AUTOMATED WATER BILLING SYSTEM WITH SHORT MESSAGE SERVICE NOTIFICATION IN ROXAS, BILAR, BOHOL

College of Technology and Allied Sciences
BOHOL ISLAND STATE UNIVERSITY
Zamora, Bilar, Bohol

MICHAEL S. BASBAS
LADY MAE A. CABANLIT
ALEXANDER M. SARONG JR.

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APPROVAL SHEET

This thesis entitled **"Automated Water Billing System with Short Message Notification in Roxas, Bilar, Bohol"** prepared and submitted by *Michael S. Basbas, Alexander M. Sarong, and Lady Mae Cabanlit* in partial fulfillment of the requirements for the degree Bachelor of Science in Computer Science has been examined and recommended for acceptance and approval for oral defense.

THE THESIS COMMITTEE

ARLEN B. GUDMALIN, PhD
Dean, CTAS

REX VINCENT D. TEJADA
Thesis Adviser

MAE P. BAS, EdD, PhD
Editor

SHEILA G. TABUNO
Chairperson, DCoS

Approved by the Examining Panel during the Oral Examination conducted on May 26, 2022 with rating 1.4.

EXAMINING PANEL

MARIETTA C. MACALOLOT, PhD
Campus Director

ARLEN B. GUDMALIN, PhD
Dean, CTAS

RENANTE S. DIGAMON, PhD
Panel Expert

CECILIA T. GUMANOY
Panel Member

DARREL A. CARDAÑA
Panel Member

Accepted and approved as partial fulfillment of the requirement for the degree Bachelor of Science in Computer Science.

May 26, 2022
Date of Oral Defense

MARIETTA C. MACALOLOT, PhD
Campus Director

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The Researchers

Michael S. Basbas

Lady Mae A. Cabanlit

Alexander M. Sarong Jr.

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ABSTRACT

Barangay Roxas is one of the barangay in Bilar that operates a waterworks that still adopted the manual procedure of recording and retrieving of data processes of the concessionaire's transaction. Through this manual processes, the office encountered different problems such as separate way of recording and storing of concessionaire's data, time consuming, manual reporting, lack of security and storage. Based on the result in problem analysis, the needs of the present system are the following: Barangay Roxas must adopt the system to improve the automated water billing system with short message notification and to identify possible system bugs and errors. Concessionaire's files of barangay Roxas should be stored in electronic databases for speedier retrieving and updating of data. They should have back up files on CD tapes or flash devices to protect data security and loss. There should be an intensive hands-on training for potential users of the barangay Roxas to increase their understanding of the system's capabilities and features conducted by the researchers. SMS notification to notify them every time new bills released. The study aimed to develop a system, which includes the following features: 1. Offline networking mechanism in monitoring and recording of concessionaire's transaction. 2. Create the following modules: a. add new entry, b. manage concessionaires, c. set meter reading, d. job order, e. billing, f. payments, g. reports, 3. Business intelligence technique for decisions support to the barangay Roxas. During the testing and implementation, the researchers used the system and system usability questionnaire for evaluation and instructions for use. Based on the result, the respondents "Agree" on usability of the system. This result also suggest that the system provided high satisfaction among the respondents. Further, this also implies that the respondents agree and verbally rated "excellent" of the capabilities, function, and the ease of use of the system.

Chapter 1

THE PROBLEM AND ITS SCOPE

Rationale

The introduction of computers revolutionized many industries, including office work. By providing various tools to help office staff perform job activities, computers have helped increase their productivity and accuracy. Computers are now an essential part of almost every workplace, with most companies unable to work without them. For offices with massive databases, file storage, and retrieval offer unrivaled benefits over conventional paper file storage (Alo, 2019).

One of the relevant office is the water system office which manage concessionaire's data. It deals with large amounts of data that must be processed such concessionaire's information and billing record. Concessionaires accumulate a substantial amount of paper and records that must be updated, retrieved, computed, and billed. In the water billing system, this task is important. The advancement of technology in record processing has made it possible to manage records in a dynamic and efficient manner.

Despite technological advancements, the barangay Roxas in Bilar, Bohol Water Billing System continues to employ the manual technique. This method is time consuming having to compute billing and convert water consumptions. It gathers volume of physical papers that are to damage and loss. Such method is time consuming.

A computerized water billing system creates a more accurate and dependable record management to facilitate and speed up transactions. The researchers designed an Automated Water Billing System with Short Message Service Notification for Roxas, Bilar, Bohol. This would benefit concessionaires as it will facilitate the collection and processing of water bill payments. Additionally, it improve the effectiveness of the management by providing better method of billing. It will be very helpful to offer concessionaires and users improved services for quick and effective data collection that will benefit both payers and collectors.

Literature Background

These are the facts and information that the research's proponents gathered, which were very helpful in the study's development. Article XIV Section 10 of the Philippine Constitution states that:

> *"Science and technology are essential for national development and progress. The State shall give priority to research and development, invention, innovation, and their utilization; and to science and technology education, training, and services. It shall support indigenous, appropriate, and self-reliant scientific and technological capabilities, and their application to the country's productive systems and national life."*

According to the article, the state should prioritize science and technology adaptation in order to bring more convenience and advantage to people, particularly business people. It is essential that the government supply the most up-to-date technology so that those who work in business may readily adapt to changes and advancements. Automating the manual process of water billing

consumptions must be essentials in Barangay Roxas to adapt the advancement of computers in the present times.

Neumann (2010) states that water billing system is a necessary tool to assist small municipalities, utility providers, bookkeepers, operators, managers, and auditors in unifying their water billing services, in order to provide consistent and accurate billing information to clients and service recipients. It is essentially software that processes data and produces invoices in a given format, facilitating and unifying the billing process.

The first theory is the Principle of Automation, according to Denning and Martell (2007), covered the most efficient computing methods for completing human work. The principle attempts to emphasize that by utilizing technological advancements, and concerned with the discovery of effective computing methods for carrying out human jobs. It assists people in performing manual jobs and converting them to automated ones. The automation was applied in the designed system by automatically calculate and generate results when data is entered.

Another theory is Edgar F. Codd's Relational Database Management System. According to Codd, a database must obey in order to be a true relational database. These rules can be used with a database system that only has relational capabilities for data management. This is a standard method of organizing and accessing data from computers. The hypothesis is based on the idea that the user will update the data using interface tools (Codd, 1970). The aforementioned system has characteristics that can enable the Barangay Roxas Water Billing

System with SMS Notification function correctly, particularly in pulling data from the database to create reports and bills for users.

There are few related papers that were cited as references. These researches were found on the web. Among these significant studies are:

1. Automated Water Billing System of Hinunangan Municipality (Manun-og et al. 2018). The developed system currently implemented in Hinunganan Southern Leyte, Philippines. The system can assign or authorized personnel to register new client. It can display the corresponding payments of the consumer such as application, installation, water consumption, amortization, and other fees. It also generates an automated bill for the consumers. And lastly it provides the generation of a customized report such as income and collectible reports according to a specified period, location and others.

2. An SMS and RFID-Based Notification System of Lipa City Colleges, Lipa City, Batangas, Philippines(2022)**.**One of the worries of the parents is that if their children are really attending or not in the school during their class period. This is one of the challenges that Lipa City Colleges is confronting, since at present, the school has no way of providing the immediate information to the parents if their children are in or out of the school premises in a particular time.Hence, the researcher conducted this system development study which is considered a new technology which helped the school to solve the problem in monitoring the students' whereabouts.

3. Water Billing System with Short Messaging Services Notification (Mark Anthony Marpuri et al. 2012). The developed system currently implemented at the Laguna Water Company of Cabuyao, Laguna, Philippines. The developed system makes more convenient to the consumers and employers to remind them and to inquire their water bills by sending SMS text messages. It also sent the inquiry regarding to water billing consumption in a current month.
4. “Water Billing System with Due Date SMS Notification – (iNetTutor.com”, 2021). The developed system can be able to process bill payments, generate billing reports and issues officials receipt. The system also had a feature that notifies registered consumers about the due date of payments via SMS.
5. Design and Implementation of SMS Based Water Billing System (A Case Study of Bagudo Local Government Water Board, Kebbistate) (Byziya’u Bello 2014). This project work provides a solution called a SMS based water billing system to collect, process and notify consumers about consumption. This system will be reliable, efficient and accurate to suit the requirements of Bagudo local government water board. The proposed solution uses evolving Mobile Technologies known as SMS and vogue pay online payment technologies, over a solution which uses web application to handle the organization’s day to day transactions which will allow the water board to send bills to their consumers via SMS.

THE PROBLEM

Statement of the Problem

The aim of this study was to develop and implement a system that will have available tools needed for the water billing systems.

Specifically, it sought to answer the following questions:

1. What are the processes and operations involved in collecting water bill in barangay Roxas of Bilar?
2. What are the problems encountered in collecting water bill in barangay Roxas of Bilar?
3. What could be the possible solutions for the problems encountered?
4. What is the level of the system acceptability as perceived by the target users?

The system is to be called the Automated Water Billing System and it will integrate the processes involved in barangay Roxas. Automated Water Billing System is developed the following features:

1. Integrate an offline system mechanism to use one centralized server for the barangay Roxas, Bilar;
2. Design and implement and implement following modules:
    a. Acquisition
    b. Billing
    c. Payments
    d. Administration; and

3. Implement business intelligence technique for decision support to the Roxas water billing.

Scope and Delimitation

This study focused on the computerization of the water billing system of water works in Barangay Roxas, Bilar, Bohol. The develop system covered only the following processes:

1. **Centralization.** This facilitates a fully integrated water billing system with modular components and methodology that provides the specific needs and requirements of an automated water billing system.
2. **Acquisition.** This includes the recording of new concessionaire, addition, update of consumer's information and incorporate a simple facility.
3. **Billing.** This includes the computation of concessionaire due amount of payment based on monthly water consumption.
4. **Payments.** It involves the automated computation of customer's payments and charges.
5. **Administration.** It provides an administrative tool for the system maintenance. It also facilitates the management of users, user's privileges, and users' security. It also involves the manipulation of data that enables the administrator to add new user, change user's password, and deactivate user's accounts.
6. **Reports.** The function of this modules is to generate statistical and graphical reporting technique. It will offer customizable reports ready for

printing in tabular and graphical format; generates statistical reports of transactions such as monthly and yearly income reports, monthly and yearly uncollected reports, concessionaires list, monthly and yearly cubic meter consumed and job order report.

