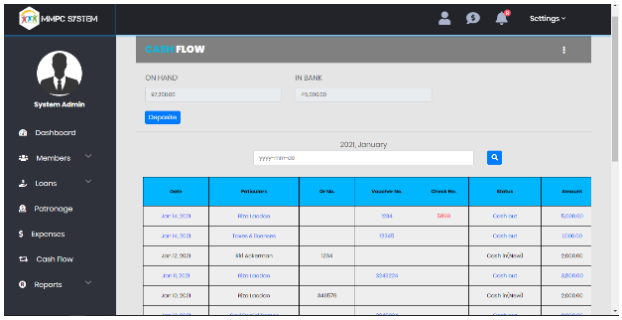

Fig. 8. Cash Flow Ledger

D. *Functionality Test*

Software evaluation is conducted to ensure that the system will meet the desired output and function accordingly. Table 4 shows that the developed system has positive feedback that goes beyond the agreeable level of 4.31. The system's Functionality is noticeable among the result with an average of 4.57 compared with other criteria, which indicates that the developed system is working according to its design and purpose. In terms of Usability, it achieved a 4.56 rating which shows that the system is easy to use for the user. The system's Reliability is also observed, with a rating of 4.37. The rating means that the developed system has fewer errors and restore lost data after a failure. Also, the system works with Efficiency with a rating of 4.31, which signifies that it responds quickly to the user's inquiry. Lastly, the Portability characteristic is Strongly Agreeable with a rating of 4.11 since it can be installed easily and function properly even the changes are made. However, Maintainability meets the agreeable level, which is 3.93. The result indicates that the application may need a technical person to maintain the application for further use, which was emphasized by several authors [6] and adopted by several studies [3] [7].

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TABLE IV. SUMMARY OF EVALUATION

Criteria	Average	Interpretation
Functionality	4.57	Strongly Agree
Usability	4.56	Strongly Agree
Reliability	4.37	Strongly Agree
Efficiency	4.31	Strongly Agree
Portability	4.11	Agree
Maintainability	3.93	Agree
General Average	**4.31**	**Strongly Agree**

IV. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The Mogpog Multi-Purpose Cooperative plays a vital role in stimulating business activities, leading to the economy's growth of the municipality of Mogpog. This study analyzes the existing process of the cooperative and found out that many processes could be enhanced by using the developed web-based system. A feasibility study shows that return on investment could be achieved in the third year of operation. Existing computer units and peripherals contribute to achieving the ROI faster. Moreover, it is advantageous that most of the employees in MMPC are well versed in computers. The developed Web-based Loan Management system has emulated the existing business process of MMPC. The evaluation result shows that the developed system reached a numerical rating of 4.31 or Strongly Agreed, referring to the system's overall Functionality based on the expert evaluation. Additionally, the system will be useful to MMPC and their members because it will speed up submitting loan requirements and the loan application without visiting the physical office, reducing human tasks, and generating reports accurately.

Conclusion

Based on the result of analysis of the existing business processes of Mogpog Multi-Purpose Cooperative, the researchers found out that they have several problems like delay in the processing of a loan, availability of the manager or Board of Director in loan approval, and the member cannot easily check their capital share because only the staff can access the existing system. To minimize the problem encountered, a Web-based Loan Management was designed and developed. The system allows the member to apply for a loan and check their account online anytime and anywhere. Then, the staff of the cooperative can efficiently process the loan request also through online. This study shows that technologies play an important role to the success of every business and help to respond in any situation like the current pandemic.

Recommendation

Based on the findings and conclusions the following recommendations are made:

- MMPC is required to undergo at least one day system training to familiarize the different functionality of the system.
- Implementation of additional features including online payment for the convenience of the member could be further develop.
- Encoding existing records includes but is not limited to member's information, ledger, journals, bills, cashbooks. The computerized records will help them kept financial records to track the transaction and support their decision-making to sustain good service to their clients.
- The researchers need to conduct impact analysis to examines the proposed changes in the business process to expose any potential negative consequences of carrying out the change.
- It is recommended for continuous survey be made about the feedback of the user towards the system for further improvement.

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HANAP-BAHAY APP: A RENTAL HOUSE MANAGEMENT APPLICATION

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Abstract—Living in a residential rental property is common in Marinduque, especially for students and employees who attend school and work far from their residences. Occupants experience unfamiliarity of the locality where the rental house can be located, unavailability of the property owner, and gaps in rental property emergency protocols. The development of the Hanap-Bahay Application aims to solve the problems and provide occupants a convenient way to find a rental property and offer improvements on managing rental properties and processing rental businesses of property owners. Different techniques like SWOT, GAP and cost-benefit analysis were used to prove the application's feasibility. Ionic 4 framework, alongside; JavaScript, CSS, and HTML, were used in creating the application. MySQL database was used for the applications database management, and PHP: Hypertext Pre-processor was used as the programming language. The application has different functionalities. It can locate a residential rental property using mapping and Global Positioning System. Also, occupants can have reservations/inquiries on a rental property. Furthermore, it has a management capability to help property owners monitor their occupants; manage rental property information and income generated from the business. As a result of the conducted Alpha testing, the application eliminated the existing problems of the occupants and property owners. Generally, the Hanap-Bahay App provided occupants a means to comfortably find available residential rental houses and improved how property owners manage their rental properties.

Keywords: Hanap-Bahay App, Residential Rental Property, Rental Management System, Mobile Application

I. INTRODUCTION

Technologies have become an integral solution and help to society. As one of its applications, the Internet serves as the platform for many aspects of today's daily living [1]. Internet Technologies like websites and mobile applications are one of the main help for its improvement. With its mobility features, accessing anything available online saves time, provides location flexibility, enhances user productivity, provides ease on research, and even streamlines business processes. These advantages that technology can provide are very suitable likely in this pandemic that prohibits people from physically interacting with others. The housing sector applies innovation when it comes to managing residential rental properties. Housing is essential for the quality of life that considers the social, economic, cultural, and personal significance. Housing plays a vital role in improving a country, with a home as an indicator of development. Having a place to live is one of the necessities of a human. Living in a comfortable, secure, well-ventilated, and low-cost home gives us relief and good quality of life [2]. Thus, having a good and comfortable place to live in is essential.

Relatively, searching for a Residential Rental Property (RRP) is common in the province of Marinduque, especially for students and employees who attend school and go to work far from their residences. To have a comfortable place to stay, occupants experienced problems in finding one. They experienced unfamiliarity with the locality where the rental house can be located. While searching for an RRP to rent to, occupants experienced a hard time roaming around an area to find a suitable rental house for them. Time, effort, and money are wasted, considering occupants have to look for an RRP many times.

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Some are not popular and tend not to provide proper signage. Others are far from the road and or difficult to find. In some cases, property owners are not available in their respective rental houses. Once an occupant reaches the RRP and decides to rent for it, there are instances that the property owner is not present. The property owners leave their contact numbers in their signage, and this situation sometimes leads to miscommunication. Also, gaps in rental property maintenance and emergency protocols are experienced. RRP maintenance like house reconstruction, electricity, and water problems are scenarios concerning only the owners' decisions.

Hence, having a mobile application in finding and managing rental properties is considered. Using online service applications makes locating, managing, and searching for available residential property easy [3, 4, 17, 18]. Finding an affordable boarding house to rent in an unfamiliar place is a hassle for this day and age, and it involves to deal the client directly [5,6]. With the effective use of mobile applications, its applications to rental property management are essential. A rental management application can provide the most convenient way to find and reserve a rental property [18]. Also, the rental management system allows users to obtain information about the RRP that they want to rent. This management system is responsible for maintaining the property administrative and legal issues related to real estate management [4, 6, 7, 18]. An Online RRP management uses computers and the internet to solve some problems usually encountered during manual operation of the RRP management [3]. It helps the Property Owner monitor and operate their property and properly communicate and transact with their occupants [8, 9, 11]. Functions and features included in many RRP Management Systems are Announcements, Complaints, Reservations, Messaging, and RRP Assessments. Other studies also use Google Maps API and other web technology to locate RRP's, which lessen the efforts in finding rental properties [7, 8].

Thus, implementing the features mentioned above of a rental management system drove the development of a Hanap-Bahay Application that answered the problems in finding residential rental property. With an interactive mobile application that supports online services, mapping, and Global Positioning System (GPS), occupants can easily search for a rental property. Furthermore, occupants can browse a suitable rental property of different types, such as houses and rooms for rent and Bed spaces, and reserve them accordingly. In addition, occupants can communicate with a property owner through an online messaging service. On the other hand, property owners can improve rental management by adding and updating RRP information, recording rental incomes, and managing occupants' information.

II. METHOD AND PROCEDURE

2.1 Requirements Analysis

A preliminary investigation was done thru fact-finding techniques such as observation and open interviews to get the needed information. Ten (10) rental apartments and boarding houses were selected randomly and presented in Table 2.1. Its property owners and several occupants were interviewed. The observation was conducted to find possible problems the businesses encountered. It was done by visiting some of their establishments and pretending to be looking for an apartment to experience what some occupants have experienced. An open interview was also conducted to support the information gathered through observation.

Table 2.1 *Rental Property and Occupants*

Name of Rental Property	No. Occupants used as Respondents
St. Mary's Boarding House	5
Murillo Bed Space Rental	6
ARMO Boarding House	7

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Malelang's Boarding House	4
Bardelosa Apartment	8
MSC Dormitory	5
Porley's Boarding House	3
Malyn Luci Apartment	4
Ricafrente's Apartment	2
Buenaventura's Boarding House	6

Table 2.2 *Identified Problems from Respondents*

Problems Encountered by Occupants	Problems Encountered by Property Owners
1. Unfamiliarity of the place where to find the RRP	1. Less communication with occupants
2. Unpopularity of the RRP	2. Unorganized monitoring of occupant's information
3. Unavailability of the property owner.	3. Unorganized rental income records
4. Rental properties immediate maintenance	

Based on the gathered data from occupants and property owners, problems were identified and presented in Table 2.2. The problems were analyzed, and it served the purpose of deriving a solution of developing the Hanap-Bahay App: A Rental House Management Application. Data Flow Diagram and Unified Modeling Language were used to present the process flow on how a common rental management system works. It was drawn to understand how the existing system works fully and to represent the process flow of the Hanap-Bahay Application. Entity Relationship Diagram and Database Schema were used to plan the compositions of the database used to store the application's data.

2.2 Feasibility Analysis

Operational, technical, and economic feasibility was conducted to prove the feasibility of developing the Hanap-Bahay Application.

SWOT Analysis in Table 2.3 was used to determine the Operational Feasibility. It was conducted to determine the strengths and weaknesses, how capable Property Owners and Occupants can adapt to the changes that the application might bring, and the opportunities and threats that may occur in using the application.

Table 2.3 *SWOT Analysis*

Strength	Weaknesses
Good service in RRP management. Ongoing innovation.	No experience in marketing. Untrained clients.
Opportunity	**Threats**
Few local competitors.	Larger Competitors.
Good profits.	Holidays and vacations.
Open for new hotel management concepts and innovation.	Slow and interruptive internet.

The GAP analysis was also conducted to prove the technical feasibility of developing the application. Using this technique identified the hardware and software requirements that were used in developing the applications. Cost-Benefit Analysis was also performed to determine the feasibility of the application in terms of economic. It presented the benefits that can be provided in using the application versus the cost of its development.

Table 2.4 *Determination of Costs and Benefits of the Application*

Development Cost/One-Time Cost	Operational Cost
Testing Expenditures	Internet Connection/Data Plan
Internet Plan/Data Plan	Web Hosting
	Communication Charges
	Transaction via E-Wallet
Tangible Benefits	**Intangible Benefits**
Lessen the expenditure when looking for Residential Rental Property.	Increase time to access and reserve for Rental Properties
Payment for Subscriptions	Improved communication process
	Possibility of not having face to face transaction

2.3 Development and Testing

To develop the application, many web

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technologies were used. Since the Hanap-Bahay App is a cross-platform application that can run on computers using a web browser, IOS, and Android devices, the Ionic 4 framework was used. Ionic 4 is a framework used for developing cross-platform applications using Web Technologies; it was used to minimize time spent during the coding phase of the application. Notepad++ editor was used as the main application in coding the program using various programming languages such as PHP: Hypertext Pre-processor 7 and JavaScript. Hypertext Mark-up Language 5 was used in providing the different user interface components. Cascading Style Sheet defined styles in the application's user interfaces. All data processing in the system was managed using XAMPP, a application employed by MySQL database management system to store, retrieve, and process information. It was used to show the structure, rules, and constraints created as tables in the application's database.

Table 2.5 *Likert Scale Rating Basis*

Weighted Mean	Adjectival Interpretation
5	Excellent
4	Very Satisfactory
3	Satisfactory
2	Fair
1	Poor

After the development, several evaluations and testing procedures were performed. First, Alpha Testing was conducted to test the functional suitability of the application and identify possible errors that might occur. Then, compatibility Testing was conducted to test if the developed application is compatible with the targeted devices, Android devices, iOS devices, and laptops or computers through a website version. After that, the system was subjected to Software Quality Evaluation based on ISO 9126 Software Product Quality Standard. This software evaluation assessed the system criteria such as functionality, usability, reliability, portability, adaptability, and maintainability. A devised questionnaire containing the above criteria was prepared, and results were measured using the Likert Scale rating basis in Table 2.5. IT experts and IT professionals administered the conduct of this software quality evaluation.

III. RESULTS AND DISCUSSIONS

As a result of the development process, the Hanap-Bahay App was developed with the following functions and requirements.

3.1 Requirements Definition

3.1.1 Functional Requirements

- User Access Management – The application requires users to register an account before accessing the system. Registered accounts will be used in logging in and out of the application.
- Rental Property Registration – The application provides an interface to property owners to register their RRPs.
- Rental Property Locating – The application has a search engine that can find a rental property in a specific target location. It is supported by real-time directions on how to locate a rental property and how far it is from an occupant's location using Google Maps API.
- Rental Property Directory – The application allows occupants to view the details of the RRP such as short description, rental rates, type of rental property, owner, contact number, address, availability, reviews and ratings, and other information that would be helpful to the occupants.
- Reservation and Inquiry Management – The application allows the occupant to make RRP reservations/inquiries that the property owner must confirm. Reservation will be automatically canceled within five (5) days if either occupants or property owner hasn't confirmed it.
- Occupants and Rental Management – The application enables the property

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owner to manage their occupants accordingly. The property owner can also register walk-in occupants in the application. A rental management user interface is also provided for the property owners to record the payment history of occupants.

- Messaging and Notification Services – The application allows occupants to send messages to the property owners for questions and clarifications, and other matters about the RRP.
- Ratings and Review Management – The application allows the occupants to rate and write reviews about an RRP. In addition, it will be helpful to other occupants to find their own rental house to live in.

3.1.2 Non-Functional Requirements

- Operational – The application runs on mobile smartphones with Android and IOS operating systems. It can also be accessed on computers using a web browser. Also, the application should have a backup server that will support the operations of the application in case its main server fails.
- Performance – The application supports more or less 3,000 users supporting user accessibility. Also, quarterly updates of the application should not compromise the user experience.
- Security and Privacy – The application always requires user login authentication. Also, the application prevents the display of messages and images with inappropriate content. It also protects users' personal information in compliance with the Data Protection Act.

3.3 Software Quality Evaluation Results

As part of the Testing and Evaluation process, the Hanap-Bahay App was subjected to the Software Quality Evaluation. The application was tested and evaluated by five (5) IT practitioners in Marinduque State College using a devised evaluation form based on the ISO 9126 Software Product Quality Model. In addition, system attributes were rated using the Likert Scale as discussed in the methodology. Below is the summarized result of ratings gathered from the evaluators.

Table 2.6 *Summary of Software Quality Evaluation*

System Attribute	Weighted Mean	Adjectival Rating
Functionality	4.36	Very Satisfactory
Reliability	4.8	Excellent
Usability	4.2	Very Satisfactory
Efficiency	4.1	Very Satisfactory
Maintainability	4.25	Very Satisfactory
Portability	4.4	Very Satisfactory
OVERALL MEAN	**4.35**	**Very Satisfactory**

With the six (6) system attributes that were evaluated, five (5) of them tallied a weighted mean with an equivalent rating of Very Satisfactory while one (1) was rated Excellent. Therefore, the summary of the software evaluation indicated that the application has a Very Satisfactory rating with an overall mean of 4.35. This result proves that the application has the quality that satisfies various users' stated and implied needs and thus provides value.

IV. CONCLUSIONS

Since their use in different aspects, mobile applications have contributed to the way people live their lives, improving their part in society. The development of the Hanap-Bahay App mobile application to help people like occupants and property owners manage their rental properties lessens common problems and improves existing business methods. With the different functions and features that the Hanap-Bahay App can do, occupants can easily find a suitable rental house. They can locate a rental house using a map that tells them its exact location and what directions to follow. Reserving a rental house can be done using the applications reservation and inquiry feature with just one click. Similarly, property owners can effectively

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manage their rental property information, directly communicate with their occupants, and collect their information and rental history accordingly.

Thus, using the Hanap-Bahay application is viable to the community. Existing occupants and property owners can benefit from it and new individuals who may become part of this environment.

V. RECOMMENDATIONS

Based on the conclusions, the following recommendations were drawn:

1. It is recommended to review the features and functions of the application and provide enhancements that can give a more significant advantage to users; and
2. It is also recommended to conduct a pilot testing of the application to further support the possible implementation of the project.

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DEVELOPMENT OF WEB-BASED BAKERY INVENTORY AND SALES MANAGEMENT SYSTEM (BAKEDPH)

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Abstract— This software project was undertaken with the purpose of giving the different bakeries a web-based information system that will reduce the problem they encounter in processing the sales, inventory and production data. The objectives of the project are 1) determine the feasibility of the system; 2) study and analyze the existing sales and inventory processes done in at least three different organizations; 3) design and develop a generic web-based information system; 4) Test the adherence of the functionality and features of the developed system to the requirements of the end-users. Initial pilot testing will be done to the three selected organizations. To determine to problems encountered with the existing system, different fact-finding techniques were used such as observation and series of interviews. To identify whether the developed system was feasible during the analysis, feasibility analysis was used. Economic feasibility was used to determine the cost and benefit of the developed system using cost and benefit analysis. To determine whether the developed system would be implemented and used by the chosen organizations, operational feasibility was utilized. Moreover, using technical feasibility, the system was successfully developed because computer hardware and application software were properly chosen and utilized. From the beginning of the research, to the actual development of the system, the developers found out that the system has a potential to give many advantages because of its different functionalities and features. This consist of inventory and sales tracking, monitoring, managing of inventory and managing of production.

Keywords: Web-based system, sales and inventory, monitoring, managing, pilot testing.

I. INTRODUCTION

Technology has become the enabler of business. Over the years, it has introduced a lot of improvements, developments and innovations across all fields whether it is in architecture, engineering, medicine, education, business, arts, and the like.

In today's generation, we are engaged in highly computerized technology aiming to make individual lifestyle more comfortable and easier most especially in the world of business. The manual system is now considered the first process after the birth of the computerized system.

The most commonly used system by several companies especially in the field of food production is the sales and inventory system. A sales and inventory system is a software-based business solution used to simultaneously track sales activity and inventory. The purpose of it is to make sure the business always has the right amount of inventory. It is an easy way of checking and listing of the sales of the company, it is faster and more reliable rather than doing manually. The system can minimize human errors in editing and be easily accessed anytime by the business. Sales and Inventory System makes the business more effective, more productive and is convenient for the business and its customers.

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In the Philippines, many business enthusiasts embark in the bakery business. Most of them are not even aware if the business is earning profit due to the difficulty of monitoring the products produced against the ingredients used. The same scenario is very evident in the island-province of Marinduque.

This study aims to develop a generic software for bakeshops to use. The proponents have selected three organizations to conduct the pilot testing.

Established in 1952 is Solomon's bakery situated in Barangay Mercado, Boac, Marinduque. It is very well known to many Boacquenos and one of the pioneer bakeries in the municipality. The second bakeshop is Recalde's Bakery, it is established in 2014 and situated in Brgy. Buyabod Sta. Cruz Marinduque. The third bakeshop is Owen's bakeshop, it is established in 2017 and situated in Brgy. Cawit, Boac Marinduque. By conducting a series of interviews with the selected organizations, the proponents found out that the processes inside the three organizations are similar. With this information, the proponents aim to develop a generic software with the functions and feature that a bakeshop will utilize.

Currently all the selected organizations are using manual system in their everyday operation which promotes a lot of problem that if not solved will cause major losses to the business. The problem in their current system is they couldn't manage simultaneously their sales and the stocks of their inventory. And also, it relies heavily on the actions of people, which increases the possibility of human error. People might forget to record a transaction or simply miscount the number of goods.

With our proposed system, all the sales and inventory will be recorded and monitored accurately within the system without much hassle. Human error will also be eliminated because of the automation of the processes.

Objective of the Study

The study aims to develop a Web-Based Inventory and Sales Management System initially for the three chosen organizations and eventually to be subscribed by other bakeries upon successful pilot implementation. The system is expected to facilitate the monitoring and controlling of bakery sales and inventory. Specifically, the project aims to:

1. Determine the feasibility of the system;
2. Study and analyze the existing sales and inventory processes done in the three selected organizations;
3. Design and develop a generic web-based information system for bakeries.
4. Test the adherence of the functionality and features of the developed system to the requirements of the end-users. Initial pilot testing will be done to the three selected organizations

Scope and Limitation of the Project

The proposed project Web-based Inventory and Sales Management System will be designed to manage the inventory and sales of different bakeshops. It will be a generic software. It will involve the basic phases of project management; requirement analysis, system planning and design, system development phase, testing and validation which are shown in the Work Breakdown Structure (WBS).

Under requirement analysis, a preliminary investigation was conducted which includes the selection of the organization, and preparing for an interview.
For system planning and design, feasibility study is conducted to determine if the developed system can be implemented and the organization is capable to adapt to the project.

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For system development phase, the proponents will perform coding and debugging of the system with the use of the different development tools that is necessary for developing the system.

For testing and validation, the proponents will conduct different tests to examine if it is performing as required or if there is an error to be corrected

Through the aid of this work packages, the scope was identified and planned accordingly. These processes help the proponents to easily determine the finished and unfinished process. The developed system "Web Based Bakery Inventory Sales Management System (Bakedph)" is limited and focuses on four processes; (1) recording of purchased raw materials (2) managing of sales record (3) managing of production (4) managing of inventory.

Significance of the Study

The system is expected to benefit the following:
Selected Organizations. The system may provide for an efficient and effective way of tracking the inventory of supplies, raw materials and products produced which in turn may furnish factual figures as to the profit gain/loss of the business by utilizing the power of a database. Moreover, it may produce projection reports which may be used to see and analyze possible trends in sales and profits.
Other Bakery Owners. The system may be used by other businesses via subscription in order to provide their businesses the same functions and features that a generic software has.

II. METHOD AND PROCEDURE

Requirement Analysis Procedure was used as a guide in methodize activity, and done with the Work Breakdown Structure as presented in Table 1.

Table 1: Work Breakdown Structure

1.0 REQUIREMENTS ANALYSIS

1.1 Establishing the Existing System
1.2 Initial Interview
1.3 Identify Key Stakeholders
1.4 Observation and Follow-up Interview
1.5 Problem Identification
1.6 Formulate Gantt Chart

2.0 SYSTEM PLANNING AND DESIGN

2.1 Formulation of Questionnaire
2.2 Conducting of Interview
2.3 Collection of Pertinent Documents
2.4 Formulation of Data Models

3.0 SYSTEM DEVELOPMENT AND TESTING

3.1 Programming
3.1.1 Coding
3.1.2 Designing

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3.2 Testing
3.2.1 Alpha Testing
3.2.2 User Acceptance Testing
3.3 Debugging

4.0 INSTALLATION

4.1 Conduct Training and Orientation
4.1.1 Formulate Questionnaire
4.1.2 Request for the Convening of Users
4.1.3 Conduct Basic Orientation Training
4.1.4 Prepare System Users Training
4.2 Beta Testing
4.3 Installation

An interview letter was prepared first then submitted to Solomon's Bakery, Owen's Bakery and Recalde's Bakery to conduct the formal and series of interviews in order to grasp a clear and understanding of how processes are executed in the business organization and to gather the needed data from the respective owners of the said bakery. Another series of interview was conducted during the 2nd week of March with the respective owners to clarify the existing process of the organization. Through the meeting, the processes of the system for the organization were identified, which served as guide for the development of the project. By the use of the Prototyping model as the methodology for the developers to follow steadily for the development processes of the system.

To assess how the system was accurate and reliable, Alpha testing will be conducted by the proponents. The proponents will review the design specification and functional requirements of the system first. Then they will develop a comprehensive test plan and test cases. After that, they will execute the test plan in order to find log defects and fix those defects. Finally, retest will be done once the issues are solved for smooth functioning software.

The prototyping methodology was used as system development model to serve as a guide throughout the development process. With this, even if the development has started, it is possible to make necessary adjustments in accordance with the needs of the organization. During development, the clients can freely suggest like how they want the system to look like and how it works.

Data flow diagram as presented in Figure 1 was created to see the overview of the current system.