Significance of the Study

The study would help barangay Roxas water billing system effectively by automating the manual processes, transactions and providing secure storage for important documents in water billing. Moreover, this study would be beneficial to the following:

Barangay Captain. It could manage all of the system's transactions, such as concessionaire billing information and report monitoring. The proposed system could assist the barangay in supplying water bill information.

Barangay Officials. It would provide daily, monthly, and yearly records that are required for the inventory of water billing in barangay Roxas. The proposed system could make it easier to generate reports for water billing transactions.

Barangay Worker. The barangay worker could easily receive payments without any inconvenience. The proposed system provides up to date bill of the month and can update the remaining balance of the concessionaires.

Concessionaire. The concessionaire would be notified about their monthly billing obligation through SMS notification.

Researchers. For future researchers and developers, this study provides significant contribution in terms of automation of water billing system especially in

large water corporation or company. For the researchers of this study, it will improve their reasoning and analytical skills, as well as broaden their knowledge of designing and system development in preparation for their future career.

RESEARCH METHODOLOGY

Development Framework

Figure 1 below shows the conceptual diagram of the study. It follows the input- process- output principle. The inputs are coming from the barangay officials, plumber and barangay worker. The procedures include documenting new acquisition, concessionaire's interactions, administration, and report generation. The output assists water billing administration in making decisions.

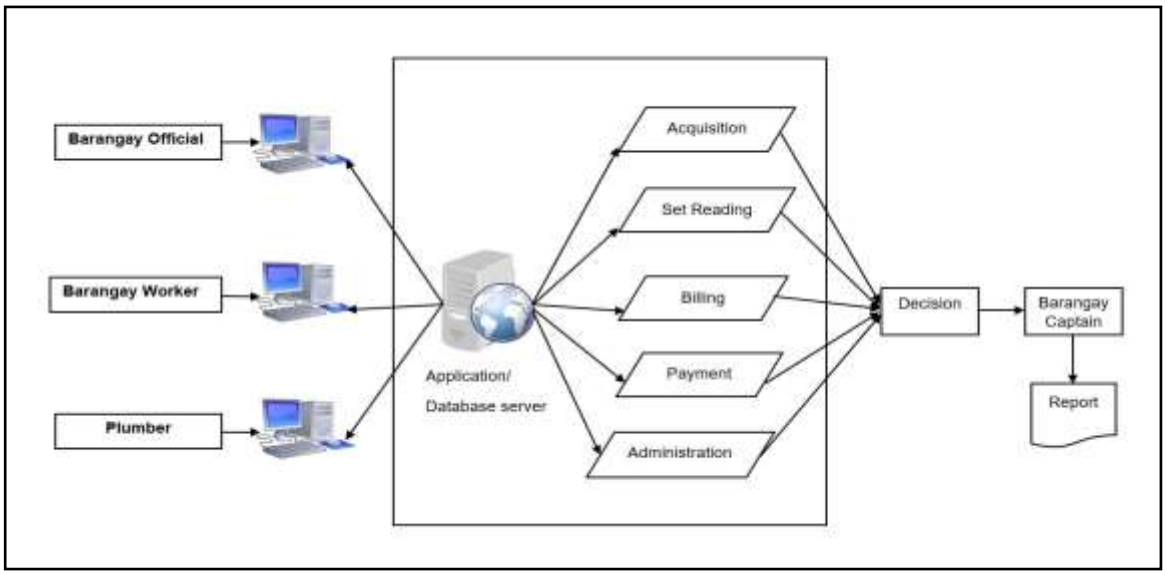


Figure 1. Conceptual Diagram of the Study

Figure 2 below shows the blocks of diagram of the propose water billing system in Barangay Roxas of Bilar. It covers the specification of the basic functionality of the system that represents the work of the barangay officials, barangay worker, plumber and concessionaire. This includes all the transaction like entering new concessionaire, updating and billing processes. The systems also generate reports of the billing, concessionaire's information.

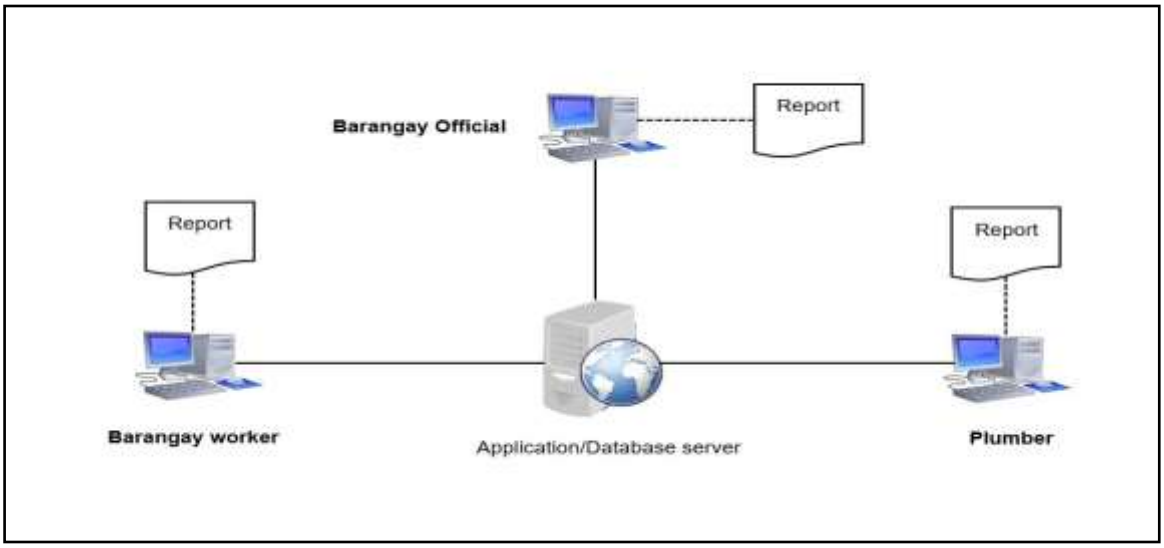


Figure 2. Block Diagram of the Study

Development Model and Approaches

Rapid Application Development (RAD) will be employed, as shown in Figure 3 on the following page. It is a software development methodology that uses techniques such as iterative development and software prototyping. For this project, software prototyping will be used. If the client doesn't know what they want and can't explain it, prototyping is a good way to acquire functional requirements. It is preferable to create a prototype so that users may get a firsthand look at and feel of the current situation. As a result, client will be able to convey their wants and desires considerably more easily.

The barangay Roxas water billing office provided all relevant data for the analysis. The data was compiled into a meaningful explanation of how the data can be used after it has been processed. Then, using the processed data, a design was created, and the software prototype was created. After the software prototype was completed, it was shown to potential clients, and their feedback was used to improve the prototype. The prototype program was developed, demonstrated, and refined several times until the clients were satisfied. Following these repetitions, the final testing and implementation took place.

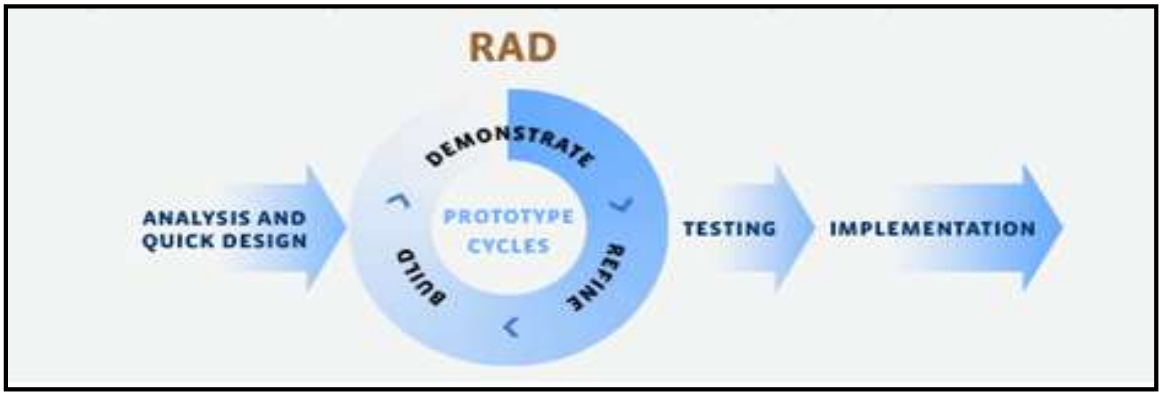


Figure 3. Rapid Application Development (RAD) Diagram

Adopted from Eton Digital, (2012). Rapid Application Development (RAD) from (http://www.etondigital.com/devices/rapid-application-Development)

The following are the tools that will be used in the development of the system:

1. **Windows server 2012 (R2)** — codename “windows server 8.1”, is the seventh version of the windows server operating system by Microsoft, as part of the windows NT family of operating systems. It was used to run the application of Automated Water Billing System.
2. **Visual Studio 2012 (Visual Basic Programming Languages)** — it is the programming language in which the system was developed. It takes part in

the automated water billing system's offline development. It comes with a graphical user interface that lets you drag and drop objects into the software. It is used in software development to make it simple and efficient.

3. **WAMP Server** – An acronym for "Windows Apache MySQL and PHP." It is used to create a database that can store data from the developed system using MySQL.
4. **MySQL Connector/ODBC 5.1** – A computer software from Oracle Corporation. It is used to connect the data from the database to help generate reports from the developed system.
5. **Adobe Photoshop CS 6** - A software program developed by Adobe that allows users to edit graphics. It is used as a tool for enhancing the design for the development of the developed system.
6. **Broadband Stick** – it is used to send short SMS to the consumers for their monthly bills.
7. **Crystal Report** - It is a popular windows-based report writer (report generation program) that allows a programmer to create reports from a variety of data sources with a minimum of written code. It is used in order to generate and view the reports/information from the developed system.

Environment and Participants

The study was conducted at the Roxas, Bilar, Bohol. The respondents of the study are the barangay captain, barangay treasurer, barangay councilors and plumber in the water billing system. A personal interview was conducted to the

barangay treasurer who handled and managed about the process of the water works.

Data Collection

The researchers asked permission from the barangay captain to conduct a study of the water billing system regarding the information, their process, and procedures. The developers gather information by conducting a personal interview, observing concessionaire during the process of payments. The developer also asked who was responsible for keeping and retrieving the records and also in managing the water billing.

There were 10 total respondents composed of 1 barangay Captain, 1 barangay Secretary, 1 barangay Treasurer, 6 barangay councilors and 1 plumber. Table 1 on the below represents the summary or respondents in the system usability.

Table 1

Summary of respondents of the System Usability

Respondents	No of Respondents
Barangay Captain	1
Barangay Secretary	1
Barangay Treasurer	1
Barangay Councilor	6
Plumber	1
Total	**10**

The system usability testing survey with target clients was used to assess functionality. It was carried out in order to determine the system's efficacy. The system usability testing was carried out using a rating system based on the Lewis James R. Questions system usability questionnaire. It determined whether or not the system's functionality satisfied the users. The guide for interpreting system usability outcomes is shown in Table 2.

Table 2

Interpretative Guide of the System Usability

Weight	Range	Description	Interpretation
7	6.4 – 7.0	Strongly Agree	The respondents strongly believe and confident that the system is very usable.
6	5.5 – 6.3	Agree	The respondents believe and confident that the system is usable.
5	4.6 – 5.4	Tend to Agree	The respondents tend to believe that the system is usable.
4	3.7 – 4.5	Neither Agree nor Disagree	The respondents are neutral in trusting that the system is usable.
3	2.8 – 3.6	Tend to Disagree	The respondents tend not to trust that the system is usable.
2	1.9 – 2.7	Disagree	The respondents believe that the system is not usable.
1	1.0 – 1.8	Strongly Disagree	The respondents strongly confident that the system is not usable.

To come up with the average weighted mean of the system usability, the weighted mean score (WMS) was computed to evaluate/ assess the usability of the system as perceived by the respondents using the following formula:

$$WMS = \frac{1f_1 + 2f_2 + 3f_3 + 4f_4 + 5f_5 + 6f_6 + 7f_7}{n}$$

Where:

WMS= Weighted Mean Score

f_1 = frequency of respondents given a rate of 1

f_2 = frequency of respondents given a rate of 2

f_3 = frequency of respondents given a rate of 3

f_4 = frequency of respondents given a rate of 4

f_5 = frequency of respondents given a rate of 5

f_6 = frequency of respondents given a rate of 6

f_7 = frequency of respondents given a rate of 7

n = total number of respondents

1, 2…7 = constant (rating to the service provide)

OPERATIONAL DEFINITION OF TERMS

Acquisition. A process of acquiring or obtaining data from inputs and storing it in the database.

Barangay Officials. Refers the barangay captain of Roxas. He/she is responsible for decision making of reports of the system. He is also responsible for managing all the activities of the water billing system.

Barangay Worker. Refers to the barangay treasurer of Roxas. He/She is responsible for receiving the payment of the concessionaire's bill.

Concessionaire. Refers to the individuals who participates in the water service of the automated water billing system in barangay Roxas, Bilar, Bohol.

Plumber. The chosen barangay councilor of the barangay Roxas, Bilar, Bohol. He is the one who repair and install water pipes for the concessionaires and make water reading for their monthly cubic consumption.

Roxas. A barangay in the municipality of Bilar where the system conducted.

SMS (Short Message Service). Commonly known as texting. It's a way to send text-only messages of up to 160 characters between phones. Its use to send notification to the consumers.

Software. Refers to the applications on a computer that was developed for a certain purpose.

Water billing system. An automated system that was based on paying water bills. It is a computer application that accepts inputs, processes the inputted data, and provide an output from the processed data for water billing transaction.

Chapter 2

PRESENTATION OF FINDINGS, ANALYSIS AND INTERPRETATION OF DATA

Existing Operation and Processes

The barangay water billing system is responsible of the waterworks system's supply to the entire barangay of Roxas, Bilar, Bohol. The Water Billing System in Roxas, Bilar, Bohol is managed by barangay officials.

A. Installation Process

To obtain water services, an applicant need to provide the following materials liked water pipe, water meter, faucet, tapelon and water line /PVC fittings and pay a charge of (70) seventy pesos for installation. No new water service connection can be placed until all of the necessary materials have been gathered. The barangay treasurer will also issue the new concessionaire’s Tax Card after paying the installation fee, and completion of all materials, and the barangay captain will give an order to the barangay officials to have an installation for the new member. The treasurer will enter the new applicant's information into the record book and issue a Tax Card. After recording the new applicant's information, the installation services begin.

B. Meter reader submits meter reading

Every 18th day of the month, a meter reading is usually taken. The meter reader recorded the concessionaire’s meter reading on their Tax card. The meter reader sends the reading to the treasurer to records it in the monthly reading book.

The barangay treasurer will issue a monthly water bill covering the first day after the previous reading until the 18th day of the following month. After reading, the treasurer calculates the concessionaire's monthly water cost by subtracting the current reading from the previous reading and multiply it by 12.

C. Concessionaire pay monthly bill

Payments will be made between the 19th and 31st of the within this month. Water cost with normal water rates will be enforced for residential and communal consumption. A minimum fee of (12) twelve pesos per cubic meter apply. When a concessionaire wants to pay their bill, they should go to the barangay treasurer to check their account for their monthly payment. The concessionaire's record book and Tax card, as well as the privilege of paying the monthly payment will be retrieved by the treasurer and marked as paid. The fees for the water connection utilized by the barangay hall, health center, and day care center are exempted.

D. Process of disconnection

If a concessionaire is unable to pay their payments between the 19th and the 31st day of the within this month, a 10% penalty will be applied to the unpaid monthly water bill until it is fully paid. The barangay secretary will issue a notice of disconnection if a concessionaire has still not paid their bill for three months. If a concessionaire fails to comply within three days of receiving the warning, the barangay officials would disconnect the concessionaire's service. After the

barangay officials have completed the disconnection service, the concessionaire will be disconnected.

E. Process of Reconnection

If a disconnected concessionaire desired to reconnect their water supply, he or she had to pay the reconnection fee of one hundred seventy pesos (170), plus the penalty. If the transaction is completed, the treasurer will create a job order to reconnect the lines.

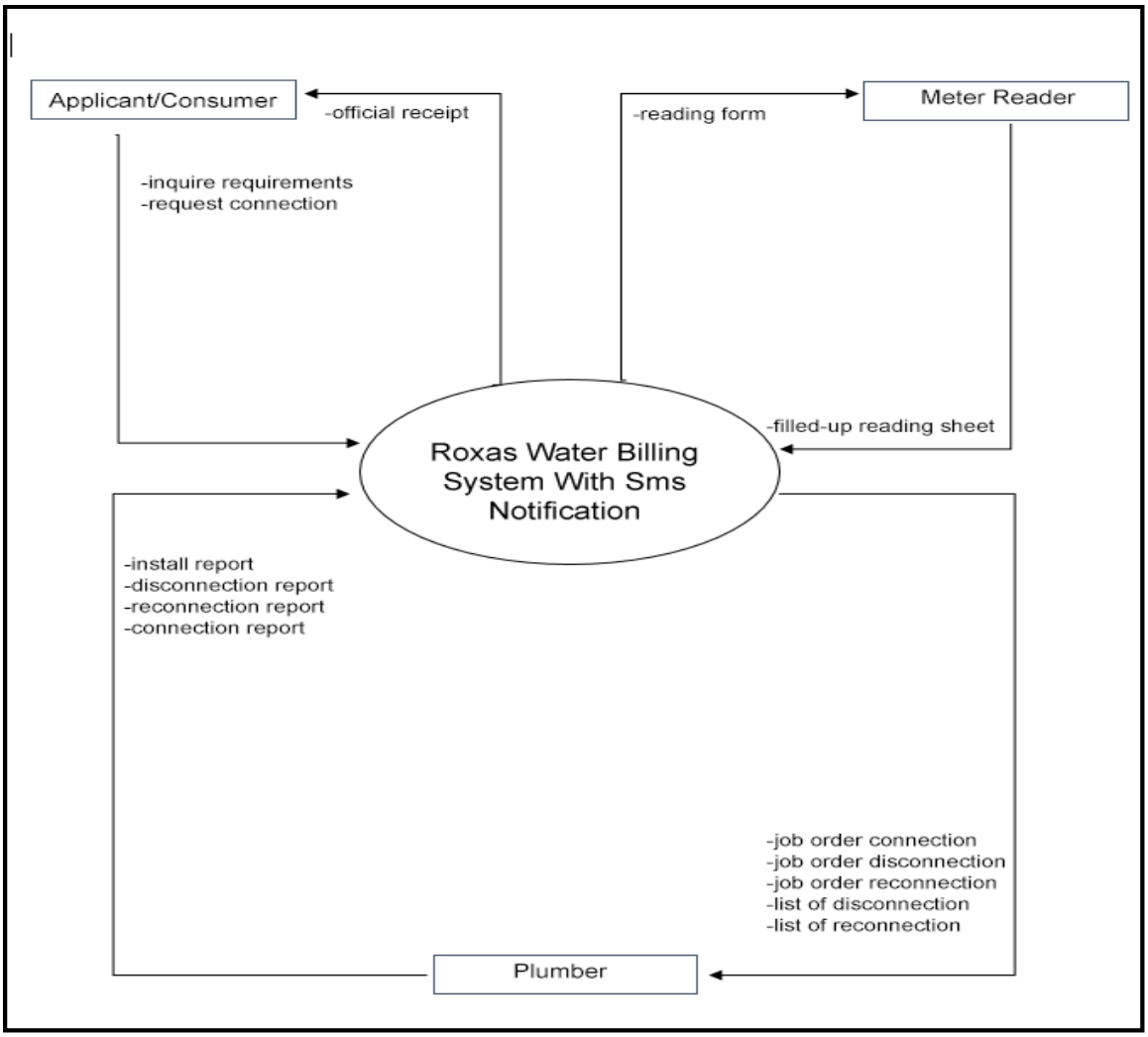


Figure 5. Conceptual diagram of the present system

Event Specifications

Event List of the present system:

1. Installation Process
2. Meter reader submits meter reading
3. Concessionaire pay monthly bill
4. Process of disconnection
5. Process of reconnection