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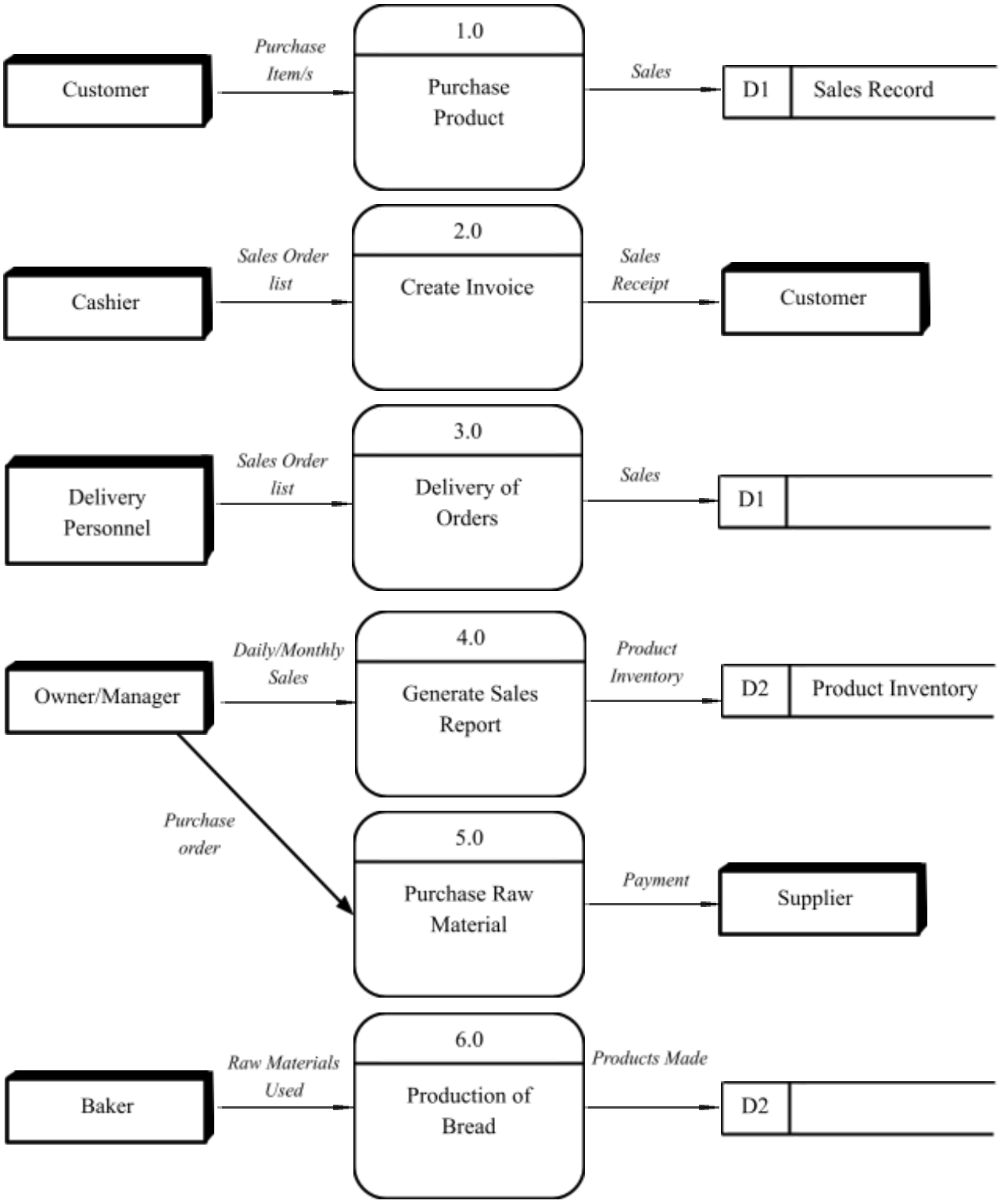
Figure 1: Data Flow Diagram
Existing System (Solomon's, Owen's, Recalde's Bakery)



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It was used to quickly identify the procedures and transactions done in the existing system. in addition, the proponents used work breakdown structure (Table 1) as a guide for the development of the system as well as Gantt Chart as presented in Figure 2 in order to identify the schedule of activities to be conducted for the development of the system.

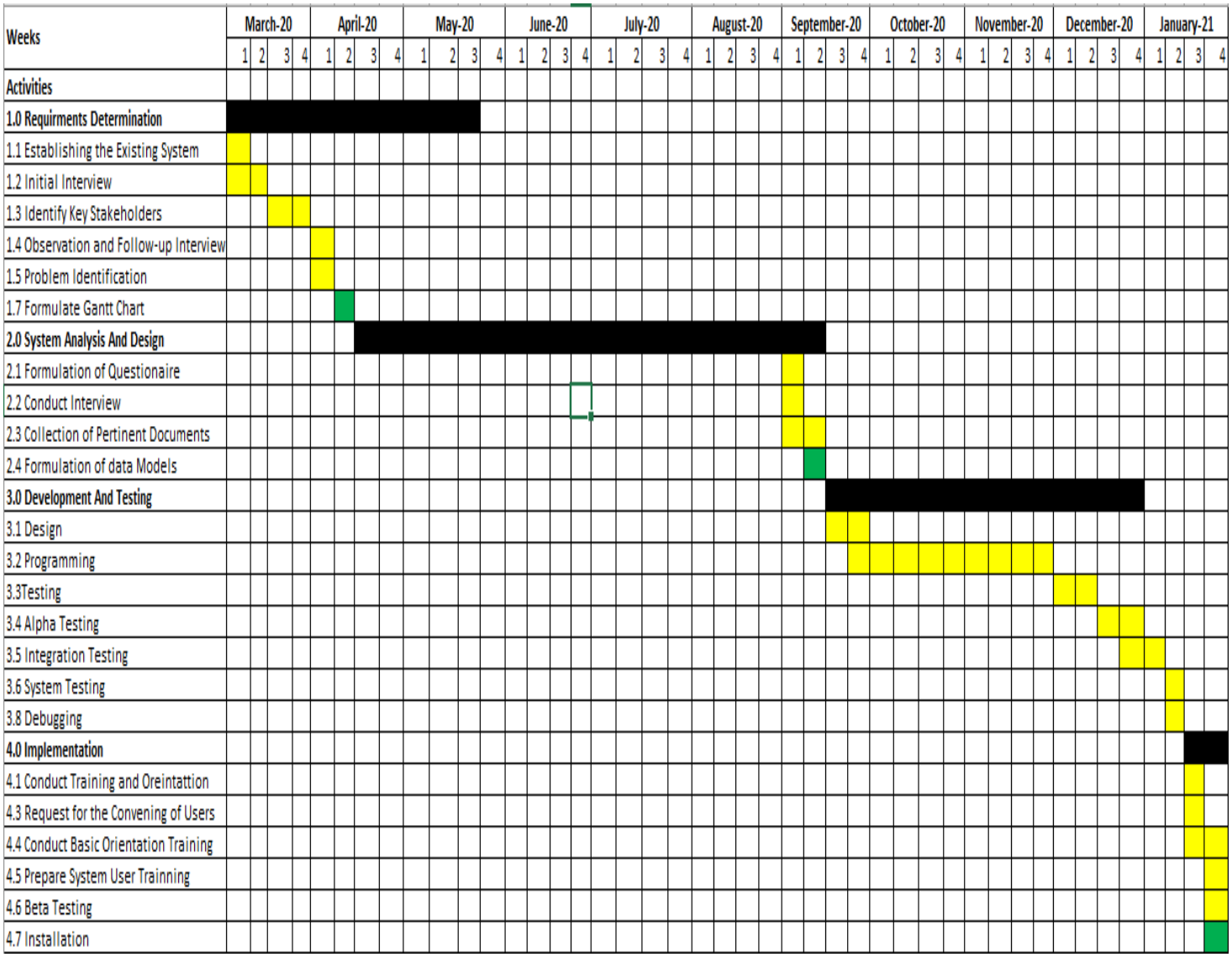
Figure 2: Gantt Chart

LEGEND:

Target Date for Activities

Activities Finished

Milestone



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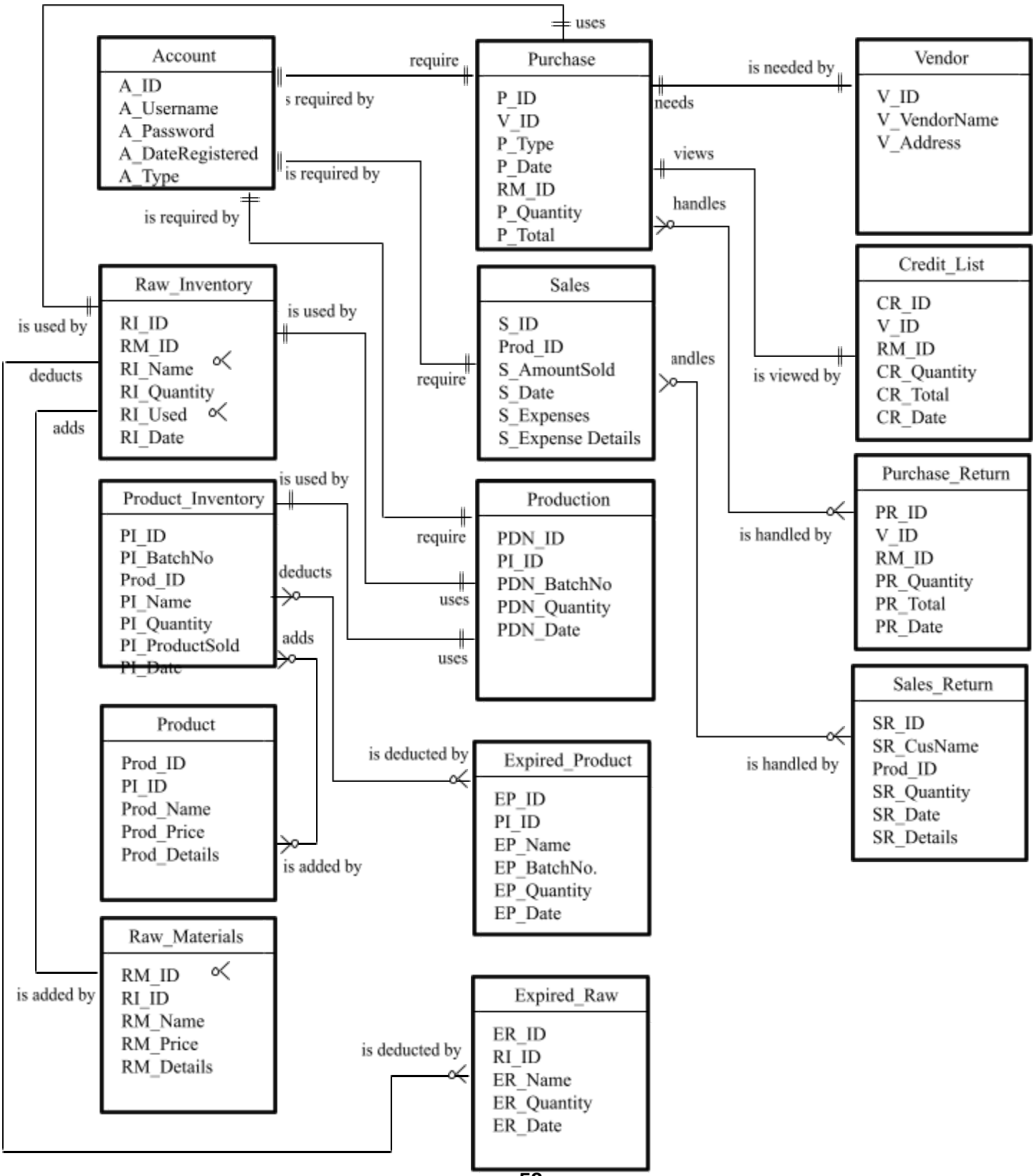
In addition, Entity Relationship Diagram as presented in Figure 3 was used to visualize the needed entities and attributes on the database of the system. Also, it helps to understand the relationship between those entities and its attributes and the processes connecting the two entities

Figure 3: Entity Relationship Diagram



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Furthermore, Database Schema as presented in Figure 4 was used in order to organize and show the information inserted in the database of the system.

Figure 4: Database Schema

Account Table – *account_tbl*

Field Name	Data Type	Constraint
Account ID	Varchar (10)	Primary Key
Account Username	Varchar (20)	Not Null
Account Password	Varchar (20)	Not Null
Registration Date	Date	Not Null
Account type	Varchar (10)	Not Null

Purchase Table – *purchase_tbl*

Field Name	Data Type	Constraint
Purchase ID	Varchar (10)	Primary Key
Vendor ID	Varchar (20)	Foreign Key
Purchase Type	Varchar (20)	Not Null
Purchase Date	Date	Not Null
Raw Material ID	Varchar (10)	Foreign Key
Purchase Quantity	Varchar (20)	Not Null
Purchase Total	Varchar (20)	Not Null

Vendor Table – *vendor_tbl*

Field Name	Data Type	Constraint
Vendor ID	Varchar (10)	Primary Key
Vendor Name	Varchar (20)	Not Null
Vendor Address	Varchar (20)	Not Null

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Credit List Table – *creditlist_tbl*

Field Name	Data Type	Constraint
Credit ID	Varchar (10)	Primary Key
Vendor ID	Varchar (10)	Foreign Key
Raw Material ID	Varchar (10)	Foreign Key
Credit Quantity	Varchar (20)	Not Null
Credit Total	Varchar (20)	Not Null
Credit Date	Date	Not Null

Purchase Return Table – *purchasereturn_tbl*

Field Name	Data Type	Constraint
Purchase Return ID	Varchar (10)	Primary Key
Vendor ID	Varchar (10)	Foreign Key
Raw Material ID	Varchar (10)	Foreign Key
Purchase Return Quantity	Varchar (20)	Not Null
Purchase Return Total	Varchar (20)	Not Null
Purchase Return Date	Date	Not Null

Sales Table – *sales_tbl*

Field Name	Data Type	Constraint
Sales ID	Varchar (10)	Primary Key
Product ID	Varchar (10)	Foreign Key
Amount Sold	Varchar (20)	Not Null
Sales Date	Date	Not Null
Expenses	Varchar (20)	Not Null
Expenses Details	Varchar (20)	Not Null

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Sales Return Table – salesreturn_tbl

Field Name	Data Type	Constraint
Sales Return ID	Varchar (10)	Primary Key
Customer Name	Varchar (20)	Not Null
Product ID	Varchar (10)	Foreign Key
Purchase Return Quantity	Varchar (20)	Not Null
Purchase Return Total	Varchar (20)	Not Null
Purchase Return Date	Date	Not Null

Production Table – *production_tbl*

Field Name	Data Type	Constraint
Production ID	Varchar (10)	Primary Key
Product Inventory ID	Varchar (10)	Foreign Key
Production Batch Number	Varchar (10)	Not Null
Production Quantity	Varchar (20)	Not Null
Production Date	Date	Not Null

Product Table – *product_tbl*

Field Name	Data Type	Constraint
Product ID	Varchar (10)	Primary Key
Product Inventory ID	Varchar (10)	Foreign Key
Product Name	Varchar (20)	Not Null
Product Price	Varchar (10)	Not Null
Product Details	Varchar (20)	Not Null

Raw Material Table – *raw_tbl*

Field Name	Data Type	Constraint
Raw Material ID	Varchar (10)	Primary Key

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Raw Inventory ID	Varchar (10)	Foreign Key
Raw Material Name	Varchar (20)	Not Null
Raw Material Price	Varchar (10)	Not Null
Raw Material Details	Varchar (20)	Not Null

Product Inventory – prodinv_tbl

Field Name	Data Type	Constraint
Product Inventory ID	Varchar (10)	Primary Key
Product Batch Number	Varchar (10)	Not Null
Product ID	Varchar (10)	Foreign Key
Product Name	Varchar (20)	Not Null
Quantity	Varchar (10)	Not Null
Amount Sold	Varchar (10)	Not Null
Date	Date	Not Null

Raw Material Inventory – rawinv_tbl

Field Name	Data Type	Constraint
Raw Inventory ID	Varchar (10)	Primary Key
Raw Material ID	Varchar (10)	Foreign Key
Raw Material Name	Varchar (20)	Not Null
Quantity	Varchar (10)	Not Null
Amount Used	Varchar (10)	Not Null
Date	Date	Not Null

Expired Product Table – *expprod_tbl*

Field Name	Data Type	Constraint
Expired Product ID	Varchar (10)	Primary Key

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Product Inventory ID	Varchar (10)	Foreign Key
Product Name	Varchar (20)	Not Null
Batch Number	Varchar (10)	Not Null
Quantity	Varchar (10)	Not Null
Date	Date	Not Null

Expired Raw Table – *expraw_tbl*

Field Name	Data Type	Constraint
Expired RawID	Varchar (10)	Primary Key
Raw Inventory ID	Varchar (10)	Foreign Key
Raw Material Name	Varchar (20)	Not Null
Quantity	Varchar (10)	Not Null
Date	Date	Not Null

A personal interview with all the respective owners of the bakeshops was made for this feasibility to gather information of the resources used in their operation. To determine the Payback year and Return on Investment (ROI), the Cost and Benefit Analysis in Figure 5, 6, 7 was done to all the selected organizations. Then comparison of all the results was done to determine the projected cost benefit.

Figure 5: Cost Benefit Analysis (Solomon's Bakery)

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Total Cost of the Operational Existing System	112,200.00	66,410.00	76,351.00	83,986.10	92,384.71
Total Cost of the Operational Proposed System	18,200.00	19,520.00	20,972.00	22,569.00	24,325.60
Subscription Fee	7,200.00	7,200.00	7,200.00	7,200.00	7,200.00
Project Cost Benefit	94,000.00	46,890.00	55,379.00	61,417.10	68,059.11
Cumulative Benefit	**₱86,800.00**	**₱126,490.00**	**₱174,669.00**	**₱228,886.1**	**₱289,745.21**

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Figure 6: Cost Benefit Analysis (Owen's Bakery)

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Total Cost of Operational Existing System	52,350.00	39,908.00	43,898.00	48,288.18	53,117.55
Total Cost of Operational Proposed System	18,200.00	19,520.00	20,972.00	22,569.00	24,325.60
Subscription Fee	7,200.00	7,200.00	7,200.00	7,200.00	7,200.00
Project Cost Benefit	34,150.00	20,388.00	22,926.00	25,719.18	28,791.95
Cumulative Benefit	**₱26,950.00**	**₱40,138.00**	**₱55,864.00**	**₱74,383.18**	**₱95,975.13**

Figure 7: Cost Benefit Analysis (Recalde's Bakery)

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Total Cost of Operational Existing System	56,350.00	39,908.00	43,898.00	48,288.18	53,117.55
Total Cost of Operational Proposed System	18,200.00	19,520.00	20,972.00	22,569.00	24,325.60
Subscription Fee	7,200.00	7,200.00	7,200.00	7,200.00	7,200.00
Project Cost Benefit	38,150.00	20,388.00	22,926.00	25,719.18	28,791.95
Cumulative Benefit	**₱ 30,950.00**	**₱ 44,138.00**	**₱ 59,864.00**	**₱78,383.18**	**₱99,975.13**

Technical Feasibility. In order to develop the system, stable and proper computer hardware and application software should be used. Gap Analysis as shown in Figure 8 was used to determine if the proponents have the available hardware and software requirement to develop the system.

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Figure 8: Gap Analysis of Proponents

Hardware Specification		
Needed Technical Specification	**Available Resources**	**Action Needed**
Processor Intel® Core i3 CPU @ 2.7 GHz	AMD FX 6300 @ 3.5 GHz	Use the available resources
Random Access Memory (RAM) minimum of 4GB	Random Access Memory (RAM) 8 GB Memory	Use the available resources
Hard Disk Drive Capacity 500 GB	Hard Disk Drive Capacity 1 TB	Use the available resources
Software Specification for Computer or Laptop		
Operating System Windows 7 Ultimate	Operating System Windows 10 Home 64-bit Edition	Use the available resource
Web Browser Google Chrome 63.0.3239.108	Web Browser Google Chrome	Use the available resources

The proponents also assessed their IT literacy level to know if they are capable of developing the system using SWOT Analysis in Figure 9. In SWOT analysis, strengths, and weaknesses of the proponents were determined as well as the opportunities and threats in developing the system.

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Figure 9: SWOT Analysis of Proponents

Strength	Weaknesses
• The proponents have the programming capability to develop the proposed system. • The proponents have required software and hardware resources for the development of the system. • Have teamwork and willing to finish the development of the system.	• Miscommunication to the client of the organization. • Poor time/Schedule Management • Financial boundaries. • The proponents may have divided attention due to ongoing classes.
Opportunities	**Threats**
• Enhance the knowledge in documentation • Apply the knowledge from previous subjects in the development of the system	• Frequent power interruption • Slow or no internet/mobile data connection. • Hardware or Software Failure

Operational Feasibility. It was done to determine whether the developed system would be implemented. Using SWOT analysis in Figure 10, it helps the proponents to determine the strength, weaknesses, possible opportunities and threats of the project in an organization. It's also to determine the technical specification available and needed ICT resources of the organization. This is done to determine the system requirements needed for the developed system. The Gap Analysis (Appendix V) was used to compare the existing resources of the organization and the resources needed for the implementation of the system. The capability of the user to use the system was also identified.

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Figure 10: SWOT Analysis of Organizations

Strength	Weaknesses
• The selected organizations are interested and willing to support the development of the proposed system. • The Selected Organizations already owns a computer and have access to the internet.	• No proper monitoring of sales. • No proper inventory of raw materials.
Opportunities	**Threats**
• More help to the organization in terms of being monitoring the inventory. • The developed system will be very useful for it will increase the productivity and efficiency at work	• Frequent power interruption • Slow or no internet connection

The Gap Analysis in Figure 11 was used to compare the existing resources of the organization and the resources needed for the implementation of the system. The capability of the user to use the system was also identified.

Figure 11: Gap Analysis

(Solomon's Bakery)

Hardware Specification		
Needed Technical Specification	**Available Resources**	**Action Needed**
Processor Intel® Core i3 CPU @ 2.7 GHz	Intel® 8th Gen™ Core i7-8550U CPU @ 1.80 GHz	Use the available resources

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Random Access Memory (RAM) minimum of 4GB	Random Access Memory (RAM) 8 GB Memory	Use the available resources
Hard Disk Drive Capacity 500 GB	Hard Disk Drive Capacity 2 TB HDD	Use the available resources
Software Specification for Computer or Laptop		
Operating System Windows 7 Ultimate	Operating System Windows 10 Home 64-bit Edition	Use the available resource
Web Browser Google Chrome63.0.3239.108	Web Browser Google Chrome	Use the available resources

(Owen's Bakery)

Hardware Specification		
Needed Technical Specification	**Available Resources**	**Action Needed**
Processor Intel® Core i3 CPU @ 2.7 GHz	Intel® 6th Gen™ Core i3-6100H CPU @ 2.7 GHz	Use the available resources
Random Access Memory (RAM) minimum of 4GB	Random Access Memory (RAM) 4 GB Memory	Use the available resources
Hard Disk Drive Capacity 500 GB	Hard Disk Drive Capacity 500 GB	Use the available resources
Software Specification for Computer or Laptop		
Operating System Windows 7 Ultimate	Operating System Windows 10 Home 64-bit Edition	Use the available resource
Web Browser Google Chrome 63.0.3239.108	Web Browser Google Chrome	Use the available resources

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(Recalde's Bakery)

Hardware Specification		
Needed Technical Specification	**Available Resources**	**Action Needed**
Processor Intel® Core i3 CPU @ 2.7 GHz	AMD A10 7860k CPU @ 3.6 GHz	Use the available resources
Random Access Memory (RAM) minimum of 4GB	Random Access Memory (RAM) 8 GB Memory	Use the available resources
Hard Disk Drive Capacity 500 GB	Hard Disk Drive Capacity 1 TB	Use the available resources
Software Specification for Computer or Laptop		
Operating System Windows 7 Ultimate	Operating System Windows 7 Ultimate	Use the available resource
Web Browser Google Chrome 63.0.3239.108	Web Browser Google Chrome	Use the available resources

Development and Testing Procedures

Development Procedures of the System. The proposed system was developed using several essential tools and application. Sublime Text was used as the source code editor. HTML was used in defining the structure and layout of the Web-document by using a variety of tags and attributes. Using this, the developed system which is web-based, will be a responsive and dynamic one. For the back end, the codes embedded are in Hypertext Pre-processor (PHP) while XAMPP (Apache) will be used as the local server to test the web system from time to time. MySQL was used as the database of all the data inside the proposed system. Cascading Style Sheets (CSS) was used for styling purposes of the web pages interface. Reminders or notifications in the system will be done through JavaScript. Stripe was used as an API to process the payments that the system will receive.

Testing Procedures of the System. To assess how the system was accurate and reliable, Alpha testing will be conducted by the proponents. The proponents will review the design specification and functional requirements of the system first. Then they will develop a comprehensive test plan and test cases. After

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that, they will execute the test plan in order to find log defects and fix those defects. Finally, retest will be done once the issues are solved for smooth functioning software.
User Acceptance Testing (UAT) will be conducted after the Alpha Test. The proponents will first request from the respective owners of the selected organizations for the availability of user participants. Orientation with the users will be conducted on the purpose of User Acceptance Testing. UAT feedback sheets will be provided to the users to gather possible feedbacks on the system. After that, the proponents will act on the user feedback as soon as possible.
After that, the system will be ready for Software Product Quality test that is created based on ISO 9126 Software Product Quality Standard. After passing, it is now ready for deployment.

Installation Plan

First, the installation plan will be executed by connecting the computers in the different business site to the system via the internet. After connecting, mentoring and coaching is initially rendered to the end-user in order to assist them in learning how to utilize each function and feature of the system. Secondly, orientation training prior to implementation discussing the basics of automated processing may be pursued depending on the I.T. literacy level of the eventual end-user. Lastly, a User's Manual will be created and be given to the organization which will serve as the guide of the client as the system begin to be used, and for some instance of encountering certain errors with the system.
The proposed system when developed, will be immediately delivered and presented to the selected organizations to commence beta testing. After the testing, if the developed system satisfied the requirements, the system will be prepared for web hosting and getting a domain name. After the system is stored inside the web host and after getting the domain name (.co), the developed system will be immediately available for subscription for all bakeries or bakeshops. The proponents will be the one managing and maintaining the software.

III. RESULTS AND DISCUSSIONS

Description of the Existing System

All the selected organizations utilize manual process on how they manage all the transactions in their business. Almost all of the processes in their current system are similar. There may be some minor differences but the purpose of each process is the same. In purchasing raw materials, Solomon's bakery and Owen's bakeshop only buys raw materials when they see that their current stock is few. Recalde's bakery on the other hand, buys their raw materials every day. All the three organization doesn't have a proper inventory of their raw materials. In production, Solomon's Bakery records the raw materials that will be used in production and the number of produced bread while Recalde's and Owen's only records all the produced bread and not the raw materials used. In sales, all the three organizations calculate their sales at the end of each day based on the inventory record of the products.

Requirements Specification

As to the determined result based on the users' requirements and supporting documents collected, the following will be the functionalities and non-functionalities of the proposed system.

Functional Requirements

Sign up/Sign In

- The system shall allow the developers to have an admin account.

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- The system shall allow the client to register an account in the system.
- The system shall allow the client to choose the subscription plan upon signing up.

Purchase Management

- The system shall allow authorized user to enter the purchase module.
- The authorized user will select the appropriate supplier name from the supplier list.
- If the supplier name is not available, then the system will allow authorized user to create new supplier details.
- Purchase orders can be 2 types, cash or credit. If the purchase is on credit, the user will mark the transaction as credit.
- The system shall show the list of credit supplier and credit transaction details.
- The system shall allow the user to set the due date for the credit.
- The system shall notify the user if the due date for the credit is near.
- If the payment is made to the credit vendor, the user will remove the credit check and the system shall remove the name from the credit list.
- The authorized user will select the appropriate raw material name from the list.
- If the material is not available, then the system will allow authorized user to create new raw material details.
- The system shall allow the user to view the raw materials inventory.
- The system shall update the inventory automatically.
- The system shall automatically calculate the total purchase amount based on the unit price and quantity purchased.
- The system shall allow the user to view the purchase history.
- The system shall allow the user to export the purchase record.

Sales Management

- The system shall allow the authorized user to enter into the sales module.
- The system shall allow the authorized user to check the quantity in the product inventory before recording sales order.
- The authorized user will input the amount of all the products sold.
- The system shall automatically calculate the total sales amount, based on unit price and number of products sold.
- The system shall automatically update the quantity of the products left in the inventory.
- The system shall allow the user to view all the daily, weekly, monthly and annual sales record.

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- The system shall allow the authorized user to record all the expense details.
- The system shall deduct all the daily/weekly/monthly expenses to the daily/weekly/monthly sales to generate the net sales.
- The system shall allow the authorized user to generate daily, weekly and monthly sales report.
- The system shall allow the user to export the sales record.

Production Management

- The system shall automatically update the quantity of the raw materials left in the inventory.
- The system shall allow the authorized user to add all the finished product by batch in the inventory.
- The authorized user will select the appropriate product name from the product list. The Batch Number will be automatically generated by the system.
- If the product is not available, then the system will allow authorized user to create new product's details.
- The system shall allow the user to export the production record.

Inventory Management

- **Raw Materials**
  - The system shall allow the user to view the raw materials inventory.
  - When raw materials are purchased, the authorized user will enter the purchase details and the system will automatically update the stock amount of that particular raw material.
  - The system shall allow the user to add and edit raw materials details.
  - The system shall automatically deduct all the raw materials used in production to the raw materials inventory.
  - The system shall allow the user to set their desired minimum level for inventory.
  - When stock reaches a certain minimum level, the system will display a notification to the user.
  - The system shall automatically deduct all the expired raw materials in the inventory.
  - The system shall notify the user if there is an expired raw material.
  - The system shall allow the user to export the raw material inventory record.
- **Products**
  - The system shall allow the user to view the products inventory.

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- The system shall allow the authorized user to set the ingredients that will be used in order to produce a certain product.
- When products are sold, the authorized user will enter the sales details and the system will automatically update the stock amount of that particular product.
- The system shall allow the user to add and edit product details and pricing.
- When product stock reaches a certain minimum level, the system will display an alert to the user.
- The system shall automatically deduct all the expired product in the inventory.
- The system shall notify the user if there is an expired product.
- The system shall allow the user to export the product inventory record.

Subscription and Account Management

- The system shall allow the admin to verify the subscription of the clients.
- The system shall allow the admin to add or edit subscription plans.
- The system shall allow the user to back up all the data.

Non-Functional Requirements

The Administrator must be able to access their account 24 hours a day, seven days a week.

Security

- The system must have protection from unauthorized users. By using username and password.
- The system will also show if the username or password is incorrect.
- To use the system, the user has to login by their username and password.
- The application should secure all information stored in the local and online database

Performance

- The system is supposed to respond in less than 2 seconds.

Availability

- The system shall be available 99.5% of the time.
- The system should have an available server online 24 hours per day, 365 days per year.

Results of Feasibility Analysis

Technical Feasibility. From the conducted SWOT Analysis as shown in Figure 9, it shows that the proponents have the needed strength for the development of the system. A Gap Analysis as shown in Figure 8 was used to represent the study of hardware and software resources available for the

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development of the system. This feasibility determined that the Web-based Bakery Inventory and Sales Management System (Bakedph.co) is technically feasible.

Operational Feasibility. From the conducted SWOT Analysis as shown in Figure 10, it shows that the selected organizations have the needed strength for the development of the system. A Gap Analysis as shown in Figure 11 was used to represent the study of available ICT resources and technical specification in the selected organizations compared to the required system requirements of the developed system. This feasibility determined that the Web-based Bakery Inventory and Sales Management System (Bakedph.co) is operationally feasible.

Economic Feasibility. The Cost and Benefit Analysis (Figure 5, 6, 7) was used to see the return of investment and Break-Even year and Ratio of the proposed project. By comparing all the results from the Cost and Benefit Analysis of the selected organizations, it reveals that all the selected organizations could receive benefit from the system after only 1 to 2 years. With the Projected Income Table as shown in Figure 12, it shows that the proponents could also receive benefit from the system after two years, confirming that the project is economically feasible.

Figure 12: Project Income of Proponents

Description	Year 1	Year 2	Year 3	Year 4	Year 5
Target Subscriber	Boac	Mogpog/Sta. Cruz	Torrijos/ Buenavista	Lucena City	Metro Manila
Estimated Number of Bakeries	5	10	10	20	50
Subscription Rate	500/month	500/month	500/month	500/month	500/month
Expenses of the Proposed System	35,089.00	24,909.00	26,361.00	27,958.20	29,714.60
Projected Income Per Year	**-₱5,089.00**	**₱ 35,091.00**	**₱ 33,639.00**	**₱ 92,041.8**	**₱27,0285.4**

Test Result

The proponents were able to successfully conduct and finish the Alpha Testing. Various problems and defects have been identified and were fixed immediately. Retests has been done after the issues have been solved in order to have a smooth functioning software. The developers

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also found out that the system will be acceptable to the different organizations by means of the Software Product Quality test that has been answered by the different users.

IV. CONCLUSION

By studying the different processes and of three different organizations, the proponents were able to identify the major processes and also the problems encountered with the existing system. The developed system, Web-Based Inventory and Sales Management System (Bakedph) is a generic software that has been initially tested within the three organizations.

The proponents found out that the developed system plays a big role in the progress of monitoring the sales and inventory. From the beginning of the research, using different techniques such as interview and observation, to the actual development of the system, the developers found out that the system has a potential to give many advantages because of its different functionalities and features. This consist of inventory and sales tracking, monitoring, managing of inventory etc. It also has the security which will be maintained regularly by the proponents to avoid system breach and to assure the confidentiality of the data inside the system.

V. RECOMMENDATIONS

The developers may recommend integrating business intelligence into the system. This will help spot market trends, spot business problems, gain competitive advantage and identify ways to increase profit.

Another recommendation is the integration of Business Analytics. This will help in improving the decision-making process, uncovering fresh business insights and improving financial efficiency.

Another recommendation is to add a feature that records and manages sales return and purchase return.

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CLASS OBSERVATION AND MONITORING SYSTEM

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Abstract **-** Manual Class Observation and Monitoring was a process in which information about the teaching performance of the Teachers were gathered. In order to gather the Teaching Performance of Teacher the person-in-charge to gather this information tends to consume a lot of time and at the same time gives a great effort. But because to the Pandemic the manual Class Observation and Monitoring became a problem on one of the schools in Marinduque State College which is the School of Information and Computing Sciences. Therefore, the developers proposed a web-based application. This study's main objective is to help the Dean to provide objective number in the evaluation at the end of the semester and also to avoid any physical interaction between Dean, Program Head and the Teacher. And because it requires no physical interaction the Dean, Program Head will monitor the teacher of the SICS Faculty virtually. This web-based application aims to develop a computerized system that would meet the needs of the organization for effective and efficient performance of work.

The development of Class Observation and Monitoring System was developed to improve the Manual Observation and Monitoring of School of Information and Computing Sciences to provide a more convenient and organized reports as well as to avoid physical interaction of every individuals who are involve in this web-based application to comply on the Health and Safety Protocols of the new normal. With the wide spread advancement of technology, different information can be accessed through internet connection. One of them is the remote learning in which classes are be done using virtual classrooms which had been in demand to different schools due to wide spread of the pandemic. The web-based application provides updating, searching, observation and monitoring of Teachers in School of Information and Computing Sciences regarding on the teaching performance. It has also the ability to generate summary of reports from the data collected from the observation and monitoring of the Dean and Program Head. Moreover, the developed system will greatly benefit not only to the Dean and Program Head but also for the School of Information and Computing Sciences. This could be one of the systems that helped in the Observation and Monitoring of Teacher in different Schools inside Marinduque State College.

Keywords: Class Observation and Monitoring System, Monitoring System, Class Observation

I. INTRODUCTION

Technology as of today, is a well-known symbol of advancement. Technology has helped institutions in many ways, productivity has increased and work is made easier. Institutions are now adapting technology to be able to perform efficiently [10].

Traditionally, class monitoring is taken manually, which is a time-consuming event. Moreover, it is very difficult to verify one by one teacher's in a large school department environment whether the authenticated teachers are actually responding or not. It is not inefficient using papers but it will require

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the management of the academic institution to offer a well-managed filing system to provide the class monitoring records.

Attendance is a significant concern when it comes to different fields and organizations [8]. Attendance is established and noted to monitor employee's attendance [1]. Also, attendance records have primarily become the proxy to determine the success of the employee in different institutions [12].

Nowadays manual method is not effective. Monitoring manually is time consuming and requires a lot of manpower and effort by calling names or signing on paper and even unsecure, because there is a possibility of proxy attendance and also avoid drawbacks of traditional ways [10] [7] [11].

Marinduque State College, is known for using paper-based approach when Monitoring Class of Faculty, The School of Information and Computing Sciences (SICS) is one of the schools of MSC Boac main campus, which is using the said approach. The process of using this approach, starts with the Dean that assign checker, the assigned checker will be one of the faculty that picked by the Dean, then the assigned checker will do the rounds in the school department and check whether the teacher is teaching in their designated room. If the teacher was absent his/her attention will be caught by the office of the school dean the next day to confirm their absence and know the reason behind it.

These days remote learning had become in demand to different schools. Attending classes using virtual classrooms became a big role on Faculty member in a school. This can be one of the most important factors that can help students excel in their studies even if it doesn't require any physical interactions. With the help of the internet and applications such as (Edmodo, Google Classroom, etc.) it is now possible for a teacher to share his/her knowledge to students virtually.

Due to the risk of the pandemic that people are facing, the developers' developed a web-based application that can avoid any physical interaction between the Dean / Program Head and the Teacher. And because it requires no physical interaction the Dean / Program Head will monitor the teacher of the SICS Faculty virtually. This application will help them to log all the activities of the faculty and counter check it if the faculty is adapting what is stated in the syllabus to their google classroom. Also, this application will help them to monitor synchronous activities for example, if teachers are conducting online lectures or how many hours do, they spent in online lectures whether it is congruence on what is indicated in their Course Syllabus. The other one is asynchronous activities the said application can check whether the activities given by the teachers enough and how long is the range of the asynchronous activity. The matters mentioned above are monitored to test whether the students are participating and at the same time if they are learning from the lessons.

There will be an analysis that will show whether the teacher is already monitored and teachers who are not yet monitored. Statistics or Analysis will be provided to show the Teacher's timeliness, if teachers are being delayed or attending in-time on their classrooms. The analysis will indicate whether the teacher will be advice to undergo makeup class. One of the purposes of this class monitoring is that at the end of the semester the Dean can give number of objectives on the evaluation. This application will no longer be a burden to the Dean because there will another person who will help on monitoring the teachers.

Thus, a web-based application which is the Class Observation and Monitoring System was developed as a solution to lighten the workload of the Dean as well as the Program Head and also avoid physical interactions due to the risk of the pandemic.

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II. METHOD AND PROCEDURE

Requirements Analysis Procedure

A preliminary investigation thru fact finding techniques such as interview to the Dean of the School of Information and Computing Sciences was conducted to get the needed requirements on the first quarter of 2020. A letter of seeking permission, (Appendix C) was given to be able to conduct a series of interview. Throughout the face-to-face interview, (Appendix D) was prepared and used as an interview guide questions.

Prototyping model was used as a software development model where a prototype is created, tested and then reworked as necessary until an appropriate result is reach from which the entire system or product can be produce. It works best in scenarios where the project's requirements are not known in detail such as online systems and web interfaces.

A Work Breakdown Structure (Appendix A) outlines the project and breaks it down into smaller, more manageable portions. It was used to achieve the project goals and to generate the necessary outputs. Gantt Chart (Appendix B) is used for the preparation of projects of all sizes and are a useful way to indicate what work is planned to completed on a particular day It was used to help the developers determine the project duration, identify the resources needed and track the project's progress.

A review of related literature was directed to support the well-known problems, to look for a possible solution to be advanced and to compare the ideas and previous work of other researchers related to the project.

Feasibility Analysis Procedure

An interview to the Dean of School of Information and Computing Sciences was done to analyze if the system is feasible. It was conducted to completely understand the process being performed by the Dean when monitoring the class attendance of the SICS Faculty.

For operational feasibility, an interview to the Dean of the School of Information and Computing Sciences was conducted. After the interview, SWOT analysis (Appendix E) was used to define whether the organization has the capacity to operate a computer system for the preparedness of the people who will use the system. This will also be used to identify how they will familiarize the changes of the system and to classify the threats and opportunities that originated outside the organization. Gap Analysis (Appendix F) was used to analyze if their ICT resources can support the developed system and to determine its specification.

For technical feasibility, the developers' technical resources were evaluated to determine its specification. And to analyze if their existing ICT resources can be used in developing a web-based application, Gap Analysis (Appendix G) was used.

Additionally, SWOT Analysis (Appendix H) was used to classify and to measure the skills and technical abilities of the developers'.

The developers' assessed their technical skills and abilities together with their opportunities and threats that their team might experience throughout the development of the project.

For economic feasibility, the supplies and materials and other expenses of the Dean for whole process of monitoring the SICS Faculty were evaluated. In Order to determine even if the web-based application

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would feasible and economically beneficial or not, Cost Analysis (Appendix I) was used. The development cost was examined based on the personal services, preservation, operation and other related expenses of the developers throughout the development. Break – Even Analysis was done to find out the payback ratio that would be made by the system to them.

Development and Testing Procedure

The web-based application was coded based on its planned functionality. The following tools and methods were used.

Use case diagram (Appendix J) was used to illustrate and define the functional requirements of the developed system and its interaction with the actors.

Entity Relationship Diagram (Appendix K) was used to shows the connection or relationship of people, objects, places, concepts or events within the system. Database Schema (Appendix L) will be created based on the ERD and the database management will be designed using MySQL.

PHP: Hypertext Preprocessor was used as a server-side scripting language and a tool used for creating static webpages of the developed system. JavaScript will also have used to update and change both HTML and CSS.

Hypertext Markup Language was used as the primary markup language and a tool for creating webpages of the system. It helps to show documents and files on the system.

Sublime Text was used as the text editor. It has a lot of features like syntax highlighting, auto-identification, file type detection, sidebar, plug-in, and packages that make it easier for developers to work with the code.

Cascading Style Sheet (CSS) was used as a style sheet language and a tool for illustrating the appearance and styling of a document written in a markup language. It was also have intended to simplify the process of making web pages more presentable.

XAMMP, a free and open-source cross platform web server solution stack package was used to access and to test the functionality of the system. XAMMP which consist of Apache was used as an actual web server application. Its function is to process and deliver web contents to a personal computer.

There were series of testing that was conducted to make sure that the system is error-free. Using a test case, a system testing was also conducted to test all the process of the system and to ensure if it is defect-free. The developers' run the web-based application based on the set of data in the test plan. The outputs of the test run must match the expected results. Compatibility testing using browser testing (Appendix M) Compatibility testing was also used to test the system's compatibility when it comes to web browsers. The system was run in different web browsers to confirm that it can perform its intended purpose. The system will be tested if it follows the user requirements and specification. User Acceptance Testing was conducted together with the Dean of School of Information and Computing Sciences to determine if the system meets the expectation that is needed for the functionalities. A user acceptance form (Appendix N) was provided for the testing. The Dean use a computer to test each functionality of the system. Software Testing and Evaluation based on ISO 9126 (Appendix O) was used as the evaluation instrument to measure the system quality based on the expert's feedbacks. A form was distributed to IT experts of MSC for the evaluation of the developed system. The evaluation includes the functionality whether the developed system provides accurate execution of its functions and if it satisfies the user's expectations.

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Installation Plan

After the development process, the system will be tested through initial deployment in the School of Information and Computing Sciences. Testing procedures and installation will be done in the School of Information and Computing Sciences. Training and seminars will be conducted to the Dean in order to familiarize and be aware with system functionality and processes. The web-based application will require Dean to have technical resources such as computer units and internet connection.

The web-based application will be used to monitor and observe Teachers that will be managed in the MSC School of Information and Computing Sciences through its technology by the assigned admin extensions and commercialization program.

For the maintenance of the system, there will be professionals assigned which are technical personnel of the said school and the system will only be updated once there are major updates needed.

Training and seminars will be conducted to the Admin, Dean and Program Head in order to familiarize with system functionalities and processes. The system will require each Admin, Dean and Program Head to have technical resources such as computer units and internet connection. User manual will be handed to the Dean and Program Head as a guide for training.

III. RESULTS AND DISCUSSIONS

Requirements Specification

Class Observation and Monitoring System will be a web-based application that automates the class observation and monitoring of SICS Faculty.

Functional Requirements

In Functional requirements this section specifies the functions that the web-based application should respond to particular input and act in particular situations.

For Admin

a) Manage User Account - The admin will be the one to provide user accounts for the Dean and Program Head.

b) Manage Web Content- The admin is responsible on managing all the content inside the web-based application.

For the Dean and Program Head

a) Monitor Faculty – once the Dean and Program Head login into the system they can now monitor teachers with the provided form that they can use to get the needed information for the analysis and preparation of reports

b) Monitoring Checklist – this is where the Dean and Program Head can view the projection of unmonitored faculty together with the weeks remaining for checking and list of unmonitored Faculty.

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c) Monthly Class Observation – This will be used by the Program Head in monitoring the monthly class observation of the Faculty that will be submitted to the Dean. The Dean can access the submitted report which can also a printable file.

d) Generate Report – The Dean will generate reports regarding on the analysis results, that came from the information gathered from the monitoring form. Generated report is summarized by the system to form a Report.

The Dean and the program head will monitor teacher based on the form provided by the application with needed inputs like:

- Date Monitored
- Time Monitored
- Name of Teacher being monitored?
- Name of Class being monitored
- What activities are held by the teacher
- Rubrics that will be rated based on the observation
- Timeliness
- Summary Observation of Teacher being monitored.
- What Lesson are being tackled?
    - o Module-based Lessons/ Learning Activities
        - Each module-based lesson has a time/week allotment, the dean and the program should make sure that a faculty post lessons on the set week on their respective syllabus.
- What are the activities of the teacher being monitored?
    - o Teaching Learning Activities such as discussion forum, video presentation etc. are being monitored also as long as it is indicated in the course syllabus
    - o Assessment - In terms of assessment the program head also monitors whether the faculty give the assessment stated in the syllabus to the students and after he/she gave the learning module
- Classroom Attendance
    - o Classroom attendance is also significant because it will be one of the things that the dean and program head will consider when observing if the teacher manages his/her classroom well.

When using the web-based application, the people involved together with the application can do the following:

- The application should log all the activities of the Dean and Program Head.
- The application is the one to ensure that at the end of the semester all the teachers of the SICS Faculty are monitored.
- The application can project the number of unmonitored teachers that can be monitored within the remaining weeks before the semester ends.

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- The application will provide a checklist that contains names of monitored and unmonitored Teachers.
- The application will provide an analysis that illustrate the following:

    - Teachers Timeliness, the percentage of Teachers who are delayed and always on time on class.
    - the percentage of Monitored and Unmonitored Teachers.
    - the percentage Teachers who are following the syllabus.

Non – Functional Requirements

In Non-functional requirements this section specifies standards that can be used to evaluate the operation of an application rather than detailed performances.

Supportability - the system is a web-based application which requires an Internet connection; the system is mainly supported on desktops or smartphones.

Interface - the system is interfaced with a user-friendly minimalistic design;

Privacy/ Security- registered users such as Program Head and Dean have the ability to modify and change their password on the system. The password will be the basis on the user authentication.

Reliability- the system must be connected to the internet in order for them to communicate with the database and will guarantee that the data will be accessible at any moment. The system will give accurate output and result particularly on the analysis reports.

Size- the system has a database with a capacity of 1 Terabyte

Results of The Feasibility Analysis

Operational Feasibility

Based on the conducted SWOT analysis (Appendix E) results shows that the SICS department have strengths that are needed in the implementation of the developed system. All of the involved users are computer literate. In addition, the School of Information and Computing Sciences has internet access and equipped with ICT resources. Although some of the involved personnel are not familiar in using the automated system, there will be a training and discussion about the advantages and importance of the developed system. For the opportunities, it earned an advantage for the School of Information and Computing Sciences because the checker will perform things in a better way and the information will enter automatically in the database and other transactions will be handled more effectively and efficiently.

Since all the departments has the same procedure when it comes in monitoring of the attendance of the faculty, the developed system can also be used by other schools. However, power interruption and poor internet connectivity are the threats for the School of Information and Computing Sciences. Regardless of the said threats the SICS department is willing to have the developed system.

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Technical Feasibility

Based on the available ICT resources, the developers are able to continue with the development and its specification (Appendix G) that can support the developed system. There are three functional laptops that will be used for the development and installation of the system. Based on the SWOT Analysis (Appendix H) that was conducted, it shows that the developers' have the needed strengths for the development of the developed system such as their positivity, willingness and inspiration.

Also, the developers are familiar with the programming languages that will be used in developing the developed system. When it comes to financial, the developers' have enough budget for the development of the said system. For the weakness, it indicates that the developers' have not enough experience in software project development but there are people who will evaluate and may contribute in improving the idea and concept of the system. From the opportunities, based on the previous courses learned by the developers' they can adopt their skills in developing the said system. Also, threat shows that during the development the developers might encounter software and hardware failure, but they are knowledgeable when it comes on troubleshooting.

Economic Feasibility

Economic feasibility, the development cost is Php 49,000 which consist of the personal services and other expenses. The personal services were based on salary of the development team. The operational cost of the developed system from year 2 to year 5 is multiplied to 0.10 which is the 10% interest rate and the product is added to the previous cost of the particular supplies. The overall total of each year was computed. Web hosting is included in the operational cost since the system to be developed is a web-based.

After calculating the operational cost of the developed system, it will be evaluated using the Cost Analysis. From the year 3, the cumulative value is Php 637.10, a positive value, which shows that the developed system is economically feasible. The breakeven ratio is computed by subtracting the cumulative benefit from projected cost benefit and the difference is divided to projected cost benefit. As a result, the breakeven ratio is 0.95.

The break-even point was got by adding the break-even year and break-even ratio. As a result, the breakeven ratio is 3.95 years or 3 years and 10 months. Thus, the developed system is economically feasible.

Description of The Developed System

The developed system is designed for the Dean, Program Head and SICS Faculty who are involve and responsible in process that will be done in the organization. The physical design of the developed system (Appendix P) is summarized to visualize the actual process from the developed system.

The Dean is required to log-in in order to access the developed system. The Dean or Program Head can monitor and observe activities held by the faculty on their classroom that should be related on the syllabus. The developed system is the one to summarize all the information that the Dean and the Program Head observed on the teacher. The Program Head is the one who will do the monitoring of Monthly Class Observation and can also be substitute to evaluate the Teacher's every end of semester

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whenever the Dean is not available on that period of time. The Dean is the one who will do the evaluation of Teacher's activities, generated report and can access the monthly class observation submitted by the Program Head. The Dean and Program Head can view the faculty schedule and faculty list. The Dean and Program Head can also view their activity log.