Event diagram of present system

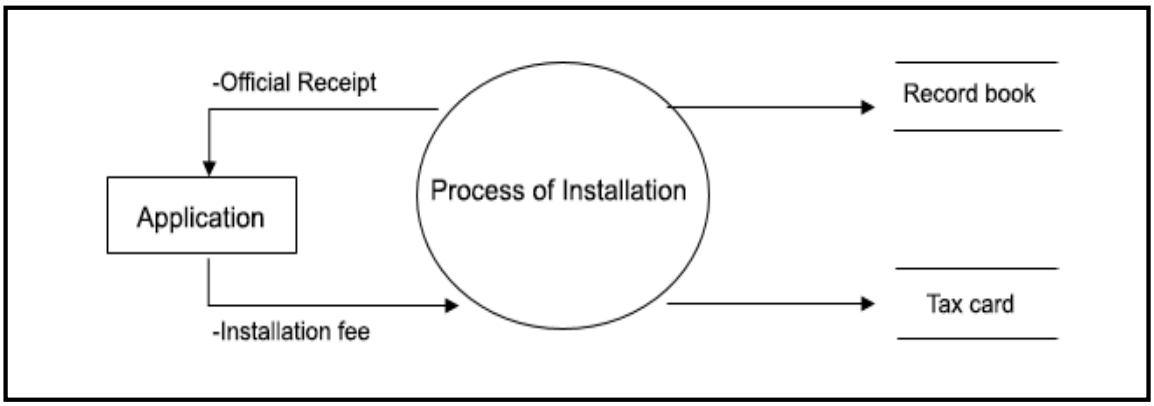


Figure 6. Installation Process (Event 1)

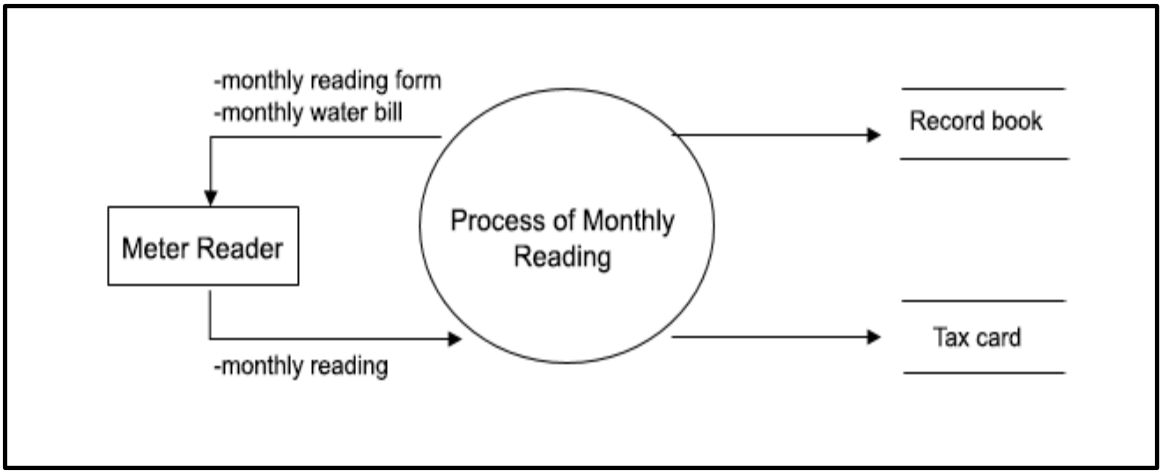


Figure 7. Meter reader submits meter reading (Event 2)

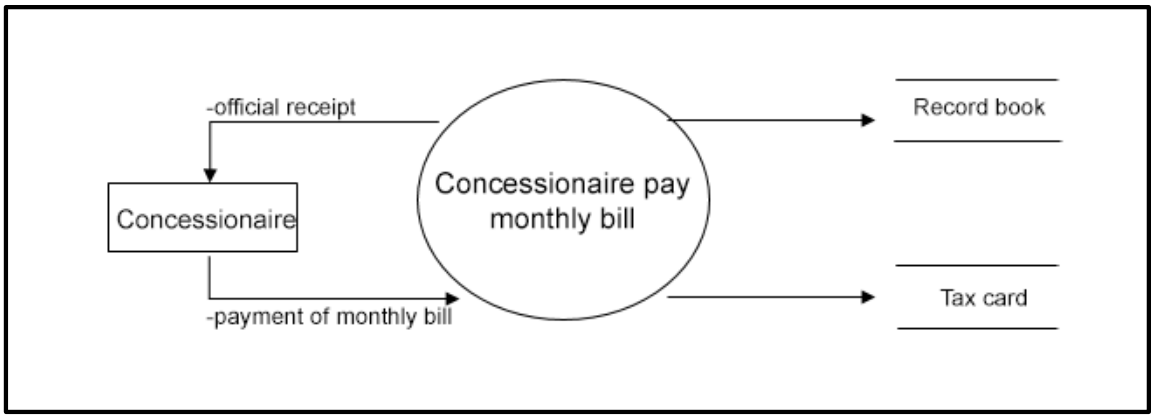


Figure 8. Concessionaire pay monthly bill (Event 3)

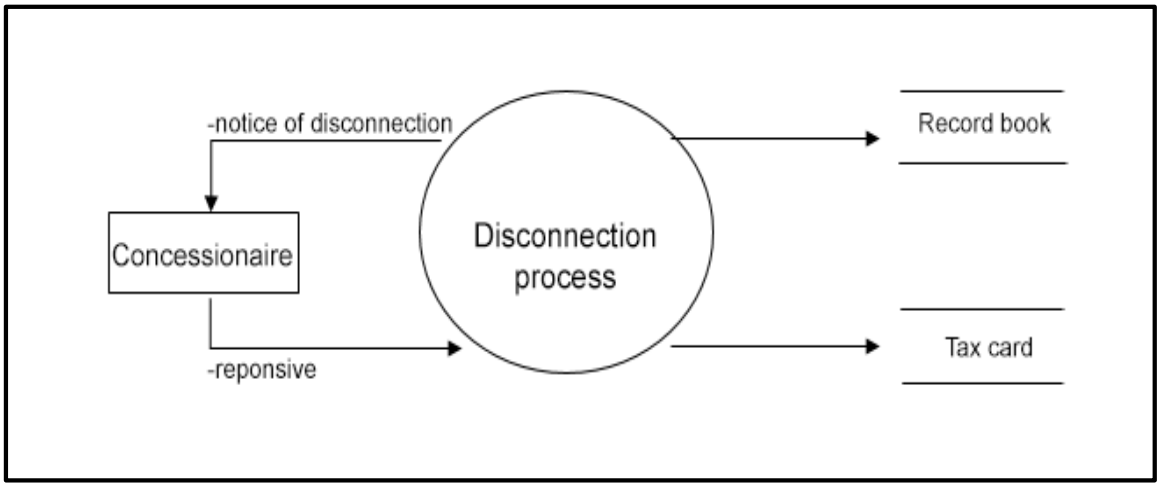


Figure 9. Disconnection Process (Event 4)

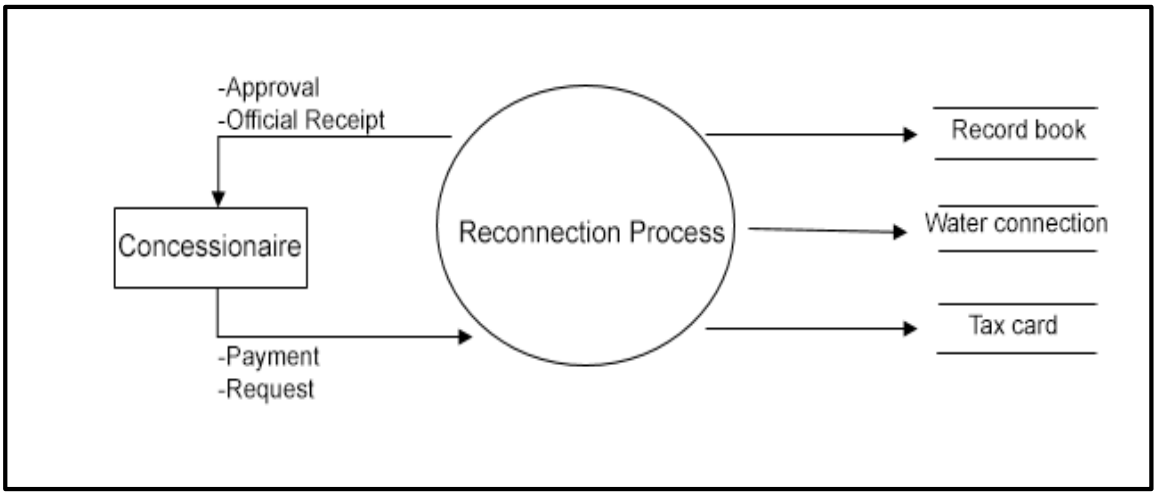


Figure 10. Reconnection Process (Event 5)

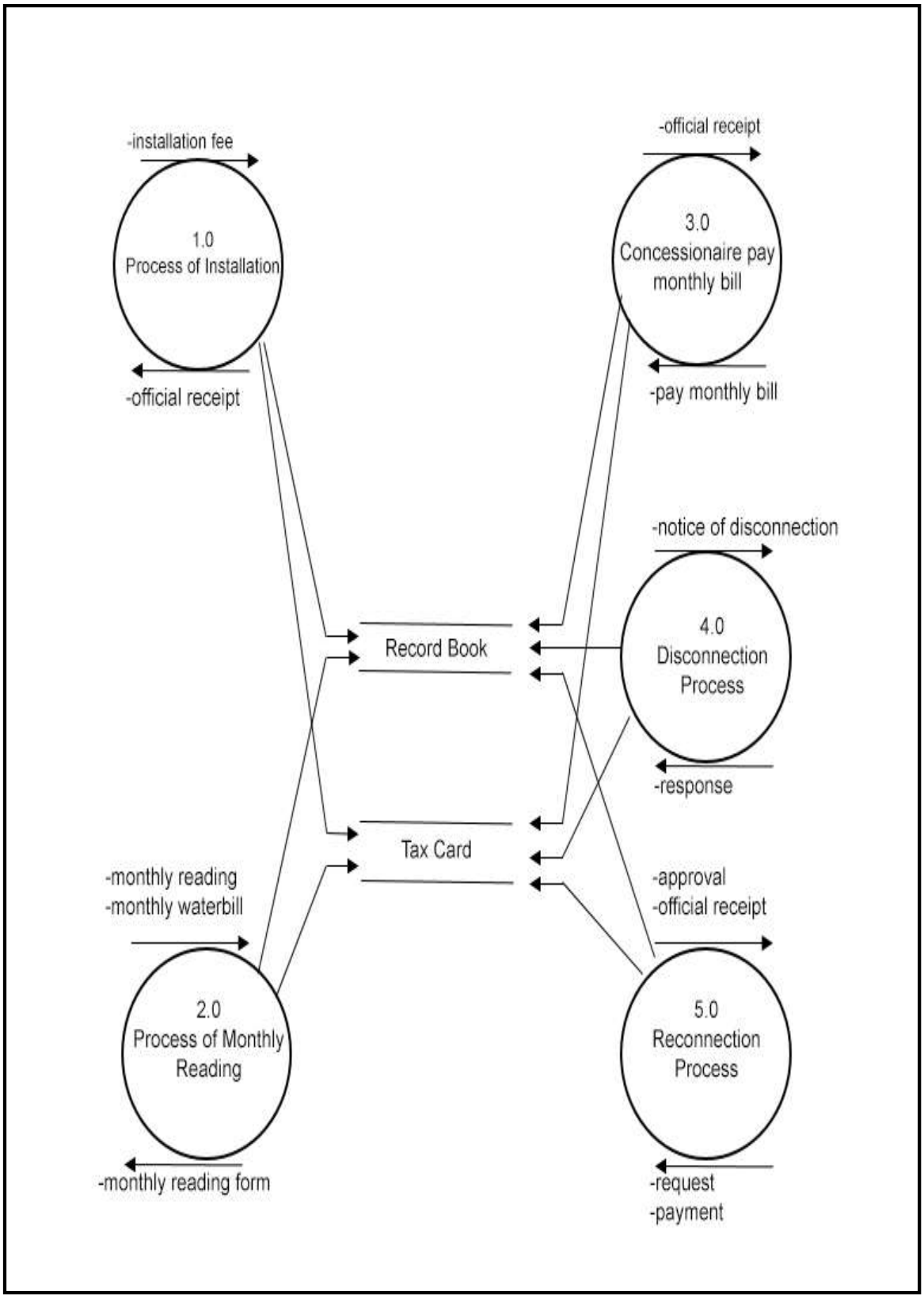


Figure 11. Top level of the present system

Needs for the Present Operational System

The researchers identified the following requirements after studying the current barangay Roxas water billing system. The current system requires automation in order to provide efficient transactions and data processing, more accurate bill computation, faster payment transaction, faster retrieval/storage of data with greater assurance of security. The following are needs of the Automated Water Billing System of Brgy. Roxas, Bilar, Bohol.

1. Fast and accurate computation of water bills.
2. In order to avoid document misplacement, adequate organization and file recording are required.
3. Back up files to flash drives or CD tapes to ensure data security in the event that the system fails.
4. Processing, updating, and retrieving relevant records in a timely manner.
5. Reports that are updated on a regular basis are used to make decisions on what actions to take.
6. SMS notification to notify them every time a new bills released.

Automated Water Billing System with Short Message Service notification

The researchers had gathered all the data and information with regards to the present system and came up with the development of the Automated Water Billing System with SMS notification.

A. Administration

The login system is the initial security module that will identify the authorized user in order to ensure the security of the development system's records and data. To gain access to the system, you must first enter your username and password. The Barangay Captain and Treasurer are the two kinds of users. The barangay Captain can only handle water billing transactions, whereas the Treasurer has access to all of the system's functions.

B. Transaction

It contains the water billing system procedure, which allows the in-charge personnel to keep track of billing transactions, offer a list of concessionaires, and track monthly profit reports.

C. Reports

The treasurer is the only person who may approve reports when they are created. The list of concessionaires, reports of collected bills, a list of uncollected bills, and a monthly profit report are all included in these reports.

Use Case Diagram

A Use Case Diagram is a list of actions or event steps typically defining the interactions between a role (known in the Unified Modeling Language as an actor) and a system to achieve goal.

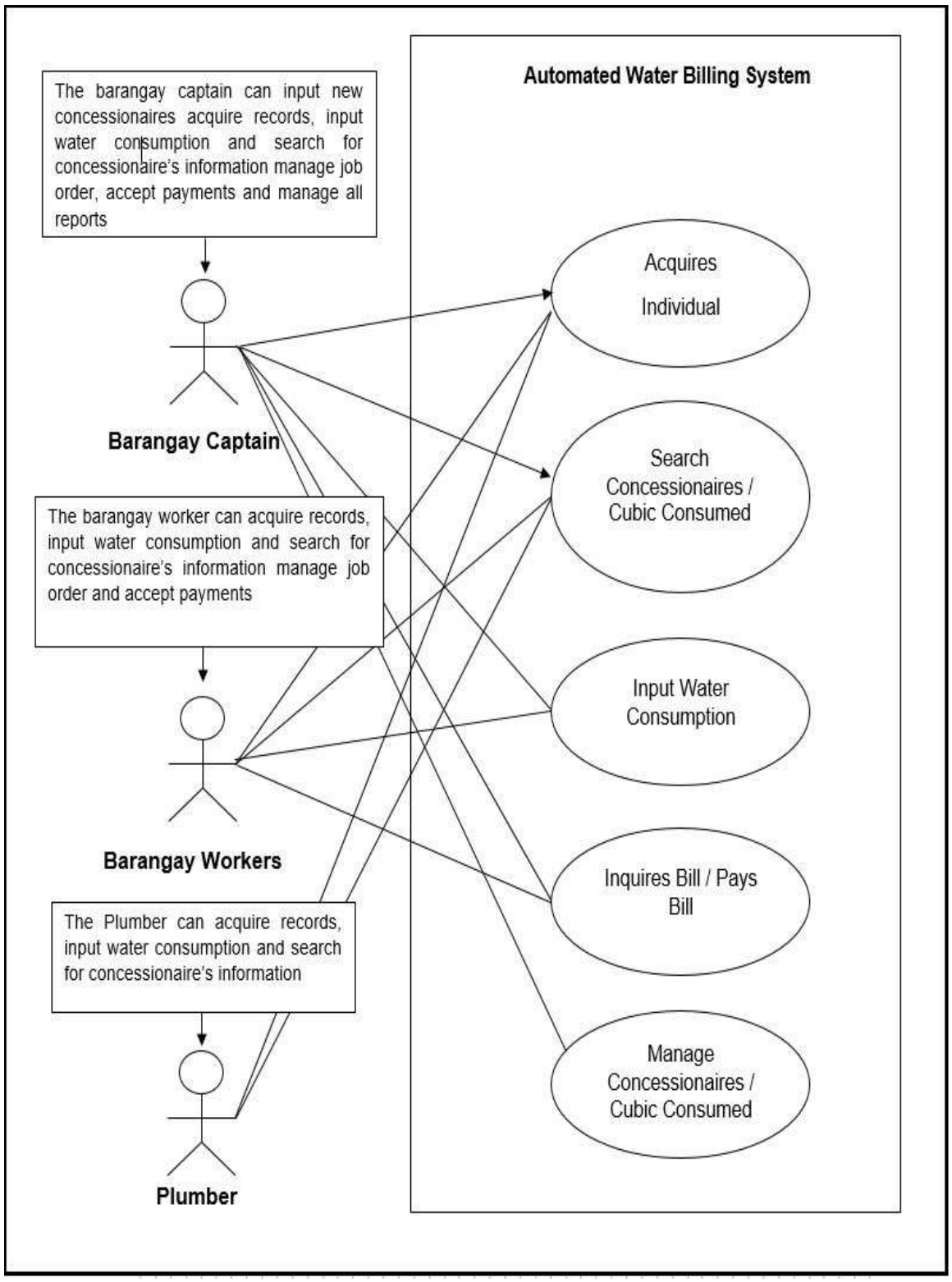


Figure 12. Use Case Diagram

Use Case Narrative

Use case narrative is a textual description of the business event and how the user will interact with the system to accomplish the task.

Use Case 1. Narrative – Acquires Record

Acquires Record (UC1)	
Scope	Automated Water Billing System with Short Message Service Notification in Roxas, Bilar, Bohol.
Level	User Goal
Goal in Context	Present a menu from which one can access concessionaire and add, update concessionaire information.
Primary Actors	Barangay official
Stakeholders	Barangay official: Wants to add concessionaire and update none
Preconditions	Barangay Official select Concessionaire on the tab menu and choose add new concessionaire.
Triggers	The system will save the concessionaire information and changes.
Success Guarantee	
Main Success Scenario:	
	Automated Water Billing System with Short Message Service Notification: Present a Concessionaire tab. Barangay Official: Select then add new concessionaire button then fill up the information asked. Selects the Save option.

Use Case 2. Narrative – Set Reading

Set Reading (UC2)	
Scope	Automated Water Billing System with Short Message Service Notification in Roxas, Bilar, Bohol.
Level	User Goal
Goal in Context	Present a menu from which one can access Set reading
Primary Actors	Plumber
Stakeholders	Plumber: Wants to enter and search concessionaire.
Preconditions	None
Triggers	Plumber select Set reading search concessionaire.
Success Guarantee	The system will save the changes
Main Success Scenario:	
	Automated Water Billing System: present a Concessionaire tab. Plumber: enter set reading tab and input.

Use Case 2. Narrative – Search Concessionaire

Search Concessionaire (UC2)	
Scope	Automated Water Billing System with Short Message Service Notification in Roxas, Bilar, Bohol.
Level	User Goal
Goal in Context	Present a menu from which one can access concessionaire and Manage concessionaire.
Primary Actors	Barangay official and worker
Stakeholders	Barangay official/worker: Wants to enter and manage search concessionaire.
Preconditions	None
Triggers	Barangay official/worker select concessionaire tab in the menu and click manage concessionaire and search concessionaire.
Success Guarantee	The system will save the changes
Main Success Scenario:	
	Automated Water Billing System: present a Concessionaire tab. Barangay official/worker: enter manage concessionaire and search concessionaire.