This system will help the Dean and the Program Head to monitor whether the lesson of the teachers is correct on the syllabus. Are the plans that are written in the syllabus are adopted in their virtual classrooms? In this way the Dean and the Program Head will be advising the teacher whether they need to provide a new content of the syllabus or not. This system will also help the Dean to provide objective number in the evaluation at the end of the semester. This system will provide monthly analysis that shows the names of monitored and unmonitored teachers. Also, this system will help to ensure that before the semester ends all the teacher of the SICS Faculty are all monitored. With the use of this system there will be projection of the number of unmonitored teachers that can be monitored within the remaining weeks before the semester ends. This system will also provide a checklist containing names of monitored and unmonitored Teachers. There will be statistics or analysis that shows the timeliness percentage of teachers in their class.

The Admin can modify the users account and at the same time can manage the content of the developed system. The Admin is in-charge of uploading and managing faculty list, which involves adding, deleting and updating of faculty members. And also responsible for managing the subjects and schedules of faculty. The admin is responsible for adding users in the system. The admin is the one who can access the maintenance of the system including the Course, Class Subject, Security Question and System Settings.

System Requirements

For the installation of the system there are technical requirements needed. The system requires a processor that is core i3 2.66 GHz or faster, a 2 gigabyte random access memory, a hard disk drive with a minimum capacity of 500 gigabytes. It also requires an operating system that is Windows 7 or higher. This developed system also needed to use a web browser such as Chrome or Mozilla. It needs web hosting and domain name for the Dean and Program Head to access this using internet.

Result of Testing

Several tests have been carried out to check the functionality and capability of the system.

Test case (Appendix Q) was used for system testing to determine whether the system is performing its intended functionality. As a result of the tests carried out, all the functionalities of the system are working and meet the expected results. The developers were the testers.

Browser testing (Appendix M) was used for compatibility testing, to know the browsers are compliant with the system to run. The result shows that the system is best able to run in chrome because its font style is consistent with it as well as its architecture. It's better than the other browsers, too.

User acceptance form (Appendix N) has been rendered and forwarded to the user for user acceptance testing. The system was tested on the basis of its expected features. As the tester is the user of the system, comments and feedback have been made. Certain processes need to be simplified, some need to be omitted and new functionality introduced.

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Software quality evaluation tools based on ISO 9126 have been used for software quality evaluation. The IT specialist was asked to monitor and review the characteristics of the device. As an outcome of the software quality evaluation (Appendix O), the functionality, reliability, usability, efficiency, maintainability and portability of the application are very satisfactory. As this is from the expert's point of view, recommendations have been made. Some of them gave their remarks on improving other qualities and strengths, such as its long-term maintenance capabilities and to help the system to become more helpful and functional other experts recommended to add additional features to the developed system.

IV. CONCLUSION

Due to the Pandemic that the country is facing today people are sticking to the new normal way of living, Schools are implementing Electronic Learning as an alternative to teach students even when at home, because of this incident the Dean and Program Heads of MSC – School of Information and Computing Sciences are encountering problems such as difficulties in observing the Faculty of SICS Department on their way of teaching, generating reports for the Evaluation of Teachers that is held every end of the Semester and Graphical Analysis of Teachers Performance.

The developed system is operationally, technically and economically feasible. Since, SICS have the needed technical resources that will support the developed system they are capable of operating and maintaining the said system. They also have technical people that could manage the developed system. The developed system is also beneficial since the expenses could regain within 3 years and 10 months. The developers had the needed resources and skills in developing a system.

Based on the results, it was concluded that by implementing a Class Observation and Monitoring System the time spent for observing classes of teachers will be more convenient and exceed less effort than the traditional way of observing teachers' activities in their classroom, at the same time Preparation of Analysis and Evaluation Report became a lot easier. Evaluation of Teachers will be a lot easier since the system can be access online and it provides an easy access on every google classroom of Teachers. On the other hand, inputted data will be stored in the Database and will be used for Graphical Analysis and Generating of Reports. Teachers are easily observed by the Dean and Program Head if they are adapting the correct sequence of the topics or modules in the google classrooms and if the activities, they held in their classrooms are related to the contents of the Syllabus.

The developed system is likely to reduce the time consumed in observing teachers and preparing generated Reports. The system can be accessed online, checking of Graphical Analysis, Generating of Report and Observing Teachers can be easily done anywhere and anytime as long as there is an internet connection. Thus, the reports and data are secured. The consolidation of the needed data and requirements is easier and faster. Since the system will be the one to generate reports, the data or contents of the report will be done with precise and accurateness.

The system can be accessed by the Dean and the Program Head of both IS and IT so that they can observe Teacher through online. They will no longer experience difficulty in observing and generating of report as well checking of graphical analysis. The Analysis in the system will help them in Preparing Generated Report every end of the Semester or School Year. Therefore, the problems encountered by the Dean and Program Heads in observing and Generating o Reports are addressed.

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V. RECOMMENDATIONS

Based on the testing and conclusions, following recommendations were made:

1. The developers recommend to implement the Class Observation and Monitoring System to minimize the problems faced by the Dean and Program Heads and to conveniently observe and monitor teachers' activities.

2. Use the recommended and existing ICT resources to maintain the developed system and to ensure that its functionality runs without any error at any time.

3. Train the users of the developed system during its implementation to familiarize how it works, to ensure the seamless flow of the system transactions and prevent confusion.

4. The developers recommend that in the monitoring form page, the current lesson textbox should be a dropdown containing the lessons for each certain subject.

5. The developers recommend features wherein the system recommends the name of teachers who can be monitor during the specific period of time.

6. The developers recommend an SMS notification so that become aware whenever they need to monitor a teacher.

7. Also, the developers recommend the system to be a mobile application.

The developed system needs an improvement. It is only intended and design for School of Information and Computing Sciences. However, it can be used by other schools within Marinduque State College just by updating and adding additional features the users can be able to use it and for the maintenance that will give greater benefit in the future.

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ENHANCEMENT OF THE DEVELOPED SUBJECT ADVISING SYSTEM OF SICS

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ABSTRACT- The subject advising system is important in current educational environment, strong academic advising system to a student is an essential ingredient of learner success, supporting advices and efficient learning. It gives an advice to students about their academic concern. The Marinduque State College has implemented subject advising to assists the students about the enrolment process which sometimes has complications. Also, the School of Information and Computing sciences encountered failures due to the situation of the students who are taking the subject and what subject they have not yet taken. The researchers conducted studies and interviews about the existing system and also reviewed works of literature to use concepts in creating the project from many institutions that have implemented computerized solutions. However, a need for an upgraded mechanism of subject advising in the MSC was proposed which entitled "Enhancement of the Developed Subject Advising System of SICS". The main objective of the project is to create a web-based subject advising system where advisors and the Dean can access the information of the students. All the requirement specification was distinguished and the prototyping method was used in the developing process. The implementation of this project is to facilitate and enhance the process of subject advising in the School of Information and Computing Sciences efficiently, and also to use the data of the students gathered for futuristic matters such as converting the system to prediction system.

Keywords: *MSC, School of Information and Computing Sciences, Subject Advising System*

1. INTRODUCTION

In this modern world, technology continue to change and influence human life. These changes are accelerating rapidly as the world become smaller. Everyone embraces these changes and find effective ways for the advancement. Business organizations whether public or private are using technologies to improve organizational performance.

With the growing importance of technology in educational environment all over the world, a strong academic advising system is effective and efficient. These would help to implement school programs successfully and to level up every process smoothly and quickly. The responsibility of technology in academic advising system is to maintain student's academic record and would also make the procedures easier and more efficient [1].

The advising process of present institutions encountered some issues and inefficiencies which lead to student's dissatisfaction [2]. These common problems include the addition and removal of subjects as well as modification of prerequisite rules, conflict student loads, long waiting periods at advisory offices and manual decision making of subject advising from the school to Registrar's office.

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During enrolment, the students depend on their academic records released from the Registrar's office for them to be advice by the enrolment adviser. In order for the enrolment adviser to give an advice to an irregular student, the student first needs to have a pre-enrolment form to be filled-up by them, an updated evaluation of grades, and the final report of grades for the last semester attended which they can get it all only at the Registrar's Office. The students can then come to the SICS office with all the required documents need for them to know what subjects to be taken for the upcoming semester which will be recommended by the enrolment adviser. The enrolment advisers depend their decision making on the documents provided by the students and from the policy stated on the student handbook before going back to the Registrar's Office for the last process of enrolment.

The School of Information and Computing Sciences (SICS) of Marinduque State College uses enrolment advising system for their enrolment processes. The enrolment advising system used by the school was a capstone project entitled "Development of Enrollment Advising System for the School of Technology" which was submitted by former SICS students to the faculty of SICS for their candidacy for the degree of Bachelor of Science in Information Technology. But since the school started operating using the enrolment advising system, the school has encountered some noteworthy problems and errors (Appendix B) from the system that should be solved. Problems such as curriculum incorporated in the system is not flexible, inconvenient restrictions of data as connected with semesters enabled in the system, inconsistency and inappropriate UI design, and security and data privacy rules on web development were not provided.

These problems will be reduced if subject advising system is adopted; quick update and monitor students' academic records. The process would be easier and save valuable time for academic advisers and for students. Hence, the project "Enhancement of the Developed Subject Advising System of SICS" was introduced to the SICS and enhance it for the benefits of their constituency.

II. METHOD AND PROCEDURE

REQUIREMENTS ANALYSIS PROCEDURES

The School of Information and Computing Sciences of Marinduque State College uses enrolment advising system for their enrolment processes. The enrolment advising system used by the school was a capstone project entitled "Development of Enrollment Advising System for the School of Technology" which was submitted by former SICS students to the faculty of SICS for their candidacy for the degree of Bachelor of Science in Information Technology.

Modification or enhancement of the enrolment advising system is the next phase for the project, proposal for the enhancement of the enrolment advising system was submitted as a proposed project title concept. After the proposed project concept was approved, the project team conducted an elicitation of new requirements, which was done to gather data that will be used in the project analysis. An interview was done with the Enrolment Adviser of the school to acquire the initial requirement for the proposed project. The information gathered was used to identify the problems involved in the system (Appendix B). The project team prepared a Questionnaire (Appendix A) that was used as a research tool consisting of a series of questions for the purpose of gathering information from the enrolment advisers. It was used by the project team as a guide in conducting the interview.

A Work Breakdown Structure (Appendix C) was used to organize the project work into manageable sections to be executed by the project team. It will be used to accomplish the project objectives and to create the required deliverables, Gantt Chart (Appendix D) illustrates the project schedule and also show the dependency relationships between activities and current schedule status of the activities. It will be useful to the project team for planning and scheduling the project. It will help the project team to assess how long the project would take, determine the resources needed, and to monitor the progress of the project. Data Flow Diagram (Appendix H) was used to graphically represent the flow of data in the existing system. It will provide information about the outputs and inputs of each entity and the process itself that will be useful for the project team. And a Flowchart (Appendix I), was used by the project team to represent the workflow or process involved in the existing system.

FEASIBILITY ANALYSIS PROCEDURES

The technical and operational feasibility was assessed to determine if the project is eligible to continue. The assessment of feasibility has proven that the project is worth pursuing.

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The technical feasibility was assessed by conducting GAP Analysis (Appendix E) of the developers to determine if the ICT resources of the project team are enough to manage the completion of the project. GAP Analysis will help the project team in comparing the current state with an ideal state or goals for their technical resources, which will highlight the shortcomings (availability) and opportunities for improvement (action plan) of the project team's resources. SWOT Analysis (Appendix F) of the developers was also conducted to help the project team identify their strengths, weaknesses, opportunities, and threats related to the project.

The operational feasibility was assessed by conducting SWOT Analysis (Appendix G) of the organization. The project team used SWOT Analysis to determine the strengths, weaknesses, opportunities, and threats of the organization that are related to the proposed system and to make the most of what the organization have and used it to the organization's best advantage.

DEVELOPMENT AND TESTING PROCEDURE

On the development stage, Mockplus Classic, a rapid prototyping tool which the project team will be using for building interactive prototypes of the subject advising system. It will allow the project team to finish a screen design quickly with its pre-built components, icons and drag-and-drop functionalities. The project team used Use Case Diagram (Appendix J) to show the main system requirements for the subject advising system underdeveloped. It helped in specifying the expected behaviour of the system and helped the project team design the subject advising system from the end user's perspective. Entity Relationship Diagram (Appendix K) was used by the project team in database design to visualize the participating entities and relationships in the database design of the proposed system. Physical Schema (Appendix L) was used by the project team to represent the logical view of the entire database. It was used as an abstraction to represent the storage of data and to show the relationships of data in the database of the proposed system.

Sublime Text 3 (ST3) is the code editor that the project team will be using on the scripting stage of the project. The project team chose Sublime as the code editor for the project because they are familiar in using the said code editor. And it also supports many programming languages and markup languages such as HTML, CSS, and PHP that the project team needs in developing the proposed system.

HyperText Mark-up Language 5 (HTML 5) will be used to uphold the design of the interface and the data content of the webpages. HTML 5 will be the interface designing platform together with Cascading Style Sheets (CSS) and PHP Hypertext Preprocessor (PHP). CSS will be used as a style sheet language for describing the look and formatting of a document written in a markup language. It will also helped the project team in designing the webpages to change the appearance and layout of all the pages of the system. Partly, PHP will be used to connect with the database and to create dynamic web pages content and Standard Query Language (SQL), a query language will be used to create a relational database structure for data storage.

XAMMP is a web server solution that will be used by the project team to create a local web server for testing and deployment purposes of the project. Everything needed to set up a web server – server application (Apache), database (MariaDB), and scripting language (PHP) – is included in XAMPP that will be helpful for the project team. XAMPP is also cross-platform, which means it works equally well on Linux, Mac and Windows. Since most actual web server deployments use the same components as XAMPP, it will make transitioning from a local test server to a live server extremely easy as well. Composer is an application-level package manager for the PHP programming language that the project team used to provide a standard format for managing dependencies of PHP software and required libraries.

GIT which is a version control system for tracking changes in computer files was used for source code management in the development phase. It served as a quick and easy access tool in order for the project team to quickly launched and access the system without having to use command prompt (CMD -Microsoft Windows) which usually consumes time. And web browser such as Google Chrome, Mozilla Firefox, Microsoft Edge, and Opera will be used by the project team to access and to test the functionality of the subject advising system.

In identifying whether the system is free from errors, several tests will be conducted such as Stress Testing, Browser, Alpha, Beta, Security Testing, and Acceptance Testing to ensure its proficiency. Stress Testing will be conducted by the project team to determine the robustness of the subject advising system by testing beyond the limits of its normal operation. It will be done by using test cases that are designed to confront the system with abnormal situations that attempts to break the system. Browser testing will be used by the project team to compare

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and analyze the behaviour of the system in different browser environments and will help the project team to ensure that the system delivers an optimal user experience, independent of the browser used to access it. . Alpha Testing will be done by using test cases to evaluate and debug errors from the system to run effectively. It will be conducted by a representative group of end-users from the organization with the project team on site. The subject advising system will be used by the end-users with the developers "looking over the shoulder" of the users and recording errors and usage problems. Beta Testing will be conducted at one or more end- user sites. Unlike Alpha Testing, the project team will not be present. The end-users will record all problems (real or imagined) that are encountered during Beta Testing and will report these to the project team at regular intervals. As a result of problems that will be reported during Beta Testing, the project team will make modifications and then prepare for the release of the subject advising system to the organization. Security Testing will be conducted by the project team using test cases to uncover vulnerabilities of the system and determine that its data and resources are protected from potential intruders/ unwanted users of the system.

Lastly, Acceptance Testing will be conducted to enable the organization to validate all system requirements. For the acceptability of the system, ISO 9126 and Likert Scale will be used by the organization to measure the success and satisfaction of the project. The ISO/IEC 9126 standard will be used by the project team to address some of the well-known human biases that can adversely affect the delivery and perception of a software development project. A Likert scale will be used by the project team to measure organization's attitude by asking the extent to which they agree or disagree with a particular question or statement about the system.

RESULTS OF FEASIBILITY ANALYSIS

Technical Feasibility

In the technical feasibility (Appendix E) for Gap Analysis, there are available equipment and software that can use for the system development. As such, the system may be developed immediately and can use more effectively. From the SWOT Analysis (Appendix F), it shows that the developers has the strength to develop a system because they have experience and practical understanding when it comes to web development. On the other hand, the weaknesses of the developer's indicate that their commitment to the project may not be that strong. For the opportunities, it shows that they have a deeper understanding of web development and a higher quality of decisions. However, the threats of the developers indicates that additional time for developing the project will be needed and also the internet connection was not that stable as well as the schedule of the members might be conflict.

Table 3.1 SWOT Analysis of the Developers

STRENGTHS	WEAKNESSES
• Web development experience • Practical understanding of the web development	• Commitment to the project may not be strong
OPPORTUNITIES	**THREATS**
• Higher quality of decisions • Deeper understanding of web development	• Schedule conflicts of members • Interruption of Internet Connection • Additional time will be needed for the development of the project

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Operational Feasibility

In the operational feasibility the School of Information and Computing Sciences and office of the dean have available working computer and are connected to the internet. Furthermore, from the conducted SWOT Analysis (Appendix G), it shows that organization has the strengths to have personnel who are competent to operate and manage the system and also the organization have accessible computers that met the required hardware specifications to operate using the system. However, the weaknesses of the organization indicates that they needs time to reach the target data entry that the system needs, another is they need to exert efforts on gathering all the data that are crucial for the system and also the organization have no data servers for repository of information that the system will provide. For the opportunities, it shows that they can have faster subject evaluation process as well as secure and reliable data collection. On the other hand, the threats of the organization shows that the internet connection might loss, can have power interruption and some bugs might occur during the use of the system.

Table 3.2 SWOT Analysis of the Organization

STRENGTHS	**WEAKNESSES**
• The organization have accessible computers that met the required hardware specifications to operate using the system • The organization have personnel who are competent to operate and manage the system	• The organization needs time to reach the target data entry that the system needs • The organization needs to exert efforts on gathering all the data that are crucial for the system • The organization have no data servers for repository of information that the system will provide
OPPORTUNITIES	**THREATS**
• Faster subject evaluation process • Secure and reliable data collection • Better decision making support	• Some bugs might occur during the use of the system • Security breach and data integrity • Power interruption • Loss of internet connection

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DESCRIPTION OF THE PROPOSED SYSTEM

The proposed enhancement of enrolment advising system will be developed to refine and improve upon the existing advising system. It would include functionalities from the existing system with some additional features.

The Dean will assign an enrolment adviser that would register a user account. The enrolment adviser will use that user account to log-in to the system. To enrol a student, the enrolment adviser is tasked to input the previous semester's grades of the student to update their student record. The Enrolment Adviser will advise subjects with the aide of the system that will generate a Study Plan in addition to the appropriate subjects to be taken up by the student. The system can incorporate student sectioning. The system can also provide a ready-to-print generated pre-enrolment form.

Upon logging-in, the system will allow the enrolment adviser to add, drop, and change the subjects taken by students. The enrolment adviser can also make modifications on the Set System Settings such as Curriculum, Subject or Academic Year updates. In reference to the existing system, the proposed system would remain web-based so it can be accessed regardless of location.

III. RESULTS AND DISCUSSIONS

FUNCTIONALITY TESTING

The developers did stress Testing (Appendix M) to identify all the errors and the parts that are still not working. The mock testing was conducted with the enrolment adviser in School of Information and Computing Sciences. Functionality Testing (Appendix N) was conducted using test scenarios to check if the system will stop the process of recommending subjects if the entered units have exceeded the allowed units for each student type, and this functionality passed the testing. The next functionality of the system is to check if the system allows the enrolment adviser to view the list of students' information and the third one is to check if the system recommend subjects, and the result of these test scenarios are passed, respectively. The fourth functionality is to check if the generated pre-enrolment form by the system can be printed, and the result is passed. The fifth functionality is to check if the enrolment adviser can input grades of the students, which is in the student record and the result is passed. The sixth test is to check the system if it can provide reports/information of students in graphical form and the result is passed. The seventh test passed, it allowed the enrolment adviser to view the list of sections, subject, curriculum, and students. The next functionality is to check if the system allows the enrolment adviser to add, drop, and change subjects, and the result is passing. Last is to check if the system can handle fifty students and or above, the result is passed. The Acceptance Testing (Appendix O) was done together with the involved organization. Enrolment Advisers have tested the system and proven to be useful and ready to be deployed.

Table 4.2 Functionality Testing

Step No:	Test Scenario	Test Step	Expected Result	Actual Result	Pass	Fail
	Check the system if it will warn the	1. Go to Advised Mode	The system should warn the	The system warn the		

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1	enrolment adviser when the unit have been exceeded.	2. Advised student 3. Advised many subjects	enrolment adviser for advising more load to the student	enrolment adviser for advising more load to the student	✓	
2	Check if the system allows the enrolment adviser to view student information	1.Go to Students 2. Input the Student Id No 3.View the student profile	The system should allow the Enrolment adviser to view the student information	The system allow the Enrolment adviser to view the student information	✓	
3	Check if the system recommend subjects	1.Go to Students 2.Go to Advice subject	The system should recommend subjects to be taken by the students	The system recommend subjects to be taken by the students	✓	
4	Check the system if generated pre-enrolment form can be printed	1.Go to pre-enrolment form 2.Click print button	The system should produce printed output	The system produce printed output of Pre-enrolment form	✓	
5	Check the system if the enrolment adviser can see grades of	1. Go to Students 2. View student records	The system should view the previous grades of the students	The system view the previous grades of the students	✓	
	student					
6	Check the system if it can provide reports of student in graphical form	1. Go to Students 2.View Student Profile	The system should provide reports of student	The system provide Graphical reports of student	✓	
7	Check the system if it can view list of sections, students	1. Go to Maintenance 2. Select Class and Curriculum	The system should allow the enrolment adviser to view the list of sections, subjects	The system allows the enrolment adviser to view the list of sections,	✓	

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	curriculums and subjects		curriculums and students.	subject, curriculum and students.		
8	Check if the system allow the enrolment adviser to add, drop, and change subjects.	1. View Student Profile 2. Go to Advise Subject 3. Perform changes/actions	The system should allow the enrolment adviser to add, drop and change subjects.	The system allows the enrolment adviser to add, drop and change subjects.	✓	
9	Check if the Enrolment adviser can input grades of student	1.Go to Student Record 2.Select the Registra-tion 3.Add Grade	The system should allow the Enrolment adviser to input grades	The system allow the Enrolment adviser to input grades	✓	
10	Check if the system can handle 50 above student data	1. Go to student 2. Select the Add student	The system should handle more student data	The system handle more student data	✓	

IV. CONCLUSION

The researchers have proposed an enhanced subject advising system to help students and subject advisers during the registration period.

To determine the technical feasibility of the proposed system, a Gap Analysis (Appendix E) and a SWOT Analysis (Appendix F) was conducted which revealed that the technology needed to develop the proposed system is currently available and that the developers have the technical know-how to continue to pursue the project. Furthermore, a SWOT Analysis (Appendix G) of the organization was conducted to determine the operational feasibility of the proposed system which showed that the organization have accessible computers that meet the required hardware specifications and has competent personnels to operate and manage the system.

A special focus has been given on analysing the processes and how data flows through the existing system. And in order to enhance the system, the researchers gave emphasis on the concerns and suggestions of the subject advisers who operated the existing system beforehand. Their observations were crucial in improving not just the functionality but as well as the user experience of the proposed system.

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The testing and coding tasks were done simultaneously in order to locate and deal with errors on the spot. Experimental runs have indicated that the proposed system is ready for deployment. The Beta and Acceptance Test was conducted together with a subject adviser, a member of the organization, which resulted in a success. Comments regarding changes and upgrades have been recommended by the subject adviser to make the system more complete and useful. Additionally, we will seriously take into account the constructive opinions with respect to the future extension of the system.

V. RECOMMENDATIONS

There were certain things that the system has a lack of, due to the shortage of time in finishing the whole project. The developers recommend to the future developers that the system should have:

1. Since the system is web-based, it should at least operate using the internet because it has not been tested using it. The network connectivity is not that effective if the system was used with it.

2. The database of the system should be synchronized to the database of the Office of the Registrar.

3. The system is intended mainly for Irregular Students to provide Study Plan that will offer a summary of the subject requirements of a student course and indicates when planned subjects should be taken.

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SALES PERFORMANCE MONITORING OF MSME

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Abstract— Monitoring the performance sale in a business is very important. A manual process of this is very time consuming and hard for a person to do. As for a customer, when buying a product in a physical store, a lot of their time is also wasting. Therefore, the developers conducted and developed web-based and mobile system entitled Sales Performance Monitoring of MSME's (Micro Small and Medium Enterprises) to make the sales performance monitoring easy to work over by the Trade Promotion Officer of DTI (Department of Trade and Industry) and to lessen the time waste for the costumer when buying a product. This web-based and mobile system has a function that allows the Trade Promotion Officer and the MSME's themselves to monitor their sales performance daily, monthly, and yearly. It also allows the MSME's to sell and promote their products online through the use of the said systems. The software project's objective is to analyze the existing monitoring, and sales system the organization has; improve the monitoring of the performance sales of each registered MSMEs and to upgrade their sales of different products with the use of internet. The software project was developed using some tools such as prototype that was made based on the client and user's viewpoint; Work Breakdown Structure, Data flow diagram was used as a guide in methodize activity; Entity Relationship Diagram was used to visualize the needed entities and attributes on the database of the system; Gap Analysis, SWOT Analysis, and Cost-Benefit Analysis were used to conduct the Feasibility Analysis. Through the tests and evaluation of the system, the feasibility analysis result shows that the software project is feasible to be used by the target client/s. The system's development showed that the client/s problem could be lessen and help them to make their work easily done.