Use Case 3. Narrative – Billing/payment

Billing/Payment (UC3)	
Scope	Automated Water Billing System with Short Message Service Notification in Roxas, Bilar, Bohol.
Level	User Goal
Goal in Context	Present a menu from which one can access billing and view the concessionaires billing information.
Primary Actors	Barangay official and worker
Stakeholders	Barangay Official/worker: Wants to enter and manage the billing.
Preconditions	None
Triggers	Barangay officials/worker select Billing Tab in their menu and choose what concessionaire they want to view and process.
Success Guarantee	The system save and update the data .
Scenarios:	
	Automated Water Billing System: Present a Billing tab in menu. Barangay Official/worker: Selects the Billing Tab then search for concessionaire and save for the update.

Use Case 4. Narrative – Manage

Manage (UC4)	
Scope	Automated Water Billing System with Short Message Service Notification in Roxas, Bilar, Bohol.
Level	User Goal
Goal in Context	Present a menu from which one can access all the tabs.
Primary Actors	Barangay official
Stakeholders	Barangay official: Wants to enter and manage all the features.
Preconditions	None
Success Guarantee	Officials produce reports
Scenarios:	
	Automated Water Billing System with Short Message Service Notification: present a Report tab Barangay official: enter the menu and load to generate report.

Database Design

Database design is the process of creating a database's data model. This data model comprises all of the necessary logical and physical design options, as well as physical storage parameters, to develop a design in a data definition language, which may then be used to establish a database.

System design is a component of system development that acts as the foundation for the system and improves the water billing system in Roxas, Bilar, and Bohol.

Enhancements were implemented to improve the database management of human resources in order to meet the needs of the concessionaires. The goal of this design is to simply create a solution to a problem and assist end users in quick record retrieval and saving time in producing reports that are required by the system.

Class Diagram

A class diagram models the static structure of a system. It shows relationships between classes, objects, attributes, and operations.

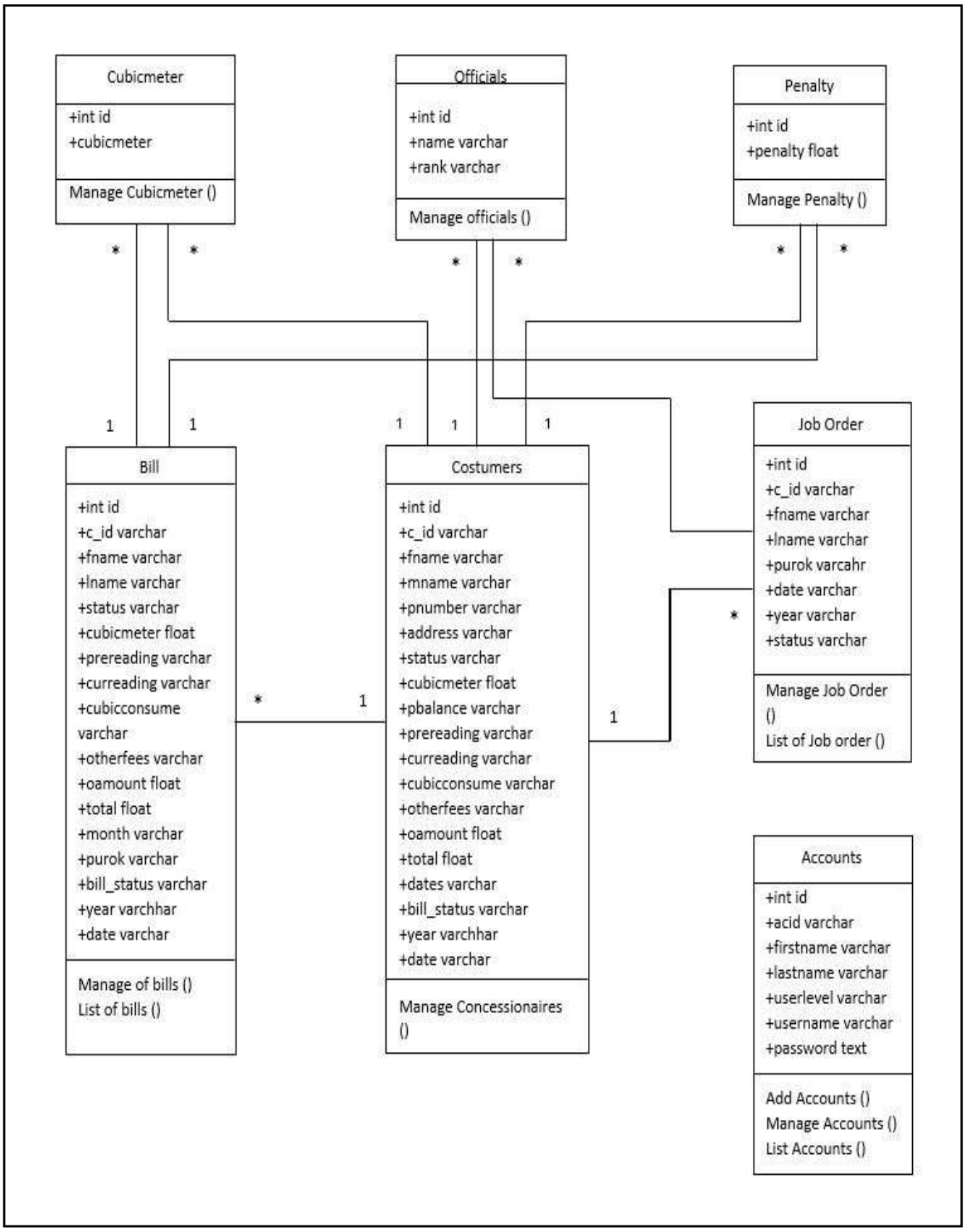


Figure 13. Class Diagram

Data Structure

The following database tables were used in storing the information inputted in the system together with the collection of operations that facilitate billing.

Table 2

Data Structure for System security and login

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	int	6	Primary key
2	username	Varchar	30	User type name
3	password	Varchar	30	User Password
4	Rank	Varchar	30	Rank
5	Date	Varchar	30	Date
6	Tin	Varchar	30	Time in
7	tout	Varchar	30	Time out

Table 3

Data Structure for account

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	Int	6	Primary Key
2	accid	Varchar	30	Account Id
3	firstname	Varchar	30	First Name
4	lastname	Varchar	30	Last Name
5	userlevel	Varchar	30	User Level
6	username	Varchar	30	User Name
7	password	Varchar	30	Password

Table 4

Data Structure for the Recording of the Purok Concessionaire’s

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	int	6	Primary Key
2	barangay	int	6	Purok

Table 5

Data Structure for Keeping the Records of the bill Concessionaire's

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	Int	6	Id
2	c_id	Varchar	15	Consumer's Name
3	fname	Varchar	30	First name
4	lname	Varchar	30	Last name
5	status	Varchar	6	Status
6	cubicmeter	Varchar	6	Cubic meter
7	preading	Varchar	6	Present reading
8	curreading	Varchar	6	Current reading
9	cubicconsume	Varchar	6	Cubic consume
10	total	float	.	Total
11	month	Varchar	15	Month
12	purok	Varchar	20	Purok
13	year	Varchar	20	Year
14	bill_status	Varchar	15	Billing Status

Table 6

Data Structure for the Cubic Meter

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	Int	6	Id
2	cubicmeter	Varchar	6	Cubic meter

Table 7

Data Structure for the job order

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	int	6	Primary Key
2	c_id	Varchar	15	Consumer's id
3	fname	Varchar	15	First name
4	lname	Varchar	15	Last name
5	purok	Varchar	6	Purok
6	date	Varchar	15	Date

Table 8

Data Structure for customers

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	Int	6	Primary Key
2	c_id	Varchar	20	Consumer's id
3	fname	Varchar	30	First name
4	lname	Varchar	30	Last name
5	mname	Varchar	11	Middle name
6	pnumber	Varchar	30	Phone number
7	address	Varchar	30	Address
8	status	Varchar	15	Status
9	cubicmeter	Varchar	6	Cubic meter
10	pbalance	Varchar	6	Previous Balance
11	prereading	Varchar	6	Present reading
12	curreading	Varchar	6	Current reading
13	cubicconsume	Varchar	6	Cubic consume
14	total	float		Total
15	dates	Varchar	15	Dates
16	bill_status	Varchar	25	Billing status
17	year	Varchar	30	Year

Table 9

Data Structure for penalty

FIELD	FIELD NAME	TYPE	WIDTH	DESCRIPTION
1	Id	int	6	Primary Key
2	penalty	float		Penalty

Program Hierarchy

The diagram on the next page is a simple hierarchy chart, showing the establishment's functions and activities of the system. It is described as a visual representation of a system of hierarchy and can also be referred to as a structure chart. Roles, ranks, or positions are clearly laid out in an illustrated format that

depicts the relationship between the elements. The top of the chart is generally reserved for the most important or significant part of the system of hierarchy.

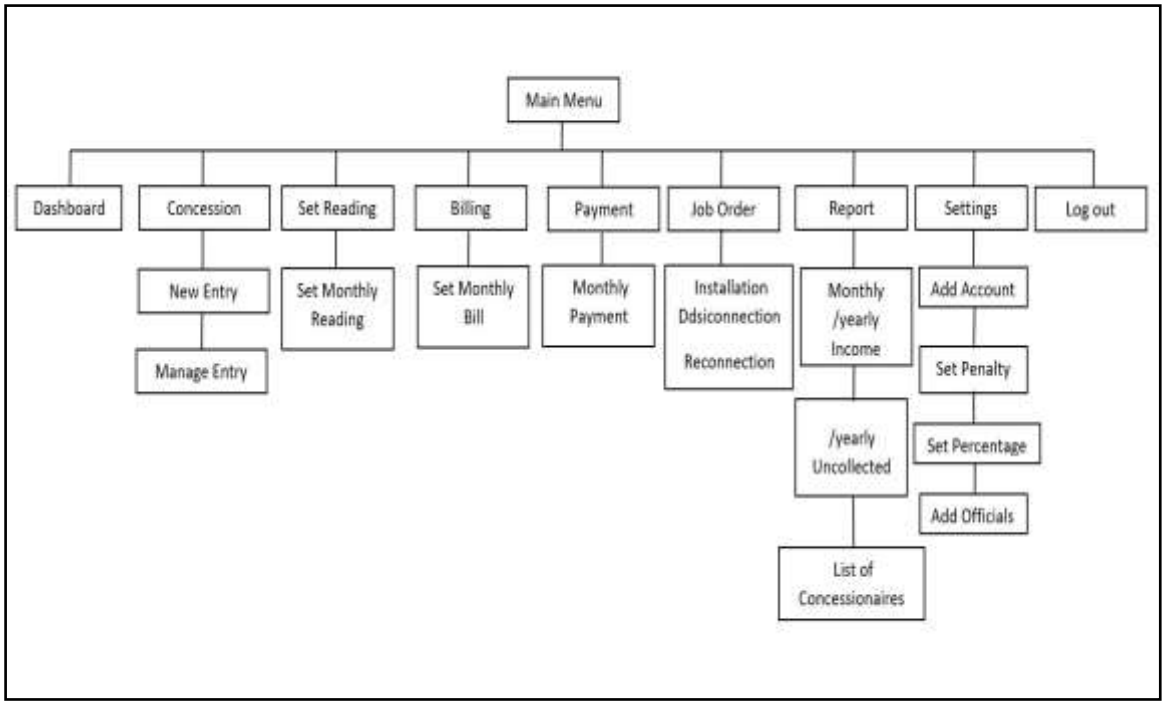


Figure 14. Program Hierarchy

Functional Requirements

The functional requirements were developed using the prototype in order to elicit capture requirements through contrasts communication with Barangay Officials, Barangay Workers, and all inhabitants of Barangay Roxas. The following functionalities are based on current standards for an automated water billing system with short messaging service in Roxas, Bilar, Bohol, with residents' permission and coordination:

Access to the system

FREQ 1: Password protection is required for system access.