Keywords: sales performance monitoring, mobile-based system, web-based system, e-commerce, point-of-sale

I. INTRODUCTION

Currently, most of the things people do depend on modern technology that nowadays is essential in our life. Modern technology advances rapidly throughout the year making things more convenient than the usual way. Web, one of the most revolutionary technologies, changes business environment and leads dramatic impact to future electronic commerce (e-commerce). E-commerce is a web-based platform refers to the method of buying or selling item/s or service/s and has improved into a dynamic set of technologies, where applications and businesses are significantly moved to the digital form and passed through the web.

Traditionally, shopping or buying of good/s are done face-to-face and is inconvenient since it requires leaving the comfort of your homes, travel for minutes or hours going to the chosen store/s and another time consumed on deciding what item to buy, paying for the selected product/s and additional hours consumed returning to their homes. Nowadays, with the help of electronic commerce (e-commerce), shopping becomes more convenient. You can shop 24/7, save money because you can compare price and best possible deals, save time going to different stores, it is more convenient since you won't deal with the crowds, cashier line-ups, etc., and the availability of the needed item can be search to another source or store through online.

Brick-and-mortar business found that it is difficult to compete with mostly web-based businesses because the latter usually have lower operating costs and greater flexibility. Manual selling and inventory of products is time consuming and has the highest possible of human error. Since traditional brick-and-mortar businesses are paper based, documents are prone to be misplaced and/or damaged. Furthermore, monitoring of their sales is quite challenging to handle since looking to bunch of papers can be tiring and time consuming.

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Point of Sale (POS) system are now increasingly adopted by businesses allowing customers to place orders, reservations and pay bills electronically. It serves as a place for costumers where they can pay for goods or products that may be taxable. In addition, it handles everyday transactions such as product purchasing, inventory control, and receiving and transferring of products to other locations lessening the workload of organizations.

The Department of Trade and Industry (DTI), a government agency, help those organizations through highlighting procedures, and one of those strategies is product promotions. They help Micro Small and Medium Enterprises (MSMEs) by providing one-stop shop, which can help MSMEs to grow their business. One of the ways to help MSMEs grow is providing other means of promoting and selling their products to other municipality through trade fare events, which approved by the Assistant Regional Director. Trade fare events were organized to introduce and highlight the different products of each MSMEs. The organizations will send invitations about the event to every registered businesses owners and it is their decision to join or not. Through the event, the MSMEs can gain customers from the crowd that eventually be the start for their products to be known. After the event, they will compile their sales and submit it to DTI for the observation of its performance.

The proponents planned a web-based business framework to help DTI Negosyo Centers and MSMEs to show their product/s, manage sales, and precisely diminish the costs and inconvenience in capacities advancement. The web-based system is envisioned to eliminate the problems and difficulties encountered in the manual process. With the observed challenges faced by the organization, the proponents have analyzed and further planned to create an information system promoting MSMEs' products.

The development of the web-based system intends to provide faster and efficient way of monitoring the product/s and products sales. System will automatically deals with the everyday struggles in handling order and sales management of MSMEs. For the organization, they can easily manage and review the sales report of each MSMEs. This system provides a better way of advertising and coping with the rising of e-commerce nowadays, together with the innovations and technology applied in e-commerce.

II. METHOD AND PROCEDURE

Requirement Analysis Procedure

Requirement Analysis Procedure was used as a guide in methodize activity, and done with the Work Breakdown Structure as presented in Table 1.

Table 1: Work Breakdown Structure

1.0 INITATION

- 1.1 Determine Project Team
- 1.2 Project Team Meeting
- 1.3 Develop Project Proposal
- 1.4 Submit Proposed Project
- 1.5 Milestone: Approval of Proposed Project

2.0 PLANNING

- 2.1 Create Preliminary Scope Statement
- 2.2 Develop Plan for Proposal

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2.3 Project Team Meeting
2.4 Submit Proposed Project to the Organization Management
2.5 Milestone: Plan Approval

3.0 EXECUTING

3.1 Process Business Analysis
3.2 Milestone: System Requirements & Design
3.3 Coding and Designing of System
3.4 System Trial
3.5 Project Status Meeting
3.6 Milestone: System Fully Functional
3.7 Installation of System
3.8 Beta Testing

4.0 MAINTENANCE/CONTROL

4.1 Correct Bugs & Errors
4.2 Project Status Meetings
4.3 Milestone: Project Status Report
4.4 Risk Management
4.5 Milestone: Update Project Management Plan

5.0 CLOSE-OUT

5.1 Procurement Auditing
5.2 Compile System Error and notes
5.3 Compile Document
5.4 Milestone: Update Documentation
5.5 Milestone: Update System

A preliminary investigation thru fact-finding techniques such as interview to the organization was conducted to get the needed requirements. Permission and interview to gather information and requirements from the organization was done through online meetings with the organization official. The meeting was held though Zoom App with Department of Trade and Industries' Assistant Regional Director (ARD) together with the Dean of School of Information and Computing Sciences of Marinduque State College and our Capstone Project Adviser. Through the meeting, the processes of the system for the organization were identified, which served as guide for the development of the project. By the use of the Prototyping model as the methodology for the developers to follow steadily for the development processes of the system.
Essential development of the system was included on the alpha design of the system, whereat user will be able to get an idea regarding the system. To determine some of user's relevant suggestions that can be used to improve the system, an alpha Prototype for both Web and Mobile system was provided for them to browse and to explore.

Implementation of the user suggestions and other acceptability was applied to the Final Prototype of the system, which was included on the development of the project and for the Finalization of the system.

Data flow diagram as presented in Figure 1 was created to see the overview of the system.

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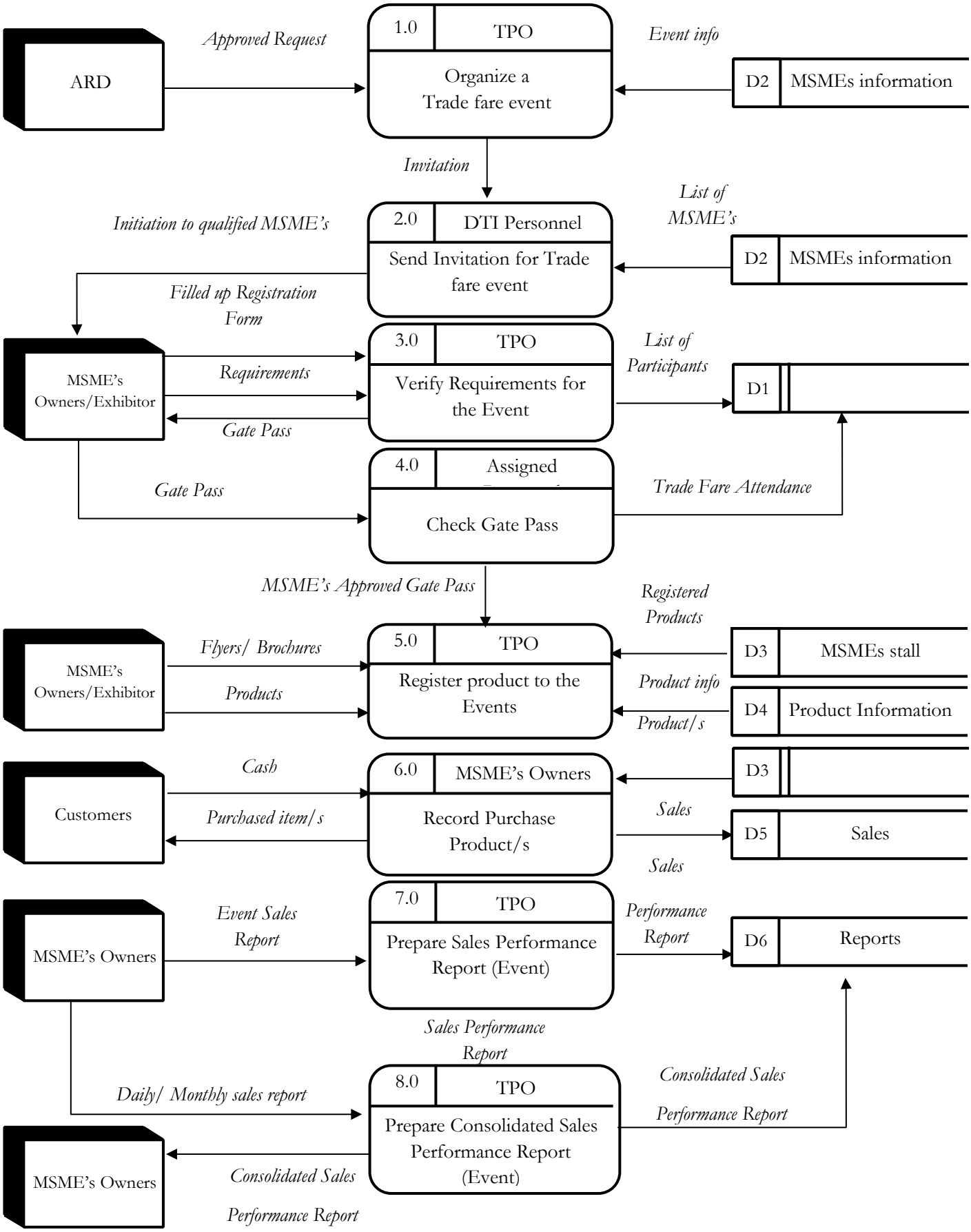

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Figure 1: DATA FLOW DIAGRAM
DFD of Existing Process (Trade fare Event)

Legend:
ARD – Assistant Regional Director
TPO – Trade Promotion Officer
MSMEs – Micro, Small, and Medium Enterprises

It was used to quickly identify the procedures and transactions done in the existing system. In addition, the proponents used Work Breakdown Structure (Table 1) as a guide for the development of the system as well as Gantt Chart as presented in Figure 2 in order to identify the schedule of activities to be conducted for the development of the system.

ID	Task Name	Start	FINISH	DURATION	STATUS
1.0	**INITIATION**	**03-Aug-20**	**10-Aug-20**	**6 Days**	**100%**
1.1	Determine Project Team	03-Aug-20	03-Aug-20	1 Day/s	100%
1.2	Project Team Meeting	04-Aug-20	04-Aug-20	1 Day/s	100%
1.3	Develop Project Proposal	05-Aug-20	06-Aug-20	2 Days	100%
1.4	Submit Proposed Project	07-Aug-20	07-Aug-20	1 Day/s	100%
1.5	Milestone: Approval of Proposed Project	10-Aug-20	10-Aug-20	1 Day/s	100%
2.0	**PLANNING**	**11-Aug-20**	**25-Sept-20**	**21 Days**	**100%**
2.1	Create Preliminary Scope Statement	11-Aug-20	18-Aug-20	6 Days	100%
2.2	Develop Plan For Proposal	19-Aug-20	16-Sept-20	10 Days	100%
2.3	Project Team Meeting	17-Sept-20	18-Sept-20	2 Days	100%
2.4	Submit Proposed Project to the Organization Management	21-Sept-20	23-Sept-20	2 Days	100%
2.5	Milestone: Plan Approval	24-Sept-20	24-Sept-20	1 Day/s	100%
3.0	**EXECUTING**	**25-Sept-20**	**29-Dec-20**	**70 Days**	**100%**
3.1	Process Business Analysis	25-Sept-20	25-Sept-20	1 Day/s	100%
3.2	Milestone: System Requirements & Design	28-Sept-20	28-Sept-20	1 Day/s	100%
3.3	Coding and Designing of System	29-Sept-20	16-Oct-20	14 Days	100%
3.4	System Trial	19-Oct-20	11-Dec-20	40 Days	100%
3.5	Project Status Meeting	14-Dec-20	14-Dec-20	1 Day/s	100%
3.6	Milestone: System Fully Functional	15-Dec-20	15-Dec-20	1 Day/s	100%
3.7	Installation of System	16-Dec-20	16-Dec-20	1 Day/s	100%
3.8	Beta Testing	17-Dec-20	29-Dec-20	10 Days	100%
4.0	**MAINTENANCE/CONTROL**	**04-Jan-21**	**25-Jan-21**	**14 Days**	**100%**
4.1	Correct Bugs & Errors	04-Jan-21	12-Jan-21	7 Days	100%
4.2	Project Status Meeting	13-Jan-21	13-Jan-21	1 Day/s	100%
4.3	Milestone: Project Status Report	14-Jan-21	14-Jan-21	1 Day/s	100%
4.4	Risk Management	15-Jan-21	20-Jan-21	4 Days	100%
4.5	Milestone: Update Project Management Plan	21-Jan-21	21-Jan-21	1 Day/s	100%
5.0	**CLOSE-OUT**	**22-Jan-21**	**29-Jan-21**	**6 Days**	**100%**
5.1	Procurement Auditing	22-Jan-21	25-Jan-21	2 Days	100%
5.2	Compile System Error and notes	26-Jan-21	26-Jan-21	1 Day/s	100%
5.3	Compile Document	27-Jan-21	27-Jan-21	1 Day/s	100%
5.4	Milestone: Update Documentation	28-Jan-21	28-Jan-21	1 Day/s	100%
5.5	Milestone: Update System	29-Jan-21	29-Jan-21	1 Day/s	100%

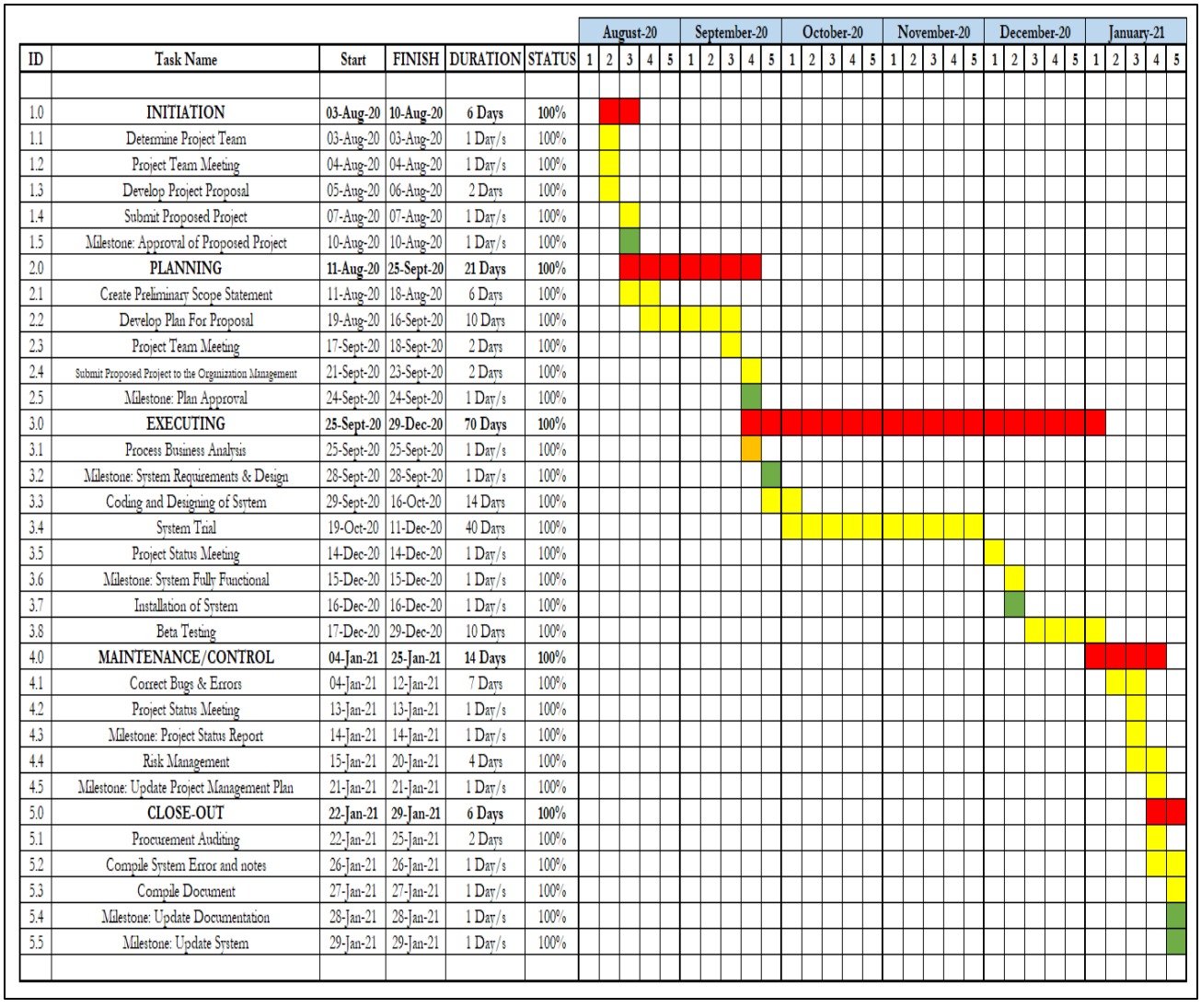

Figure 2: Gantt Chart
Legend:
Red – Duration time of development of the whole task
Yellow – Duration time of development of a certain task
Green – Milestone/Accomplished task

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In addition, Entity Relationship Diagram as presented in Figure 3 was used to visualize the needed entities and attributes on the database of the system. Also, it helps to understand the relationship between those entities and its attributes and the processes connecting the two entities.

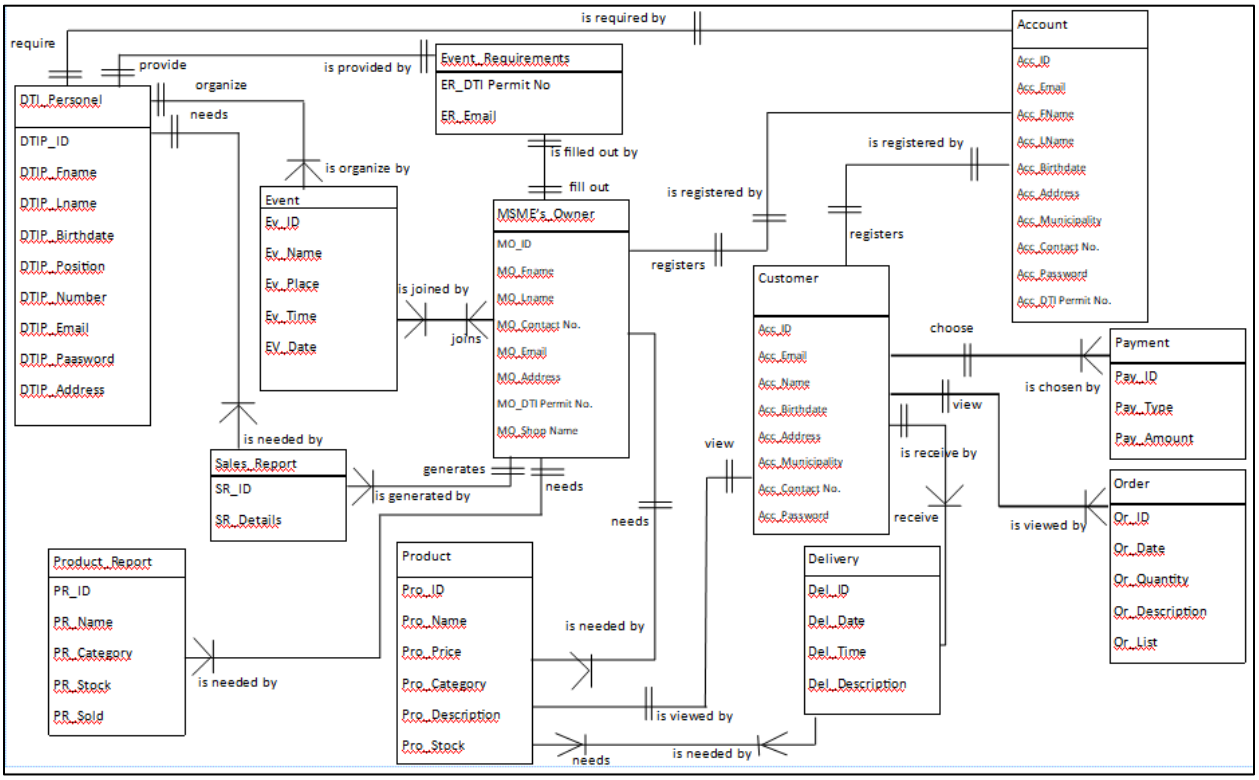

Figure 3: Entity Relationship Diagram

Furthermore, Database Schema as presented in Figure 4 was used in order to organize and show the information inserted in the database of the system.

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#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	id	int(11)			No	None		AUTO_INCREMENT
2	email	varchar(200)	latin1_swedish_ci		No	None		
3	password	varchar(60)	latin1_swedish_ci		No	None		
4	type	int(1)			No	None		
5	firstname	varchar(50)	latin1_swedish_ci		No	None		
6	lastname	varchar(50)	latin1_swedish_ci		No	None		
7	birthdate	date			Yes	NULL		
8	address	char(30)	latin1_swedish_ci		Yes	NULL		
9	municipality	int(2)			No	0		
10	contact_info	char(12)	latin1_swedish_ci		No	None		
11	photo	varchar(200)	latin1_swedish_ci		Yes	NULL		
12	dti_permit_number	varchar(100)	utf8mb4_unicode_ci		Yes	NULL		
13	status	int(1)			Yes	0		
14	activate_code	varchar(15)	latin1_swedish_ci		No	None		
15	reset_code	varchar(15)	latin1_swedish_ci		Yes	NULL		
16	created_on	date			No	None		
17	critical_prod_number	int(2)			No	5		

USERS TABLE – *users*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	eventid	int(11)			No	None		AUTO_INCREMENT
2	qrcode	varchar(100)	latin1_swedish_ci		No	None		
3	eventname	varchar(100)	latin1_swedish_ci		No	None		
4	eventdetails	varchar(200)	latin1_swedish_ci		No	None		
5	dateofevent	date			No	None		

Event Table – *events*

Product Table – *product*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	id	int(11)			No	None		AUTO_INCREMENT
2	seller_id	int(10)			No	None		
3	category_id	int(11)			No	None		
4	name	text	latin1_swedish_ci		No	None		
5	description	text	latin1_swedish_ci		No	None		
6	slug	varchar(200)	latin1_swedish_ci		No	None		
7	price	double			No	None		
8	price_old	double			No	0		
9	quantity	float			No	None		
10	photo	varchar(200)	latin1_swedish_ci		No	None		
11	date_view	date			Yes	NULL		
12	counter	int(11)			No	None		
13	expiration_date	date			Yes	NULL		
14	deleted	int(1)			No	0		
15	created_at	timestamp			Yes	CURRENT_TIMESTAMP		

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#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(10)			No	*None*		AUTO_INCREMENT
2	**user_id**	int(11)			No	*None*		
3	**order_number**	char(20)	utf8mb4_unicode_ci		Yes	*NULL*		
4	**order_total**	double			No	*None*		
5	**payment_method**	int(2)			Yes	1		
6	**shippingfee**	double(4,2)			No	0.00		
7	**created_at**	timestamp			Yes	CURRENT_TIMESTAMP		

Order Table – *order_tbl*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(10)			No	*None*		AUTO_INCREMENT
2	**mun_id**	int(2)			No	*None*		
3	**shipping_fee**	decimal(4,2)			No	*None*		

Payment Table – *shipping_fees*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(11)			No	*None*		AUTO_INCREMENT
2	**user_id**	int(11)			No	*None*		
3	**product_id**	int(11)			No	*None*		
4	**quantity**	int(11)			No	*None*		
5	**product_price**	double			No	*None*		
6	**seller_id**	int(10)			No	0		
7	**created_at**	timestamp		on update CURRENT_TIMESTAMP	Yes	CURRENT_TIMESTAMP		ON UPDATE CURRENT_TIMESTAMP

Cart Table – *cart*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(11)			No	*None*		AUTO_INCREMENT
2	**category**	char(100)	utf8mb4_unicode_ci		No	*None*		
3	**category_slug**	char(100)	utf8mb4_unicode_ci		No	*None*		

Categories Table – *categories*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**confirmedattid**	int(11)			No	*None*		AUTO_INCREMENT
2	**eventid**	int(11)			No	*None*		
3	**sellerid**	int(11)			No	*None*		
4	**confirmed_date**	date			No	*None*		

Event Attendance Table – *confirmedatt*

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#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(11)			No	*None*		AUTO_INCREMENT
2	**order_id**	int(11)			No	*None*		
3	**product_id**	int(11)			No	*None*		
4	**quantity**	int(11)			No	*None*		
5	**prod_price**	double			No	*None*		
6	**seller_id**	int(10)			No	*None*		
7	**od_status**	char(10)	utf8mb4_unicode_ci		No	pending		
8	**created_at**	timestamp			Yes	CURRENT_TIMESTAMP		

Order Details Table – *order_details*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(10)			No	*None*		AUTO_INCREMENT
2	**user_id**	int(10)			No	*None*		
3	**order_detail_id**	int(10)			No	*None*		
4	**od_stat**	char(10)	utf8mb4_unicode_ci		Yes	*NULL*		
5	**order_notif_detail**	text	utf8mb4_unicode_ci		Yes	*NULL*		
6	**seen**	int(2)			No	0		
7	**created_at**	timestamp			Yes	CURRENT_TIMESTAMP		

Order Notification Table – *order_notifs*

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	**id**	int(10)			No	*None*		AUTO_INCREMENT
2	**user_id**	int(10)			No	*None*		
3	**order_detail_id**	int(10)			No	*None*		
4	**od_stat**	char(10)	utf8mb4_unicode_ci		Yes	*NULL*		
5	**order_notif_detail**	text	utf8mb4_unicode_ci		Yes	*NULL*		
6	**seen**	int(2)			No	0		
7	**created_at**	timestamp			Yes	CURRENT_TIMESTAMP		

Product Reviews Table – *product_reviews*

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#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra
1	id	int(10)			No	*None*		AUTO_INCREMENT
2	user_id	int(10)			No	*None*		
3	seller_type	int(2)			No	*None*		
4	shop_name	char(100)	utf8mb4_unicode_ci		No	*None*		
5	created_at	timestamp			Yes	CURRENT_TIMESTAMP		

Seller Details Table – *seller_details*

Figure 4: Data Schema

Economic Feasibility. Through an online meeting with the respective officials of the organization, this feasibility was made to gather vital information of the resources used in their operation. To determine the Payback year and Return on Investment (ROI), the organization used the Cost and Benefit Analysis as presented in Table 2, implying (or signifying) that the project is feasible with the use of the following formula were utilize.

Description	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Total Operational Cost of the Existing System		₱48, 940.00	₱31,834.00	₱35,071.4	₱38,519.14	₱41,732.00
Total Operational Cost of the Proposed System		₱32,800.00	₱19,580.00	₱21,538.0 0	₱ 23,691.8	₱ 26,060.98
Development Cost	₱49,000.00					
Projected Cost Benefits		₱16,140.00	₱12,254.00	₱13,533.4	₱14,827.34	₱15,671.02
Cumulative Benefits	-₱49,000.00	**-₱32,860.0 0**	**-₱20,606.00**	**-₱7,072.6**	**₱7,754.74**	**₱23,425.76**

Table 2: Cost and Benefit Analysis

To get the Break Even Ratio, Cumulative Benefits are should be subtracted from Projected Cost Benefits and divide it by Projected Cost Benefits. In getting the Break Even Point, Break Even Year is added to

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Break Even Ratio. In addition, to get the Return on Investment, Total Cost are subtracted from Total Benefits and divide it by Total Cost.
The estimated operating cost of the existing process and the developed system were compared to determine if the developed system is economically feasible or not within five years upon implementation of the system.

Technical Feasibility. The available resources or ICT of the organization was utilized for this feasibility. Assessment and meeting were conducted to determine the available Hardware and Software specification of the organization using Gap Analysis as presented in Figure 5 for the developers and organization to know if an upgrade or additional resources were needed for the proposed system.

Current Technical Resources	Required Technical Resources	Action Plan
Human Resources		
System Analyst	System Analyst	System Analyst personnel will help develop the system.
Programmer	Programmer	knowledgeable Programmer will be an advantage in developing the system.
Database Administrator	Database Administrator	Database Administrator personnel will be beneficial in developing the application.
Hardware Resources		
Desktop Computer		
INTEL(R) CORE™ I3-6100 CPU @ 2.30GHz	Intel (R) Celeron (R) CPU 430 @ 1.83GHz CPU or Higher	The available specification of the desktop computer available is enough and will be able support the development of the system for the desktop.
4.00 GB Memory Capacity	4.00 GB Memory Capacity	
500 Gigabytes or Hard Disk Storage	500 Gigabytes or Hard Disk Storage or Higher Storage Capacity	
Mobile Device		
1.6GHZ DUAL-CORE ATOM	1.6GHZ DUAL-CORE ATOM	The available specification of the Mobile device available is enough and will be able support the development of the system for the mobile device.
2GB Memory Capacity	2GB Memory Capacity or higher	
16 Gigabytes of Storage	16 Gigabytes of Storage or higher	
Software Resources		
Desktop Computer		
64- bit Windows 8.1 operating system	64- bit Windows 8.1 operating system or latest	The available software requirements are enough to support the development of the system for the Desktop.
Mobile Device		
Android 7.0 (Jellybean) Operating System	Android 7.0 (Jellybean) Operating System	The available software requirements are enough to support the development of the system for the Mobile.

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Figure 5: Gap Analysis

Assessing the skills and technical capabilities of the proponents was done to know if they are capable of developing the system using SWOT Analysis as presented in Table 3. The proponents assessed and evaluated their technical skills and capabilities as well as the opportunities and threats that their team might encounter during the development of the project.

Strength	**Weaknesses**
● The proponents/researchers have the required tools and equipment for the software development.	● Some components of the developed system takes time to fully understand. ● Members have divided time and attention due to ongoing classes and Personal Activities.
Opportunities	**Threats**
● The critics to the project may help improved the ideas and concept in developing the system	● Frequent power interruption ● Slow or no internet/mobile data connection. ● Hardware or Software Failure

Table 3: SWOT Analysis of Proponents

Operational Feasibility. The level of the Operational feasibility will mark (or repute) the developed project if it is suitable to the organization business environment. In this Operational Feasibility, interview was conducted through meetings with the organization respective officials, as a result the succor of system developments was determined. Operations and different problems encountered by the user were identified, analyzed in the manual system to provide a relevant and applicable solution- a result of tested, effective and positive approach.

Development and Testing Procedures

Development Procedures of the System. Tools and applications of the system were utilized for the fulfillment of the clients' request. The Database Management System that was used in the system was MYSQL for Web and Google Firebase to ensure real-time acquiring of data together with the offline capability to synchronize data to in the server once Internet connection is not available for the Mobile Application. HTML and CSS were utilized to make the front end to and fabricate a powerful UI of the created framework through the Sublime platform. For the Back end or the server side, codes embedded are in PHP while WampServer was used as local server to test the web system from time to time. For the system's reminders, to inform a notification was made through the JavaScript. The system development will be based on different criteria, starting with the pilot design, its function, different useful techniques, relevant tools and applications. Android Studio will be used for the development of the requested mobile application. The said mobile application will be available and compatible with any android smartphones with an operating system of Android version 4.4 (KitKat) or higher, simplified to make sure the application will work on 98% Android smartphones. For the development, Java will be used for the system design to utilize and produce UI and for the functions of the framework. Additional API was used

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for the QR scanner of the mobile system. Additional API was also use for different functionalities of the mobile system.

Testing Procedure of the System. Functionalities and capabilities are expound in the development of the system using essential tools to create the base model. End user evaluation and testing were used for system development in testing procedure. Through the use of an assessment form, stability and frailty of the developed system were determined by user's answer and an IT expert. Functionality, reliability, usability, and efficiency was based on the ISO 9126 (Figure 6). Software Evaluation Standards was used on evaluation form during evaluation. To guarantee if the system fulfilled, organization necessities, the branch officials and business owners (MSMEs) were included as beta testing user of the developed system, and the stability of the developed system, tools and programs were utilized during the unit testing. Effectiveness of the developed system will reflect on innumerable test of internet browsers in program testing phase of system development

Evaluation of ISO 9126. Preeminent person of organizations with business owners (MSMEs) that will take the initiative to be the seller and customer conducted developed system's assessment. Stability and frailty of the developed system functionality were assessed through questionnaire provided to the organizations administrators and selected business owners as system testers.

Instruction. Please evaluate the project using the given scale and placing a checkmark on the appropriate column corresponding to your response.

Numerical Rating	Equivalent
5	Highly Acceptable
4	Moderately Acceptable
3	Acceptable
2	Fairly Acceptable
1	Not Acceptable

INDICATORS	5	4	3	2	1
A. Functionality					
1. The software has the ability to interact with the system environment (interoperability)					
2. The functions required for the system are implemented (Compliance)					
3. The functions included in the system are fully functional (accurateness)					
4. The software has provision to prevent unauthorized users from accessing the system (security)					
B. Reliability					
1. The software encounters no error or bug (maturity)					
2. The software does not terminate despite errors or bugs are encountered (fault tolerance)					
3. The software can restore its normal operation when failure occurs (recoverability)					
C. Usability					
1. The software is easy to use (easy to learn)					
2. The software is easy to operate (operability)					
3. The software displays instructions that are easy to understand (understandability)					
D. Efficiency					
1. The software can easily execute the requests (time behaviour)					
2. The software uses minimal system resources (resource behaviour)					
3. The software determines the error or bug encountered during operation (analyzability)					

Figure 6: ISO 9126

Shown on the Figure 6 is the assessment of the developed system utilizing the ISO 9126. Assessment of the developed system using the tools will be participated by a minimum of ten (10) individuals with system expertise together with chosen IT experts. A short exhibition of the system operation will be provided to all the evaluator for them to at least be familiar or to get an idea on how the developed system will work and what function it has. The organized testing result will be shown to the participants as attestation of its functionality and acceptability.

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The developers conduct a beta testing, final testing phase where the system is test by the end-user. Developers also conduct survey to gather information including suggestions, comments, and feedbacks of the users.

Evaluation Summary of ISO 9126. Figure of the result will be used to acquire the final average of the assessment of the system. The developer will administer the probing procedure to determine the system remarks, whereas, all ISO 9126 (Figure 6) result will be congregated from the tester including organizations administrator, MSMEs and chosen IT experts.

Installation Plan

Shown on the Table 4 is the Installation plan for the proposed system. Implementation plan was based on the user satisfactory, suggestions and other features can be added on the developed system.

ACTIVITIES	TASK	ROLES
System Orientation	Orientation and organizing about the project	Developers
System Installation and Distribution	The web hosting and domain name set up will be provided and installed to devices of selected organization. The Android Mobile system will be installed on the selected MSMEs.	Developers
Creating Material for End user		
	Provide User's Manual	
	Guide the user how to use and install the software to enlighten the user how to access the system and to fill in the different functionality of both web and mobile system.	Developers
Guide and Training for system Operation	Perform the acceptability testing with the users of the system	Tester
	Gives an evaluation form to the users	Developers

Table 4: Installation Plan

III. RESULTS AND DISCUSSIONS

Description of the Existing System

The Department of Trade and Industry (DTI) Negosyo Centers, help MSMEs owners through highlighting procedures, one of those strategies is product promotions. They help Micro Small and Medium Enterprises (MSMEs) by providing one-stop shop, which can help MSMEs to grow their business. One of the approaches to help MSMEs grow is providing different methods of advertising and

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selling their products to other places through trade fare events. Trade fare events are organized by the DTI Trade Promotion Team to introduce and showcase the different products of each MSME. The organizations will send invitations regarding the event information (what kind of event it is and its purpose) to every registered businesses owners and it is up to them if they are willing to join or not. If they are willing to join, they should submit the necessary documents such as filled out event registration form, and gate pass to enter the trade fare that are required and needed for the event.

During the event, exhibitors must have to present a gate pass provided by the DTI organizer for them to enter the event place. They are using flyers and brochures as visuals for customers so they will have ideas about the products of MSMEs promotes. Through the event, the MSMEs can gain customers from the crowd that will eventually be the opportunity for their products to be known. Customers can purchase products or place orders of their desired merchandise. MSMEs will gather and compile their sales every day and submit it to DTI for sales performance that way, DTI can also monitor each MSMEs daily sales performance during the event. Before leaving, they must fill a clearance form presented by assigned personnel or a guard so exhibitors can leave the event with their products.

If there is no event, the traditional way of selling will be done where their customers are walk in. They can also promote through social media, and distribution to their resellers. Monthly sales report was submitted to the DTI personnel, so even after the trade fare event, each MSMEs sales performance will be monitored.

Requirements Specification

Sales Performance Monitoring System is online system that consolidate data from different MSMEs. The system will show all the products displayed, allowing the MSMEs to manage their products, the customers can view every products the MSMEs have, and the DTI personnel can monitor the MSMEs sales performance. It will take advantage of the internet and World Wide Web to radically improve the way how the MSMEs owners sell their merchandise, the customers' way of shopping, and for the DTI personnel on monitoring each MSMEs sales.

Functional Requirements

- **Account Registration**
  - In this part of the proposed system, the MSMEs will be able to create an account. The user must fill up the required fields in order to have their data stored in the database.
- **Event Registration**
  - In this part, the MSMEs who wants to join the trade fare event must fill out the required information and it will serve as their attendance to the event.
- **Log in and log out**
  - There are three types of accessing on the proposed system. First, is for the MSMEs for them to be able to access their pages. Next is for customers to choose products to buy. Lastly, is for the DTI employees. Registered information must be used in order to access the system.
- **Home Page**
  - The starting point or the front page of the website.
- **Search Engine**
  - This is used for the locating and accessing specific information and data available on the proposed system.
- **Product catalog**

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- Product, description, and price will be displayed in this module.

- **Ordering**
  - Consumer will be able to order online to lessen the time and effort and to help the consumer in saving money.
- **Email/SMS Notification**
  - This function will let the consumer notified regarding the status of the order.
  - In addition, it will let the seller or MSMEs owner notified about their account verification.
- **Contact US and About us**
  - This contains the information about DTI Negosyo center and how interested business owners can apply.
- **My account**
  - In this module, MSMEs and consumer will be able to update, manage, and check their transaction logs.
- **Terms and conditions**
  - This module contain is where the general and special arrangements, provisions, requirements, rules, specifications and standards that form an integral part of agreement or contract.
- **Users counter**
  - This will keep track on the number of users in the webpage.
- **Mobile QR event scanner**
  - This feature will let both MSMEs and consumer to scan QR code to register on an available event.
- **Event Management**
  - This will allow the administrator to monitor the event attendance for them to know who join or did not join the event.

Generate Reports

- **Sales Reports**
  - This report will allow the organization to view all MSMEs products that are being purchased and sold daily and total sales per month and year. Moreover, through that, a report of total performance of an MSMEs will be generated.

❖ **Daily Sales Report**

- This report will allow the organization to view all MSMEs products that are being purchased and sold daily.

- **List of MSMEs**
  - This report will display all the list of the registered MSMEs in the organization.
- **Product Report**
  - This report views the list of products with their corresponding description and details.
- **Product Report**
  - This report will display all the available products in the proposed system.

❖ **Utilities**

- **Level of access**
  - This module will allow the administrator to arrange the permission of a certain employee to the proposed system.

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- **User Management**
  - This module will allow the administrator to add, update, delete, and search for registered user's information in the system.

Non-Functional Requirements

❖ **File Maintenance**
  - This module will be used by the employee of the organization to update, maintain record of the system. This will also allow specific department to add, edit, and delete particular record. Under are the following sub-modules.
- **Category Maintenance**
  - This will maintain the category of the products.
- **Registered MSMEs maintenance**
  - This will maintain the registered MSMEs information.
- **Product Maintenance**
  - This will maintain the products wof the organization.
- **Customer Maintenance**
  - This maintain the information of the consumer.
- **About us**
  - This maintain the Negosyo Center contact details.

❖ **Transaction**
- **List of Order**
  - This module contains the list of all orders that are needed to provide by the company, it also contain the detailed information about the orders.
- **Delivery**
  - This module display information about the orders that are subject for delivery. Only that are paid or chosen cash-on-delivery (COD) will be shown in this page.
- **Billing**
  - This module will display all the payment module information about the payment transaction of the consumer.

Results of Feasibility Analysis

Feasibility analysis is conducted for the development of Web-based Information System of DTI promoted products to determine and assess the difficulty in carrying out the designated task.

Operational Feasibility. Based on the interview and analysis, the organization expressed their eagerness to support the development of the proposed system in giving the necessary information and helping particularly the users of the proposed system. Through SWOT analysis as presented in Table 5 and Gap Analysis (Figure 5), shows that the organization were have strengths that are needed in developing the system.

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Strength	**Weaknesses**
• The organization is interested and willing to support the development of the proposed system • The DTI's Negosyo Centers can enhance on amplifying the advertisements of every MSMEs products. • The DTI's Negosyo Centers can supervise all MSMEs products along with their informations.	• Limited number of MSMEs has Mobile phones or personal computer to access the developed system.
Opportunities	**Threats**
• It provides an opportunity to the organization to showcase their products through online to maintain loyal customers and lure new customers • Adoption of new technology standard provide an opportunity to enter a new emerging market	• Frequent power interruption • Slow or no internet/mobile data connection.

Table 5: SWOT Analysis of the Organization

The respondents (DTI personnel and MSMEs owners) has enough knowledge of using a computer, so it is possible to make a system for the organization. Although if a user is quite unfamiliar using computer system, there will be a training and discussion about the advantages and importance of the system that will enlighten them or make them learn more. Thus, it is operationally feasible to change the manual methods to the web-based system since nowadays, online-based approach is widely used considering of the pandemic and other happenings in the world.

For the opportunities, it takes an advantage for the DTI and MSMEs owners because they will perform things in a better way, they won't consume large of time in retrieving records and future needs of the organization can be handled effectively. On the other hand, the weaknesses of the organization should be lack of computer equipment/mobile phone that can be use of MSMEs. However, power interruption and poor internet connectivity are the threats for the organization.

Technical Feasibility. For technical feasibility, A Gap Analysis (Figure 5) was used to illustrate the study of technical resources available for the development of the system. From the conducted SWOT Analysis (Table 3), it reveals that the proponents needed strengths for the development of the system such as their optimism, motivation and willingness. The assessed technical resources were the availability and capability of the project personnel, availability of required ICT resources needed for the developed system. This feasibility determined that the Sales Performance Monitoring of MSMEs is technically feasible.

Economic Feasibility. The proposed project is economically feasible since nowadays most of the transactions are done through the internet. It will provide and greatly help the DTI personnel to monitor each MSMEs sales performance and reporting process in a faster way. Also for the MSMEs owners, it will help to gain more customers, monitor transactional data (orders) from different customers, and generate reports of their sales. The main goal of the proposed system is to render a convenient service to the users and help the administrator (i.e., the person in charge) in managing products. The Cost and

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Benefit Analysis (Table 2) was used to see the return of investment, Break Even year and Ratio of the proposed project.

Return of Investment Analysis

$$\text{Break Even Ratio} = \frac{\text{Projected Cost Benefit} - \text{Cumulative Benefit}}{\text{Projected Cost Benefit}}$$

$$= \frac{₱14{,}827.34 - ₱7{,}754.74}{₱14{,}827.34}$$

Breakeven Ratio = 0.48

Breakeven Year = 4

Breakeven Point = Breakeven Year + Breakeven Ratio

= 4.48 or 4 years and 6 months

In the conducted feasibility analysis, the project could receive the benefit of the system after 4 years and 6 months.

Description of the Developed System

In improving the process of monitoring the performance sales of every registered Micro, Small, and Medium Enterprise/s (MSMEs) of the Department of Trade and Industry (DTI), the proponents intend to develop a web based framework where DTI personnel (Trade Promotion Officer) can supervise or observe the performance of each MSMEs sales during and after the trade fare events. The DTI personnel can search a certain date and view the sales of the specific MSME to see if that store is in a good pace. Also they can search the best seller items and least loved items so they can ask the MSME who's handling the product to improve it if the sales is continuously dropping. It will be put on trade fare events for more exposure to the customers. Additionally, it will be posted on short clip advertisements including suggested items on the system where customers can view and preferably choose it.

Also this web based framework improves process of promoting different products of each MSMEs wherein the customers can access the website for their inquiries or requests about the products. The customers are allowed to search and view products uploaded in the website. The searched products of a customer will be displayed with its description and also the seller who uploaded the product to guarantee the trust and familiarity between the client and the seller. The chosen products can be added to a cart where the customers can update the quantity and show total bill of all the products in the cart. The customers can provide feedbacks or inputs for the improvements of the product/s within "contact us" button. The MSMEs can provide printed receipt about their purchased items.

The MSMEs who are willing to upload their products need to register in the separated section. They are required to create their profile that will be the basis for customers trust for on their products. Once the personnel accepted their application, they can upload products on the website allowing the customers to view and authorize them to manage orders from the customers. The system is also equipped with Inventory notifications that notify which product is low on stocks. In addition, once a customer order a product, the system notifies them.

To avail the services (the ordering of products), the customer needs to create an account giving his/her name, address, contact number, and agreement with the terms and regulations. Subsequent on creating an account, the customer needs to alter his/her profile for additional information. The customer can choose items by category or name. It allows them to put everything they want to purchase in the cart where they can modify how many and how much the items they decided to purchase, also they can choose what

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payment method they're going to use. The customer will receive an SMS notification to track the products including the processing, shipping, and the delivery of the item/s.

As for the walk-in customers, they can negotiate to with the person-in-charge of store about their desired merchandise they're going to purchase. The sales will be recorded manually to the system, and internet is badly needed for it to input those items in the system. If internet is unavailable they can ask TPO to input the sales since they might have internet connection. Also, MSMEs can give printed receipt of purchased products to their customers.

The MSMEs owners and DTI personnel maintain the products in the system. The staff of DTI has a complete authorization in managing the products in the system. The personnel may add, edit, and remove products, as well as get the list of MSMEs and customers. Once the MSMEs uploads a product, the system will direct the product upload to the personnel for approval before posting on the website, ensuring the quality and description of the product. Generating reports includes the seller and product master list, order list, and a sales list. That makes the monitoring of sales performance of every registered MSMEs easier for the DTI personnel.

Moreover, DTI trade fare organizer can invite MSMEs owners to attend trade fare event for more product promotions via system notification. Once they open the said notification, a QR code will be displayed and when scanned, it will redirect to the link. Clicking the link will show upcoming event details, and if the MSMEs are willing to join, fill up the DTI Number and email space, then click "Participate" button that will serve as their attendance and registered as event participant.

TEST RESULT

The proponents conduct and finished the Alpha Testing successfully. Various problems and defects have been identified and were fixed immediately. Retests have been done after the issues were solved in order to have a smooth functioning software. The developers also found out that the system will be acceptable to the different organizations by means of the Software Product Quality test that has been answered by the different users.

IV. CONCLUSION

Based on the concerns stated objective of the study and the results of the evaluation the developers concluded the following:

1. After analyzing completely the flow of the existing system used by DTI and MSMEs it stated that there are problems encountered. Therefore, the developers proposed a system to solve the problem.
2. To make the system feasible for implementation, the developers administered a feasibility study.
3. The proposed system provides the following functions:
    - Can create account for Administrator, MSME's, and Customers.
    - Sending SMS and email for account verification.
    - Sending SMS for the updates of orders.
    - MSME provides product to sell.
    - Customers can write a review for the product they buy.
    - It can generate sales and shows which item is the most selling and how many items was sold in daily, monthly, and yearly.
    - Administrator creates a new event with QR code attach and send to MSME's that can be used for joining an event.
    - The customer can cancel their order within 30 minutes only upon purchasing.

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V. RECOMMENDATIONS

The development of Sales Performance Monitoring of MSME's is to help the DTI to monitor automatically the MSMEs' performance sales effectively and accurately. Also, to help the MSMEs on connecting to their customers whenever and wherever they are.

Based on the study, the following recommendations were made:

1. The proponents' recommends Return of items Module for every customer taking previously purchased items back to the seller for only justifiable reason.

2. Another recommendation is the FAQS and Inquiry Module to ensure that every customers' queries and question will address properly.

3. Also recommended is the Bank to Bank Transaction for any customer that prefer a bank-to-bank transaction. Like paying their orders without involvement of cash.

4. Another recommendation is the Event Page where MSMEs can put their sales during the event.

The developed system still needs an improvement. Adding additional features would be a help to encourage DTI and MSMEs to use it and for future maintenance.

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REINFORCEMENT HUB WEB-BASED LIGHTS AND SOUNDS RESOURCES MANAGEMENT SYSTEM

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Abstract— The Reinforcement Hub Web-based Lights and Sounds Resources Management System is a rental management that was developed to help the Lights and Sounds providers to engage the collaborative businesses as well as, to enhance the stream lining of their businesses and disseminating the business information to the borrower(s) even with the customer(s). With the results gathered from the selected organization, owners focuses the rental services and tend to still have difficulties in managing and monitoring the paper based that they process in manual work. Other related problems are they have no guides and references of borrowers and or customers chose what type of equipment they rented that was result mismatch of the equipment. With the development of the Reinforcement Hub Web-based Lights and Sounds Resources Management System, it can help the user in managing their rental services. The developers also conducted the feasibility analysis in order to know if it is operationally and technically feasible to be implemented. PHP and XAMMP Server are the development tools used in the development of the system.

Keywords: Reinforcement Hub, Web- based Lights and Sounds, Resources Management System

I. INTRODUCTION

Nowadays, vast use of technology is continually growing and most human activities are greatly dependent on technologies. Evidently most of the activities of an individual are greatly influenced by modern technology. The advancement of Information Technology and internet penetration has greatly enhanced various business processes and communication between companies (service providers) and their customers of which lights and sounds rental businesses are not left out.

There are a lot of celebrations and events being held in the different places in Marinduque Province and most of these are festivals, concerts, live Band, parties, corporate, weddings and even production events.

With this above mentioned events projects engage with a huge and massive live audience. In a very particular manner, this project couldn't be possibly done without lights and sound system.

Marinduque Lights and Sounds is a local business that provides reservation and rental services in the province that offer good and quality lights and sounds equipment for any events. There are some lights and sounds businesses have their own facebook page to improve their rental services.

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The municipality of the said province has different Lights and Sounds businesses. They have also a one plat form that engages a collaborative business. The studies develop generic software for the different lights and sounds businesses to use. However, the proponents selected three organizations to conduct pilot testing.

RRC Professional Lights and Sounds located at Isok1, Boac, Marinduque and was owned by Ricson M. Duenas. It is a very well known and one of the pioneer lights and sounds provider. The second lights and sounds is The Neutral Zone. It was owned by Rowell M. Jandusay, located at Ihatub, Boac, Marinduque. And the last three is Manalo lights and sounds that were owned by Delfin M. Manalo, located at Bognuyan, Gasan, Marinduque. By conducting a series of interviews with the selected organizations, the proponents found out the same and different processes of the three organizations. With this information, the proponents aim to develop generic software with the same and different functions and features that lights and sounds businesses will utilize.