FREQ 2: All data and information should be kept in a secure environment with only authorized people having access.

FREQ 3: The officer-in-charge should be able to manage the files using the system.

FREQ 4: The system should be accessible to the collecting officer.

FREQ 5: The officer-in-charge should be able to verify and amend the concessionaire's file using the system.

Inquire Reports

FREQ 6: The officer-in-charge should be able to verify and amend the concessionaire's file using the system.

Process fees/bill

FREQ 7: The system should keep track of penalties and concessionaire payments.

Non- Functional Requirements

A non-functional requirement is one that sets criteria that can be used to evaluate a system's functioning rather than specific behaviors. Functional requirements, on the other hand, specify precise behaviors or functions. The system must have protection from unauthorized users by using a username and password.

1. The system should run on existing technology, such as the company's windows.
2. The system must be accessible at all times.
3. The system should run with the hardware requirements.

Test Cases

A test case is a set of conditions or variables under which a tester will determine whether an application or software system is working correctly or not, a detailed procedure that fully test a feature or an aspect of a feature. It is also a set of input values, execution preconditions, expected results and executions, developed for a particular objective or test conditions, such as to exercise a particular program path or to verify compliance with specific requirement.

These are the test case scenarios conducted during the acceptance testing. The test plan is to let the users use the system and allow the instructions in each test case to test the developed system. The system should perform the expected result in each test case in order to be considered successful.

The following are the details of each test case:

User Account Login

Test Case 1

Module: Barangay Official account

Instructions:

1. Input user account
2. On the login form, choose your “rank” in the combo box, then click “Barangay Official”. Then click “Login” button.

Expected result:

1. User can access all the modules of the system.
2. Clean-up. Click the “Log Out” button to close the module.

Test Case 2

Module: Barangay Worker account

Instructions:

1. Input user account
2. On the login form, choose your “rank” in the combo box, then click “Barangay Worker”. Then click “Login” button.

Expected result:

1. User can access all the modules except the report module of the system.

2. Clean-up Click “Log Out” to close module.

Test Case 3

Module: Plumber account

Instructions:

1. Input user account
2. On the login form, choose your “rank” in the combo box, then click “Plumber”. Then click “Login” button.

Expected result:

1. User can access only the meter reading modules of the system.
2. Clean-up. Click the “Log Out” button to close the module.

Adding Concessionaire

Test Case 1

Module: Adding new Concessionaire

Instructions:

1. On the main menu, Click “Concessionaire”. Then Click “Add new Concessionaire".
2. Input detailed customer’s information
3. Click “Save” button.

Expected result:

1. Inputted information should be successfully save.

2. The newly added concessionaire information should be displayed on the data grid and added to the dashboard as “Pending”.

Managing Concessionaire

Test Case 1

Module: Activation

Instructions:

1. On the main menu, Click “Concessionaire”. Then Click “Manage Concessionaire”.
2. On the search box, type the corresponding family name of the concessionaire to search. Then double click the concessionaire info.
3. Click “Activate” button.

Expected result:

1. The concessionaire information update to “activate”
2. The new concessionaire is activated and it will be added to the “Active” on the dashboard.

Test Case 2

Module: Termination

Instructions:

1. On the main menu, Click “Concessionaire”. Then Click “Manage Concessionaire”.

2. On the search box, type the corresponding family name of the concessionaire to search. Then double click the concessionaire info.
3. Click “Terminate” button.

Expected result:

1. The concessionaire information update to “Terminate”
2. A concessionaire is terminated and it will be added to the “Terminate” on the dashboard.

Setting Reading

Test Case 1

Module: Meter Reading

Instructions:

1. On the main menu, click “Set Reading”.
2. Double Click the concessionaire’s information then input value on the textbox “New Reading”.
3. Click “Set Reading”.

Expected result:

1. The system send a “short message service” to the concessionaire for the new bill of the month.
2. The new reading should successfully save in the database.

Billing Process

Test Case 1

Module: Calculation

Instructions:

1. On the main menu, Click “Billing”.
2. Type the name of a concessionaire on the search box. Then double click the name.
3. Input value on “Cash Rendered” then click “Calculate”.
4. Click “Save”. Then “Generate Receipt”.

Expected result:

1. The system send a “short message service” to the concessionaire informing the paying of their bill.
2. Data should save successfully in the database.

Payment Process

Test Case 1

Module: Calculation

Instructions:

5. On the main menu, Click “Payment”.
6. Type the name of a concessionaire on the search box. Then double click the name.

7. Input value on “Cash Rendered” then click “Calculate”.
8. Click “Save”. Then “Generate Receipt”.

Expected result:

3. The system send a “short message service” to the concessionaire informing the concessionaires that they successfully pay their obligation.
4. Data should save successfully in the database.

Job Order

Test Case 1

Module: Installation

Instructions:

1. On the main menu, click “Job Order” Then choose “Installation”.
2. Click “Choose consumer” then double click consumer’s information.
3. Click “Save” button then “Generate Report”.

Expected result:

1. The new concessionaire information should display in the data grid as already installed.
2. The information should successfully save in the database.

Test Case 2

Module: Disconnection.

Instructions:

1. On the main menu, click “Job Order” Then choose “Disconnection”.
2. Click “Choose consumer” then double click consumer’s information.
3. Click “Save” button then “Generate Report”.

Expected result:

3. The new concessionaire information should display in the data grid as Disconnected.
4. The information should successfully save in the database.

Test Case 3

Module: Reconnection.

Instructions:

1. On the main menu, click “Job Order” Then choose “Reconnection”.
2. Click “Choose consumer” then double click consumer’s information.
3. Click “Save” button then “Generate Report”.

Expected result:

1. The new concessionaire information should display in the data grid as Re-connect.
2. The information should successfully save in the database.

Reporting

Test Case 1

Module: List of Concessionaires.

Instructions:

1. On the main menu, click “Report” Then choose “Concessionaire’s list”.
2. Then Click “Load” then “Generate Report”.

Expected result:

1. The system generate a graphical report and the list of active concessionaires.

Test Case 2

Module: Income report.

Instructions:

1. On the main menu, click “Report” Then choose “Income Report”.
2. Then choose “monthly” or “Yearly”.
3. Select what year and month.
4. Press Enter to load data then Press F1 to generate report.

Expected result:

1. The system generate a graphical report of the total amount of income of the month.

2. The system generate a graphical report of the total amount of income of the year.

Test Case 3

Module: Meter Consumed Report.

Instructions:

1. On the main menu, click “Report” Then choose “Meter Consumed Report”.
2. Under “Concessionaire’s Cubic Meter Consume Report”, Click “Choose Concessionaire”. Double click concessionaire’s info. Then choose what year. Click “Generate Report”.
3. Under “ Cubic Meter Consumed Report, select coverage “Month”, “Monthly” or “Yearly”.
4. Click “Load” then “Generate Report”.

Expected result:

1. The system generate a graphical report of the total amount of cubic meter consumed of the month.
2. The system generate a graphical report of the total amount of cubic meter consumed of the year.

Test Case 4

Module: Uncollected report.

Instructions:

5. On the main menu, click “Report” Then choose “Uncollected Report”.
6. Then choose “monthly” or “Yearly”.
7. Select what year and month.
8. Press Enter to load data then Press F1 to generate report.

Expected result:

3. The system generate a graphical report of the total amount of uncollected of the month.
4. The system generate a graphical report of the total amount of uncollected of the year.

Settings

Test Case 1

Module: Adding new user account.

Instructions:

1. On the main menu, click “Setting”
2. Under “Add user account”, sign up for new account and select for “user level” then click “Save”.
3. When updating and removing account click the user account info. Then click “update” or “delete”.

Expected result:

1. The input data should successfully save in the database.

Test Case 2

Module: Setting Cubic Meter.

Instructions:

1. On the main menu, click “Setting”
2. Under “Set Cubic per Meter”, double click the datagridview to update the cubic per meter.
3. Type a new value for “cubic meter” then click “update”.

Expected result:

2. The cubic per meter should successfully updated in the database.

Test Case 3

Module: Setting Penalty.

Instructions:

1. On the main menu, click “Setting”
2. Under “Set Penalty”, double click the datagridview to update the Penalty rate.
3. Type a new value for “penalty rate” then click “update”.

Expected result:

3. The penalty rate should successfully updated in the database.

Technical Requirements

The procedure requires careful selection of technology, software, and people. The components must be properly identified in order for the system to function properly. To verify that the system is relevant and effective, it must be implemented.

The physical aspect of the computer system is the hardware component. It consists of the following components: microprocessor, hard disk drive, and Random Access Memory (RAM). These components work together to process data quickly and accurately while also providing storage capacity.

Software is nothing more than a set of instructions for the machine to follow. Software is a type of algorithm that is converted into a set of computer instructions. Users would find this to be truthful, effective, and comprehensible.