Currently, all the selected organizations are using manual system in their rentals transaction. Thus, the dilemma of their existing system first is mismatch rented lights and sounds equipment because some lights and sounds business owners do not provide guides and references as borrowers chose the type of equipment they rented. There are instances that some of them are not aware to the earning profit of each, rental equipments since they don't have a written list of purchase price of their equipments. As well as, redundant counting the numbers of available items when borrowers reserve and rent of equipment, which increases the possibility of human error or simply owners might forget to record the lists of the details of all transaction. And making reports result tardiness of work because reports done with incorrect information.

With the problems mentioned above, the developer proposed a web- based system entitled “Reinforcement Hub: Web-based Lights and Sounds Resources Management System “for lights and sounds businesses. The proposed system will help the lights and sounds businesses to have an efficient way to manage and organize the rental services of the Lights and Sounds Owners.

OBJECTIVES OF THE STUDY

Generally, the project aims to develop a Web- based System that will help the Marinduque Lights and Sounds businesses to ease and make efficient their rental services.

Specifically, the proposed project aims to:

1. Analyze the existing processes and procedures in the system.

2. Assess the feasibility of developing a new system.

3. Design and develop a Reinforcement hub: Web-based Lights and Sounds Resources Management System.

4. Test the functionality and acceptability of the Web-Based System through Pilot Testing.

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SIGNIFICANCE OF THE STUDY

The proposed project would benefit first the **Marinduque Lights and Sounds Business Owners.** They will be able to market their business in a manner where their co-owner can avail their rental service. In addition, this will also serve as a marketing tool to increase their market share. Second, **the Lights and Sounds Customers.** They will be given more information about the status of lights and sounds business. It will become more convenient for them to search the place of having lights and sounds businesses and they are aware of the posting available on the system.

DEFINITION OF TERMS

Reinforcement Hub. Reinforcement Hub is a one-stop platform for lights and sounds business owners.

Client. Refers to the owner of other lights and sounds business and also borrows equipment in other lights and sounds businesses.

Borrower. Refers to client and customer.

Customer. Refers to the one who rents lights and sounds businesses.

Lights and Sounds. A combination of multiple tools and equipment in delivering audio and visual enhancement to events.

SCOPE OF THE PROJECT

The proposed project Reinforcement Hub: Web-based Lights and Sounds Resources Management System will be designed to manage the reservation, scheduling, inventory, monitoring of sales and reports of different lights and sounds businesses. It will be generic software. It will involve the basic phases of project planning/initiating; analysis and design, development and implementation, testing and validation which are shown in the Work Breakdown Structure (WBS).

The project covers planning and initiating a preliminary investigation was conducted which includes the selection of the organization, and preparing for an interview. The next phase was the analysis and design feasibility study is conducted to determine if the developed system can be implemented and the organization is capable to adapt to the project. And also, includes the preparation of the Data flow Diagram to know the problems brought by the existing system and the preparation of the Entity Relationship Diagram and Database Schema.

The third phase was the development and implementation; the proponents will perform coding and debugging of the system with the use of the different development tools that is required for developing the system.

And also, includes the layout and designing of the prototype that served as the basis to develop the expected design of the user's interface and system's functions.

Then the last phase was testing and acceptance of the business the proponents will conduct different tests to examine if it is performing as required or if there is an error to be corrected. The kinds of testing are pilot, alpha beta testing and validation of the finished system which primary concerns are requirements review, installation, implementation and users' verification and validation.

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II. METHOD AND PROCEDURE

Requirement Analysis Procedures

Initial data gathering for the requirement analysis was done. Interview guide questions as shown in Figure 1was prepared by the proponents and used during the interview with the selected Lights and Sounds Business owners. The proponents identify the differences and similarities of the existing process and procedures of their rental services. The proponents will then analyze the encountered problems of the existing system in order to proceed in the proposed system. In the proposed system procedures, this will support the process and solution to similarities and differences along with existing process.

To what type of business categorized?

Who serves as the entrepreneur of the business?

What processes are included in your business? How do you handle such?

What products or services are being offered by your business?

What basic information has to be provided by customers when renting your products?

How do you carry out the rendering of products/services to your clienteles?

Are you familiar with information System? Do you think an information System may provide competitive advantages to your business?

Are you willing to adapt the developed system entitled Reinforcement Hub:

Figure 1: ***Sample Interview Questions used during the Interview.***

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Work Breakdown Structure (WBS)

Planning/ Initiating

Selection of the Target Organization

Preparation of Interview Letter and Interview Questionnaire

Conduct an interview

Conduct Preliminary Investigation Report

Documentation

Analysis and Design

Preparation of Gantt chart and WBS

Preparation of Scope of the Project

Preparation of the Data Flow Diagram in the Existing and Developed System

Preparation of the Entity Relationship Diagram and Database Schema

Development and Implementation

Layout and Designing the System / prototype

System Coding / Debugging

Testing and Acceptance of the Business

Pilot Testing

Validation Testing

Alpha Testing

4.4 Beta Testing

Figure 2: ***Work Breakdown Structure (WBS)***was used to determine the project scope

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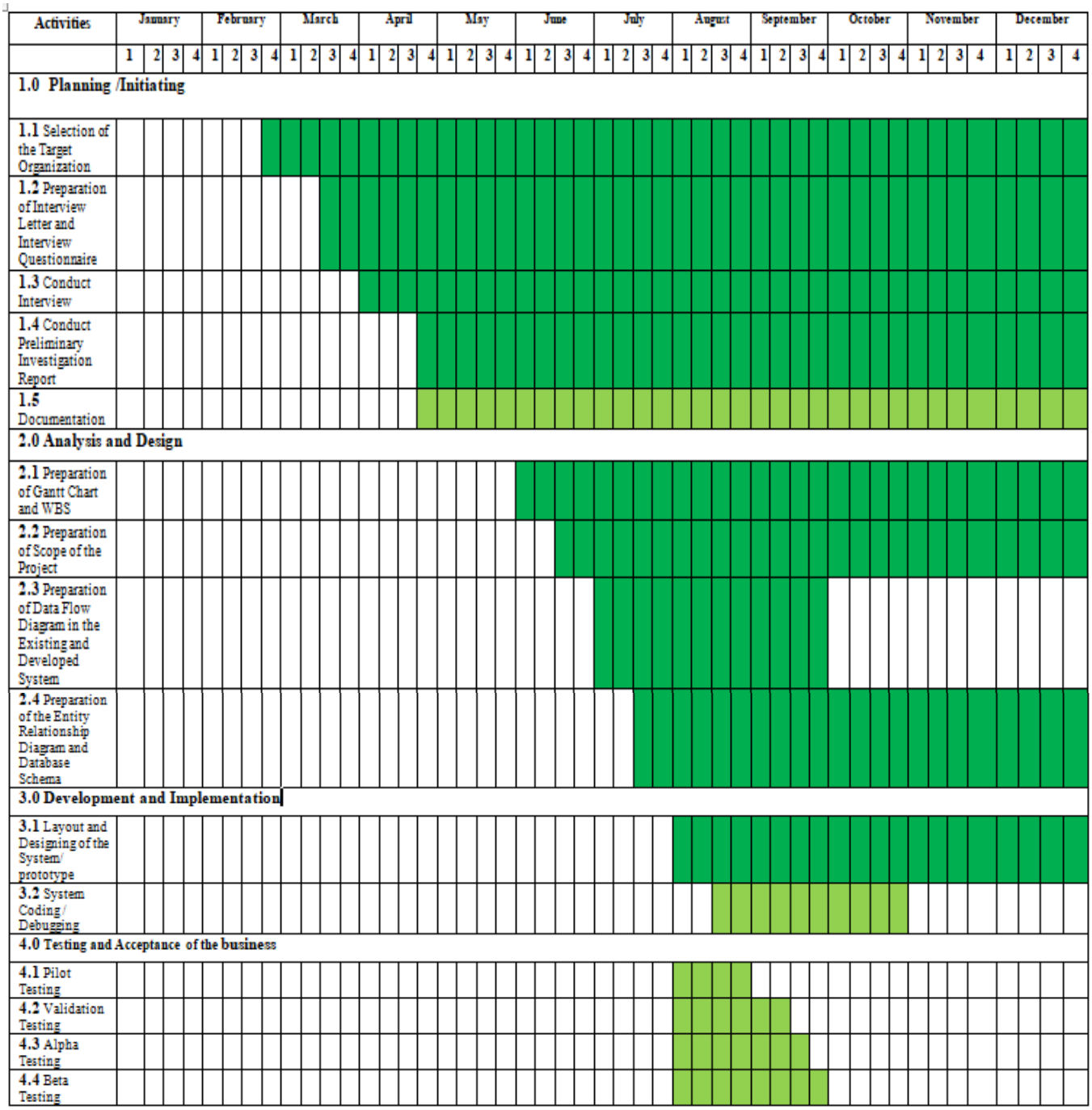
Gantt chart as shown in Figure 3 was used to view the scheduled activities within the system development span.



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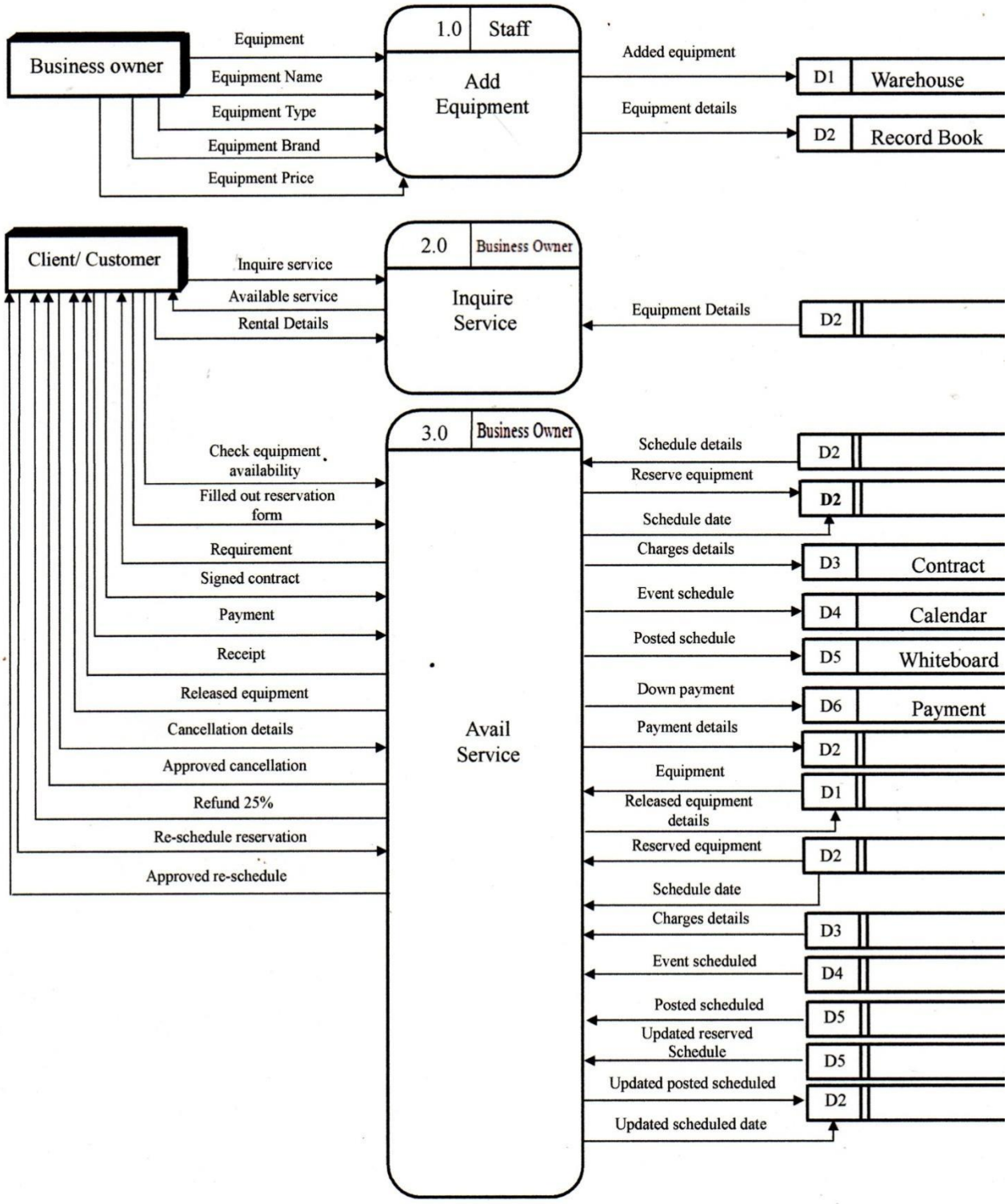
After gathering the needed information, analysis of the existing processes and procedures was done by using Data Flow Diagram as shown inFigure 4 to Figure 4.1 and Figure 4. 2. Likewise, the problems brought by the existing system were analyzed in detail.

Data Flow Diagram of the Existing System (RRC, Manalo, TNZ Lights and Sounds)



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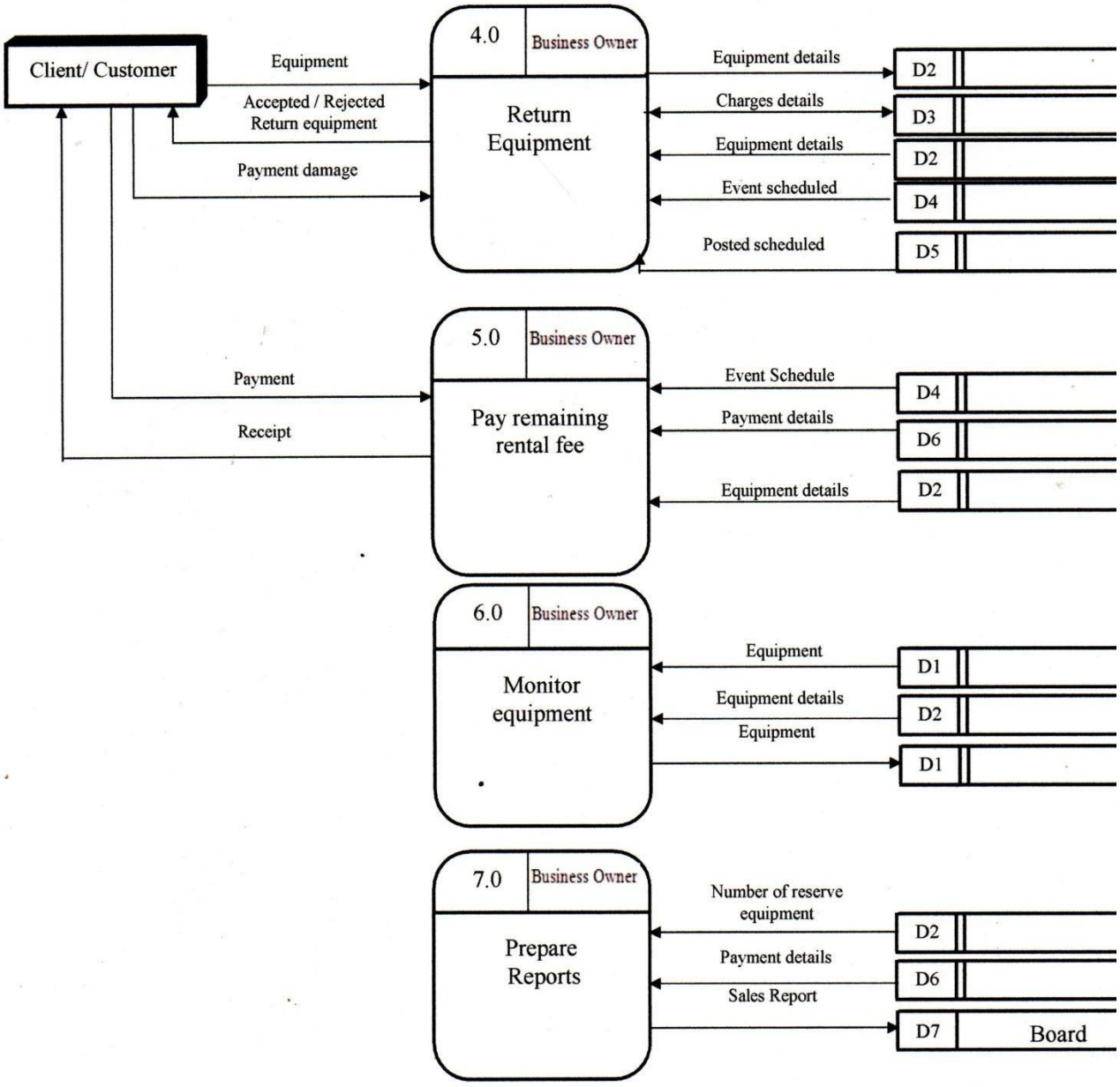

Figure 4*:* ***Data Flow Diagram of the Existing System***

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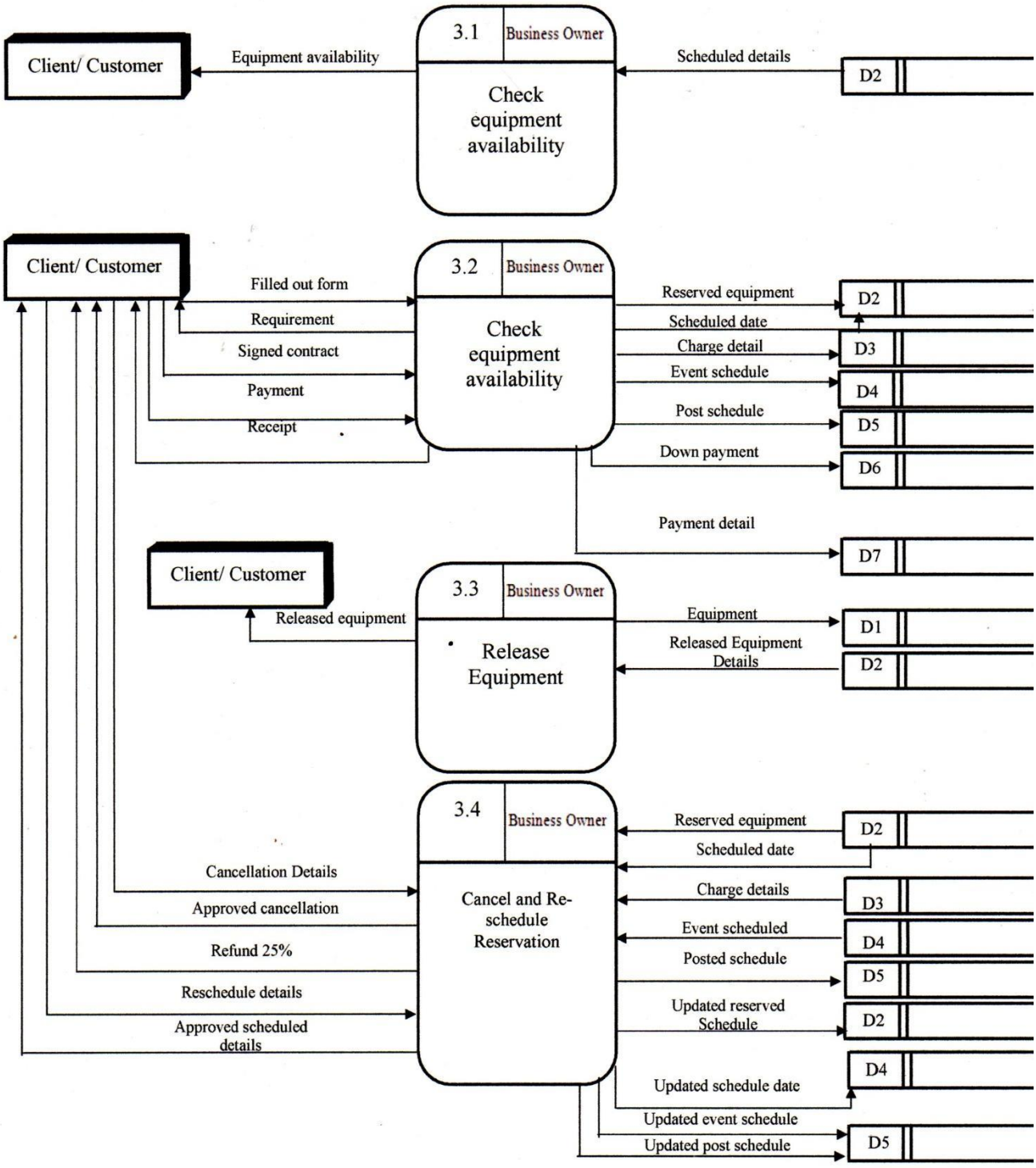
Exploded Data Flow Diagram 3.0



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Use Case Diagram as shown in Figure 6, was drawn to define the processes of the proposed system and it's interaction with the actors.

Reinforcement Hub Web-Based Lights and Sounds Resources Management System

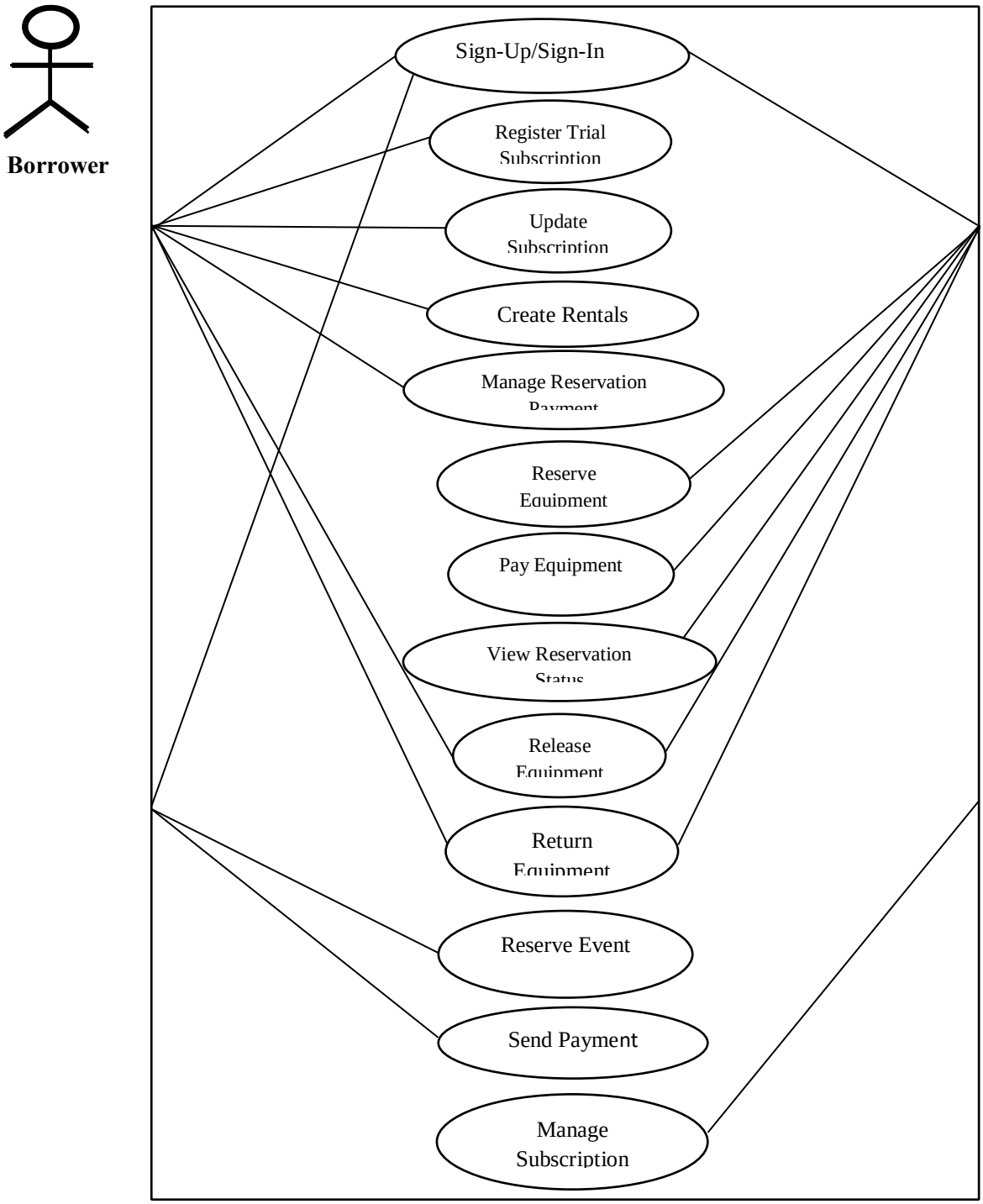

Figure 5: ***Use Case Diagram of the Proposed System***

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On the other hand, database schema as shown in Figure 7 will be used in defining the database of the system as shown in Figure 7 and through the process of normalization which primary purpose is to avoid data redundancy.

Figure 6: ***Database Schema***

Account Table – tbl_account

Field Name	Data Type	Constraint
Account ID	Int (11)	Primary Key
Account_ Image	Varchar (200)	Not Null
First Name	Varchar (100)	Not Null
Middle Name	Varchar (100)	Not Null
Last Name	Varchar (100)	Not Null
Address	Varchar (100)	Not Null
Gender	Varchar (25)	Not Null
Contact Number	Varchar (100)	Not Null
User Type ID	Int (11)	Foreign Key
Email	Varchar (100)	Not Null
Password	Varchar (100)	Not Null
Date or Registration	Datetime	Not Null
Status	Varchar (100)	Not Null
Ls Name	Varchar (100)	Yes Null
Ls Registration	Varchar (100)	Yes Null
Ls Details	Varchar (255)	Yes Null

Equipment Category Table – tbl_eqcategory

Field Name	Data Type	Constraint
Category ID	Int (11)	Primary Key
Category	Varchar (200)	Not Null

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Equipment Table - tbl_equipments

Field Name	Data Type	Constraint
Eqid	Int (11)	Primary Key
Ls_adminid	Int (11)	Foreign Key
Category_id	Int (11)	Foreign Key
Eq_Photo	Varchar (100)	Not Null
Eq_ Name	Varchar (100)	Not Null
Eq_ Description	Varchar (200)	Not Null
Eq_ Unit	Varchar (50)	Not Null
Price_ PerDay	Int (11)	Not Null
No_of_items	Int (11)	Not Null
Date	date	Not Null
Purchased_price	Int (11)	Not Null

Events Table – tbl_events

Field Name	Data Type	Constraint
Event ID	Int (11)	Primary Key
Ls_AdminID	Int (11)	Foreign Key
Event	Varchar (100)	Not Null
Details	Varchar (200)	Not Null
Price_perday	Int (11)	Not Null
Dateadded	Date	Not Null
Status	Varchar (50)	Not Null
Event_photo	Varchar (100)	Not Null

Mode of Payment Table –tbl_lsmodeofpayment

Field Name	Data Type	Constraint
Mode ID	Int (11)	Primary Key
Ls_adminid	Int (11)	Foreign Key
Mode	Varchar (100)	Not Null

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Details	Varchar (254)	Not Null
Status	Varchar (100)	Not Null

Payment Method Table – tbl_lspaymentmode

Field Name	Data Type	Constraint
Mode ID	Int (11)	Primary Key
Mode_ofpayment	Varchar (100)	Not Null
Mode_details	Varchar (150)	Not Null
Mode_status	Varchar (50)	Not Null
Ls_adminid	Int (11)	Foreign Key

Reservation Payment Percent Table tbl_lsreservationpaymentpercent

Field Name	Data Type	Constraint
Res ID	Int (11)	Primary Key
Respaypercent	Int (11)	Foreign Key
Ls_adminid	Int (11)	Foreign Key

Payment Table – tbl_payment

Field Name	Data Type	Constraint
Payment ID	Int (11)	Primary Key
Owner ID	Int (11)	Foreign Key
Client ID	Int (11)	Foreign Key
Screen_shot	Varchar (100)	Not Null
Amount	Int (11)	Not Null
Mode	Varchar (100)	Not Null
Purpose	Varchar (100)	Not Null
Status	Varchar (50)	Not Null
Messsage	Varchar (255)	Yes

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Reserved Equipments Table – *tbl_reservedequipments*

Field Name	Data Type	Constraint
Reserved ID	Int (11)	Primary Key
Ls-Borrowerid	Int (11)	Foreign Key
Owner ID	Int (11)	Foreign Key
Eq_id	Int (11)	Foreign Key
No_ofitems	Int (11)	Not Null
Res_datefrom	Date	Not Null
Res_dateto	Date	Not Null
Amount	Int (11)	Not Null
Date	Date	Not Null
Status	Varchar (200)	Not Null
Payment ID	Int (11)	Foreign Key

Reserved Event Table - tbl_reservedevent

Field Name	Data Type	Constraint
Reserved ID	Int (11)	Primary Key
Client ID	Int (11)	Foreign Key
Ls_adminid	Int (11)	Foreign Key
Event ID	Int (11)	Not Null
Res_datefrom	Datetime	Not Null
Res_dateto	Date	Not Null
No_ofdays	Int (11)	Not Null
Amount	Int (11)	Not Null
Date Transacted	Date	Not Null
Status	Varchar (100)	Not Null
Res_paymentid	Int (11)	Foreign Key
Full_paymentid	Int (11)	Foreign Key
Rate	Varchar (100)	Yes Null
Rate Comment	Varchar (200)	Yes Null

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Subscription Mode of Payment – tbl_subscriptionmodeofpayment

Field Name	Data Type	Constraint
Mode of Payment ID	Int (11)	Primary Key
Mode of Payment	Varchar (100)	Not Null
Details	Varchar (254)	Not Null
Status	Varchar (100)	Not Null

Subscription Trial Days Table – tbl_subscriptiontrialdays

Field Name	Data Type	Constraint
Trialdays ID	Int (11)	Primary Key
Trialdays	Int (11)	Not Null

Subscription Monthly Payment Table – *tbl_submonthlypayment*

Field Name	Data Type	Constraint
Submonthlypayment ID	Int (11)	Primary Key
Submonthlypayment	Int (11)	Not Null
Raw Material Name	Varchar (20)	Not Null
Quantity	Varchar (10)	Not Null
Date	Date	Not Null

Subscription Status Table- tbl_subscriptionstatus

Field Name	Data Type	Constraint
Substat ID	Int (11)	Primary Key
Ls_adminid	Int (11)	Foreign Key
Dateofregistration	Date	Not Null
Expirationofregistration	Date	Not Null
Payment	Int (11)	Yes Null
Transactioncode	Varchar (100)	Yes Null
Description	Varchar (50)	Not Null
Status	Varchar (50)	Not Null
Modeofpayment	Varchar (150)	Yes Null

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Details	Varchar (200)	Yes Null
Payment_photo	Varchar (200)	Yes Null

Terms Admin Table – tbl_termsadmin

Field Name	Data Type	Constraint
Terms ID	Int (11)	Primary Key
Terms	Varchar (255)	Not Null
Status	Varchar (20)	Not Null

User Type Table – tbl_usertpye

Field Name	Data Type	Constraint
Usertype ID	Int (11)	Primary Key
Usertype	Varchar (100)	Not Null

Feasibility Analysis Procedures

The economic, technical and operational feasibility was assessed to determine if the project is eligible to continue. The assessment of feasibility will prove that the project is worth continuing.

For economic feasibility of the existing system were identifying the operational cost of the existing system against the operational cost of the proposed system. It includes the computation of the Cost-Benefit Analysis and Breakeven Analysis was used. The proponents proposed system such us the development cost including the personal services, maintenance, operation and other expenses was analyzed. The subscription fee of the selected the lights and sounds businesses as subscribers of the proposed system. Cost-Benefit Analysis and Break-Even Analysis was used. Cost-Benefit Analysis is most commonly done based on the financial questions of the system to determine the net result. Break-Even Analysis is also conducted to determine the payback period for the investment in the proposed system. Through the use of it, proponents as system administrator will determine how long it takes to regain the expenses incurred in developing the said system.

The technical feasibility was assessed by conducting GAP Analysis to determine if the ICT resources of the proponents are enough to manage the completion of the proposed project. Also, this analysis is used to test if the resources of the proponents are adequate to handle the development of the system.

The operational feasibility was conducted to distinguish if the business owners have the ability to operate the system. SWOT *analysis* was used to determine the strength and weaknesses, opportunities and threats if the proposed system will be handled applicably. Brainstorming was conducted to distinguish the SWOT of the organization after determining the ICT resources.

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Development and Testing Procedure

On the development stage, the system was coded based on its intended functionality. This stage serves as the physical realization of the proposed system. Prototype was then used as a guide to illustrate the appearance of the system.

PHP was used as a server scripting language and tool for making dynamic and interactive web pages. JavaScript was also used for supporting the object-oriented, imperative, and functional programming styles cover by the system. This will help in detecting user actions and to ensure correctness of data being entered on the system.

XAMPP (Apache) will be used as the local server to test the web system from time to time. MySQL will be used to create a relational database structure for data storage. Web browser is the software that will be used to access the internet and the system. The Cascading Style Sheets (CSS) was used for styling purposes of the web page interface.

Implementation Plan

After the system development process, and testing procedures, implementation and installation plan will be done. The system will be implemented at selected Lights and Sounds Businesses. The installation plan will be executed by connecting the computers in the different business site to the system via the internet. After connecting, training is initially rendered to the end-user in order to assist them in learning how to utilize each function and feature of the system. An orientation will be conducted to the selected business owner in order to familiarize the user with the system functionalities and processes. Moreover, a User's Manual will be created and be given to the organization which will serve as the guide of the client as the system begin to be used, and for some instance of encountering certain errors with the system. When the proposed system developed, it will be given directly and presented to the selected organizations to start beta testing. After the testing, if the developed system satisfied the requirements, the system will be prepared for web hosting and getting a domain name. After the system is stored inside the web host and after getting the domain name, the developed system will be immediately available for subscription for all lights and sounds businesses. The proponents will be the one to administer the system and will be assigned as the server maintenance of the system.

III. RESULTS AND DISCUSSIONS

Description of the Existing System

There are three Lights and Sounds businesses that have been interviewed by the proponents namely RRC Lights and Sounds (Boac), Manalo Lights andSounds (Gasan) and The Neutral Zone Lights and Sounds (Boac). The existing system of the businesses follows the business models: Business to Business (B2B) and Business to Costumer (B2C).

The following are the processes which were gathered during the interview. In the rental of the equipment, Business Owner may avail the rental services of other lights and sounds owners whom they refer as borrowers. Based on the interviews conducted by the proponents, anyone of the owners who want to rent a particular equipment to the co-owner communicate verbally, via email or chat, sometimes thru phone call or text and even through walk-in to inquire the availability of the equipment. The borrower needs to fill-out a reservation form, the owner then checks the record book or in the whiteboard where event list are listed if the equipment is available on the chosen date(s).

The selected lights and sounds businesses have a complex computation of rental rates. Prices of their equipment rental may vary as well as the price of the rendered event(s).

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Next, a fifty (50%) percent down payment is needed to process the reservation and receipt is then given to the borrower and customer. Then the remaining balance would be given when the equipment will be returned. Both parties accepts down payment of reservation. RRC accepts online payment via GCash, Palawan Express Padala or Smart Padala, while Manalo and Ark Lights and Sounds accept only payment on a cash basis. RRC provides a business registration receipt for the payment of the co-owner/borrower, Manalo provide a temporary receipt, while Tnz Lights and Sounds marks the payment on a record book.

In some cases, borrower makes cancellation of the reservation. Sometimes because of the rate that other lights and sounds business may offer and any other reason of the co-owners/borrowers. In this case, the owner will make a refund of the half of the down payment which is twenty-five (25%).

In returning the equipment, condition of the equipment will be then checked before it will be accepted. In case that it has damage or was lost then the borrower will pay for the amount.

Manual inventory is performed monthly to check and count if the equipment has a damaged and also calibrate the equipment if it is still functional or not. The owner records their equipment and its rate in a notebook; some other businesses are in an index card or in a piece of paper.

In the process of preparing reports, the business owners performed it manually. A record book is used to record all the rented equipment, the borrower and the schedule. It is then summarized and is written in a whiteboard. RRC use a spreadsheet application in preparing the reports, Manalo Lights & Sounds record in a notebook while TNZ Lights and Sounds use a note app.

In the business to customer (B2C), The RRC, Manalo and Tnz provide lights and sounds for the events of the customer but then differ in the quality of the equipment. The businesses handle event set up for the small, medium and large events. They also offer different packages for events.

Requirements Specification

To the determined result based on the user's requirement and supporting documents collected, the following will be the functionalities and the non- functionalities of the proposed system.

Functional Requirements

Sign up/Sign In

- The system shall allow the user to register an account in the system.
- The system shall allow the user to avail the 30 days free trial subscription upon signing up.
- The system shall allow the active admin to sign in their account.

Rental Management

- The system shall allow authorized user to add or edit equipment categories.
- The system shall allow authorized user to add or edit the equipment rental details including equipment image, name, category, description, unit, price per day, stock, reserved/borrowed, remaining item, purchased price and date registered.
- The system shall allow authorized user to view the reports of individual equipment income against the purchased amount per item including the owner's name, equipment, date rented, type/unit, rented number of items, income amount and status if returned or reserved. And the total income, purchased price per item and return of investment or profit are computed.
- The system shall allow authorized user to print all individual income reporting and then will save to the selected file location.

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- The system shall allow authorized user to view the inventory details in "Equipments" menu navigation regarding the updated stock of equipment, numbers of reserved/borrowed as well as the remaining item.
- The system shall allow authorized user to add or edit the events offered including event image, event, details, price per day, date registered and status if offer or do not offer.
- The system shall allow authorized user to add or edit mode of payment, details and status if available or unavailable
- The system shall allow authorized user to update the reservation payment percentage.

Event Reservation Payment Management

- The system shall allow authorized user to manage reservation payment of their customer.
- The system shall allow authorized user to view reservation payment of the customer.
- The system shall allow authorized user to approve the payment of the customer.
- The system shall allow authorized user to decline the payment of the customer with message details.
- After validating the reservation payment of the customer, then the system shall allow authorized user to view event calendar menu navigation about the event details of the customer.
- When the event is done, the system shall allow authorized user to view the full payment of the customer.
- The system shall allow authorized user to input the payment of the customer and the change should be display.
- After the payment View ratings.
    - 2.3.1 Identify the daily income of availed event of the customers.

Equipment Reservation Payment Management

- View the walk-in payment of the borrower.
- Approve the payment of the borrower.
    - Decline the payment of the borrower with message details.
- View "validate online payment "menu navigation of the borrower.
    - Approve the payment of the borrower.
    - Decline the payment of the borrower with message details.
    - View generate equipment income report
- Search report by date rented.
- Print report for equipment income.
    - Select file location and then save printed report.
- After the validation of payment should done, "release equipment" navigation will automatically have indicator.
    - Owner shall view the release equipment.
    - When the given date of the borrower should need to release, then owner select release equipment.
- When the equipment should release, then "return equipment" navigation should automatically have indicator.
    - Owner shall view the return equipment.
    - When the borrower should return the equipment, then owner should select the return equipment.

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Reservation Management of the Equipment

- The system shall allow the user to view the Reserve Equipment navigation.
- The system shall allow the user to select schedule.
- The system shall allow the user to change reservation date.
- The system shall allow the user to select categories of equipment.
- The system shall allow user to search desire equipment to be rent.
- The system shall allow user to select different lights and sounds owners that have a same equipment wants to be rent.
- The system shall allow user to see number of available items.
- The system shall allow user to put numbers of items.
- The system shall allow user to update number of items.
- The system shall allow user to reserve the equipment.
- The system shall allow user to click Pay Equipment menu navigation.
- The system shall allow user to view Payment of Equipment Reservation.
- The system shall allow user to click Send Payment draft button.
    - Filled-out the needed information of online payment.
- The system shall allow user to click Send Screen Shot draft button.
- The system shall allow user to wait for the approval.
- The system shall allow user to update Payment.
- The system shall allow user to delete the reservation of the equipment.
- The system shall allow user to view the reservation status.

Reservation Management of the Event

- The system shall allow the user to view Reserve Event
- The system shall allow the user to select schedule.
- The system shall allow the user to click Reserve Event.
- The system shall allow the user to change reservation date.
- The system shall allow the user to search Lights and Sounds business name.
- The system shall allow the user to select lights and sounds owner.
- The system shall allow the user to reserve event for the selected owner.
- Business name image, event image, and ratings of the customers should be viewed.
    - Select available event(s).
    - After selecting event, the total reservation payment should be computed.
    - The system shall allow the user to click Reserve Event button when it desires to reserve selected event.
- The system shall allow the user to view available mode of payment with the details of the receiver.
- The system shall allow the user to click send button.
    - The system shall allow the user to view total reservation payment percentage.
    - The system shall allow the user to add screen shot of payment.
    - The system shall allow the user to select mode of payment.
    - The system shall allow the user to successful, Send Screen Shot.
- The system shall allow the user to update payment reservation.
- The system shall allow the user to delete event reservation.
- After sending payment with the approved of the owner, then customer view their event calendar in the main menu that includes their number of event renting, Lights and Sounds owner, events and specific date or simply click highlighted date reservation in the calendar provided by the system to view event details of the customer.
- Full payment should give after the event, then customer should rate based on the rented lights and sounds, they have experienced.

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Subscription Management

- The system shall allow the user to sign-in the email and password of the active admin.
- The system shall allow the user to access the system.
- The system shall allow the user to adding/ editing the admin as an active or deactivated account.
- The system shall allow the user to adding/ editing terms and conditions, and status if possibly implement and unimplemented.
- The system shall allow the user to adding/ editing mode of payment, details and status if available or unavailable.
- The system shall allow the user to updating the subscription trial days.
- The system shall allow the user to updating monthly subscription payment.
- The system shall allow the user to view the notifications of the "Approval of Application" menu navigation.
- The system shall allow the user to approve the application of the owner.
- The system shall allow the user to view the notifications of the "Subscription Payment "menu navigation.
- The system shall allow the user to validate the payment of the owners. And/or update the payment of the client with corresponding messages.

Non-Functional requirements will specify or constrain characteristics as a whole and directly concerned with the specific services delivered by the system to its users.

Non-Functional Requirements

- Security Requirements
  - Privacy/Security- Authorized user has the ability to modify such changes on the system including the lights and Sounds Business Owners and Administrator. The users' authentication will be based on the passwords provided by the administrator.
- Usability
  - Ease of use- The system will be understandable and easy to use and operate.
  - Scalability- can handle many workloads.

Availability- the system will ensure that the data will be available 24/7 and can be run on laptops with different types of browsers. The system should also be connected to the internet in order for the system to communicate with the database.

Result of Feasibility Analysis

Operational Feasibility

In the Operational feasibility, SWOT Analysis *(Appendix H)*, was conducted to evaluate the strengths and weaknesses of the Lights and Sounds Businesses to handle the system. The willingness to improve their rental services Otherwise, weakness was some of lights and sound owners are apprehensive to ICT applications, because they think it is more complicated.

Table 1 Result of SWOT for Operational Feasibility

STRENGTHS	WEAKNESSES

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• The Lights and Sounds Owners are mostly equipped with Laptops • Huge percent of lights and sounds businesses are interested than not.	• Some of lights and sound owners are apprehensive to ICT applications, because they think it is more complicated.
OPPORTUNITIES	**THREATS**
• The Web-based Lights and Sounds Resources Management System can serve better and efficient services to the organization as well as to the business owners. ` • High client satisfaction and loyalty.	• Highly competitive telecommunications market • Power Disturbance/Interruption • Internet Accessibility

Technical Feasibility

In the result of technical feasibility the conducted SWOT (*Appendix F)*, it shows that the developers have the needed resources for the system development, adequate management and discipline. However, the weakness shows that the developers haven't built a Software Project before and some components of the proposed system take time to be fully understood. For the opportunities, apply the skills that have learned through the subjects, gain trust from the target user/clients that help the project development and more knowledge skills gain from the project development.

STRENGTHS	**WEAKNESSES**
• Convenience in terms of use • Ability to overcome time barriers(time-saving) • Have enough developing equipment. • The motivation and involvement of the proponents • Can work under pressure • The proponents attended some seminars that may help the project development.	• Experience: Have not build a Software Project before • Some components of the proposed system takes time to be fully understood
OPPORTUNITIES	**THREATS**

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• Apply the skills that have learned throughout the subjects • Gain trust from the target users/clients that help the project development. • More knowledge and skills gain from the project development.	• Poor internet connectivity • Time pressure: time over quality • Failure in hardware and software development platform. • Frequent brownouts.

Economic Feasibility

In the result of Economic Feasibility, the conducted interviews in the organization identify the materials and supplies of the existing as well as the developed system. The development cost is Php209, 792.00, wherein it includes the personal services and other expenses. The personal services were based on the development duration which is 10 months multiplied to the salary of the development staff. The operational constant cost from year 1 to year 5 is Php230, 000.00 which includes the system administration and system maintenance cost. In the projected income, it was assumed that the subscription rate per Lights and Sounds Business Owners is Php4, 500.00 wherein the return of investment and the affordable price for each Lights and Sounds Business Owners was considered. The subscription of other Lights and Sounds Businesses in the following years was assumed according to the number of Lights and sounds Business Owners and these results to the cumulative benefit of Php72, 208.00, a positive value of which indicates that the proposed system is economically feasible. The proponents could regain its expenses within 3 years and 8 months after installing the system

Table 3 Cost and Benefit Analysis of Existing and Proposed System

	Year0	Year1	Year2	Year3	Year4	Year5
Development Cost	**(209,792.00)**					
Total Cost of the Existing System		Php9,845.00	Php10,829.5	Php11,912.45	Php13,343.27	Php122,514.04
Total Cost of the Proposed System		Php4,553.00	Php5,008.3	Php5,479.13	Php6,027.05	Php6,695.7
Project Benefit		5,292.00	8,492.3	709,090.03	810,199.44	1,020,702.92
Cumulative Benefit	(209,792.00)	Php(204,500.00)	Php196,007.7	Php513,082.33	Php1,323,281.77	Php2,343,984.69

Table shows presented the cost and benefit analysis. Year 0 is the year where the system will be developed. Developmental cost amounting to Php209, 792.00 is indicated. The organization could have a projected benefit amounting to Php709, 090.03 and a Cumulative benefit amounting to Php499, 298.03, a positive value of the cumulative benefit indicates that the proposed system is economically feasible.

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Breakeven Year= Year 3

Breakeven ratio = (Projected Benefit–Cumulative Benefit)/Projected Benefit

= (709,090.03-499,298.03)/709,090.03

=0.30

Breakeven Point =Breakeven Year+ Breakeven Ratio

=3+0.30

=3.3

=3years and 3months

The benefit was determined by subtracting the cost of the developed system to the existing system, while the cumulative benefit was computed by subtracting the initial cumulative benefit.

The breakeven year was determined based on the last negative amount of computed cumulative benefit. Breakeven year was equal to 1 year.

Breakeven ratio was determined by the difference between benefit and cumulative benefit over projected benefit. Breakeven point was computed by adding breakeven year and breakeven ratio and as the result 3.3 was determined as the breakeven point.

Description of the Proposed System

The proposed system will be developed to automate the process being done by the organization in terms of rental and reservation of equipment and event.

The system was designed for the lights and sounds business owners and for the customers who are currently responsible and involved in manual process being done by the organization. The entire system user including the administrator, owners/borrowers and its customer requires log-in, in order to access the following:

The administrator will manage the subscription of their client whom refers as the owner(s). An active admin filled-out the email and password to precede the interface. There is a main menu navigation to view like event calendar and admin: active and deactivated account. It allows owner to add or edit as the admin account. And it will save in tbl_account. Followed by maintenance such as terms and condition: (it will save in tbl_termsadmin), subscription mode of payment: (it will save in tbl_subscriptionmodeofpayment), subscription trial days: (it will save in tbl_subscriptiontrialdays) and subscription monthly payment: (it will save in tbl_submonthlypayment). As well as transaction namely: approval of application and subscription payment.

However, the lights and sounds owners register as a new owner membership to avail the free trial subscription. The user is responsible in adding and updating the maintenance menu navigation including the equipment category- and will save in tbl_eqcategory, equipment- and will save in tbl_equipments, events offered, - and will save in tbl_events, mode of payment- and will save in tbl_lsmodeofpayment, and reservation payment- percentage– it will save in tbl_lsreservationpaymentpercent.

The users are also responsible in approving the client event reservation payment and full payment of their customer(s). After pay for the down-payment of the customer, owner should allow to view the event calendar to view the event schedule of the customer(s). When the event(s) are finished, then owner should

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view the ratings of the customer(s) with the total amount paid. As well as validating the walk-in payment and online payment of the borrower. Updating of the payment of the customer and/or borrower should be done if the payment is incorrect with message details. And it will save in the tbl_payment.

Next, user select release equipment if the equipment has been released or else select return equipment if the equipment has been returned.

Both parties reinforce or reserve equipment vice versa. Owner selects first the schedule in the existing calendar and then select reserve equipment button to view the equipment reservation of the various lights and sounds owner. Equipment reservation can change reservation date not later than the event. The system allows the user to select categories of equipment in order to appear all categories have been selected or simply search the desire equipment(s). The selected equipment(s) needs to view the available items and will then input the number of items to be reserve. After reserving the selected equipment, borrower will pay for the reservation payment or else delete the item. It could possibly update the payment when the screenshot payment is incorrect. After the reservation payment should be done, and then it will be saved in tbl_reserved equipment(s). The available items should be deducted to the remaining item in the equipment menu until the equipment is unavailable, while the number of reserved/borrowed should be count. Moreover, borrower will then view their reservation status.

In the equipment menu will view the generate report for the individual income of the equipment against the purchase price whereas the total income, return of investment or profit should be computed. As well as the generate report for all equipment income of the different owner(s) will search by date registered. All these reports should be printed and should be saving in the selected file location.

The customers create an account and filled out the needed information to access the system. Customer allows the system to view the reserve event menu and will set schedule. Search and select available events in the different lights and sounds provider and then reserve. Reservation payment will automatically have indicator since the event has been reserved. And it will save in the tbl_reserved events. Until the lights and sounds owner is unavailable. Event calendar provide the schedule of the customer and its details. It should be viewed when the reservation of the event has been paid. After the event has done, then customer gave the remaining balance of the event and should allow to rate the lights and sounds rented based on their experience.

Result of Testing

The developers conduct the several testing and it was successfully done, various problems and defects have been recognized and were fixed immediately. Re-testing has been performed after the problems have been solved as to achieve smooth functioning software.

IV. CONCLUSION

Based on the concerns stated in the objectives of the study and results of the evaluation conducted by the researcher, the developed system was feasible in terms of operational, technical and economical. That the different processes involved in the existing were carefully analyze and the developed system will be a great help to the organization in customizing, updating, retrieving rentals of equipment and storing customers information. And that the system was designed and developed in accordance to the compliance of the requirements specification of the user as well as for the organization.

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V. RECOMMENDATIONS

The developers may recommend the full implementation of the developed system for the Marinduque Lights and Sounds group. Developers also recommend a technical resources such as the software and hardware requirement, so that the developed system will function as planned. The operational capability of the hardware requirements should be also monitored so that the features and function will provide reliable information and services to all the user of the developed system.

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