The user who would run the computer system was referred to as "People ware." Users should be able to operate the system in order to decide the development and expressions; this will give them an idea of whether or not they want to proceed with the computerizations.

The following specifications were required for the implementation of the Automated Water billing System with Short Message Service Notification in Roxas, Bilar, Bohol.

Minimum Hardware Specification

This section details the system's minimal hardware requirements in order for it to perform as intended. These criteria were based on what was available on the market and what the majority of computer package system offices used.

Components	Specification
Microprocessor	Intel Pentium 2.40 GHz
Hard Disk Drive	500 Gigabytes
Random Access Memory	4 Gigabytes

Minimum Software Specification

Item	Specification
Operating System	Runs in Windows 7

To work successfully, the Automated Water Billing System with Short Message Service Notification needs a variety of applications. This program is given below, along with the specs of the computer equipment that were used to construct the system.

Economic Performance Evaluation

The economic performance of the Automated Water Billing System with Short Message Service Notification was evaluated in terms of the initial investment. The initial investment is the amount required by the client before the system can begin to operate and be implemented.

The amount of time it takes for the new system to create enough cost savings to cover its development and expenses is determined in the presentation of the economic performance evaluation. Thus, it could give them to idea of whether they would proceed with the computerization or not.

Table 11
Initial Investment and Annual Operating cost

Items	Qty.	Unit	Unit Price	Total Amount
A. Initial Investment				
A. 1. Hardware				
Desktop Computer	3	set	₱ 20,000.00	₱ 60,000.00
Printer	1		₱ 8,000.00	₱ 8,000.00
Broadband Stick	1		₱ 500.00	₱ 500.00
Router	1		₱ 1,000.00	₱ 1,000.00
Subtotal Annual Operating Cost				₱ 69,500.00
A. 2. Software				
Software			₱ 16,000.00	₱ 16,000.00
Software Development			₱ 3,000.00	₱ 3,000.00
System Installation			₱ 1,000.00	₱ 1,000.00
Subtotal Initial Investment Cost				₱ 20,000.00
Total Initial Investment Cost				₱ 89,500.00
B. Annual Operating Cost				
B. 1. Office Supplies				
Bond paper	2	Reams	₱ 400.00	₱ 400.00
Folder	12		₱ 15.00	₱ 180.00
Fastener	12		₱ 2.00	₱ 24.00

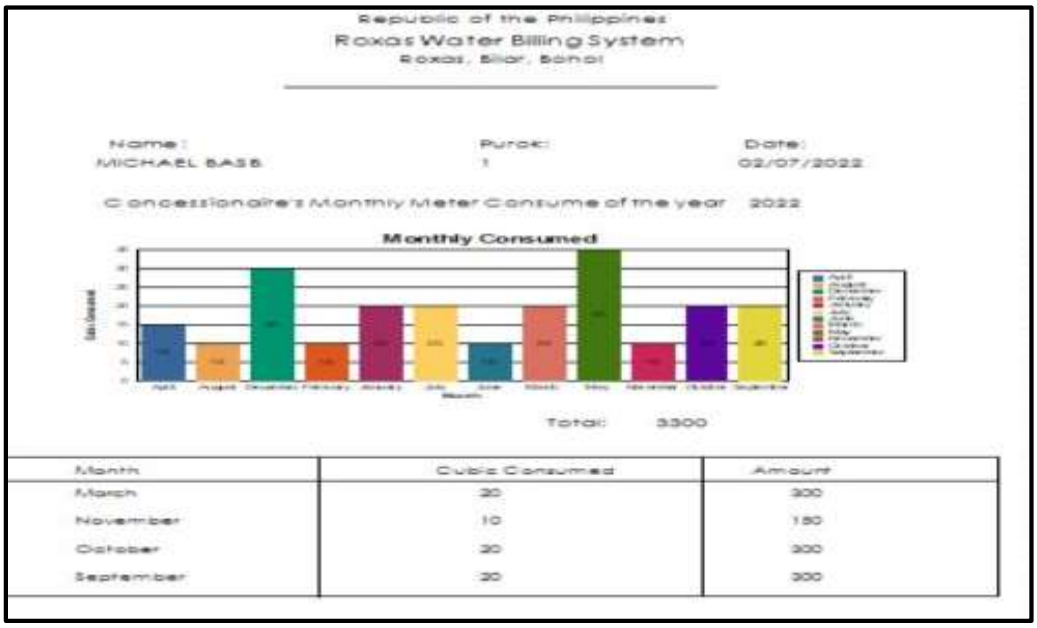
			Subtotal Initial Investment Cost	₱ 604.00
C. Utilities				
Electricity	12	Months	₱ 1,000.00	₱ 12,000.00
Load	12	Months	₱ 1,000.00	₱ 12,000.00
			Subtotal Initial Investment Cost	₱ 24,000.00
System Maintenance	4	quarters	₱ 3,000.00	₱ 12,000.00
D. General Devices				
			Subtotal Initial Investment Cost	₱ 12,000.00
			Total Initial Investment Cost	₱ 36,640.00
			Grand Total	₱126,140.00

Business Intelligence Integration

Business intelligence, according to existent theories, refers to an organization's ability to gather, maintain, and organize information. Its goal is to enable improved business practices and decision making with solutions that incorporate business intelligence reporting. Business intelligence was integrated into the system, particularly in the query and reporting components. All of the reports below are dynamic and will update in real time if the users perform any transactions. Each report is generated by joining more than one table in connecting of database. This ensures that the data in the report is accurate and consistent

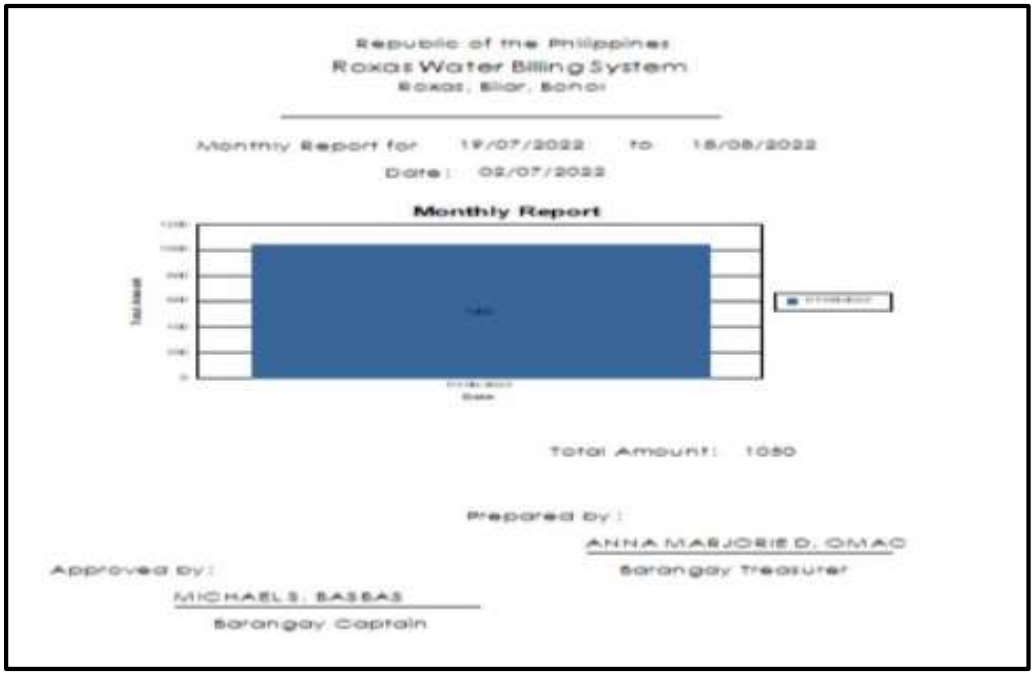
There are graphical reports created as required output of the system. This include the following: Consumer’s Monthly Meter Consumer, Yearly Installation Report, Yearly Reconnection Report, Yearly Disconnection Report and the Monthly Reading Report.

Preview 1 shows the monthly meter consume of a specified consumer in order them to compare of what month they consume water the most.



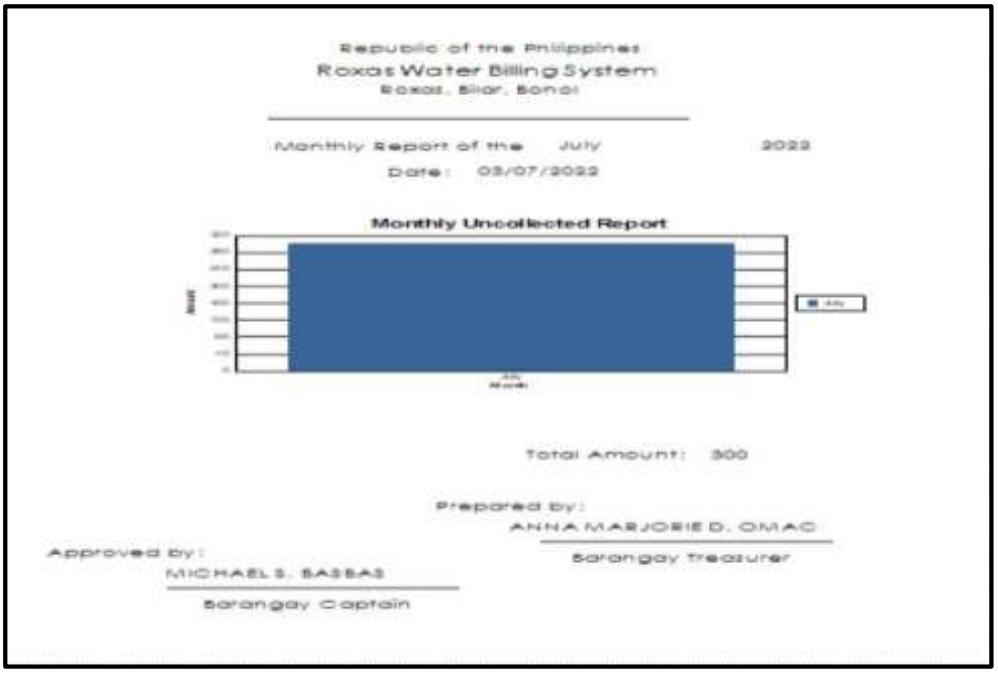
Preview 1. Monthly Meter Consume

Preview 2 is the graphical representation of collected income report of a month.



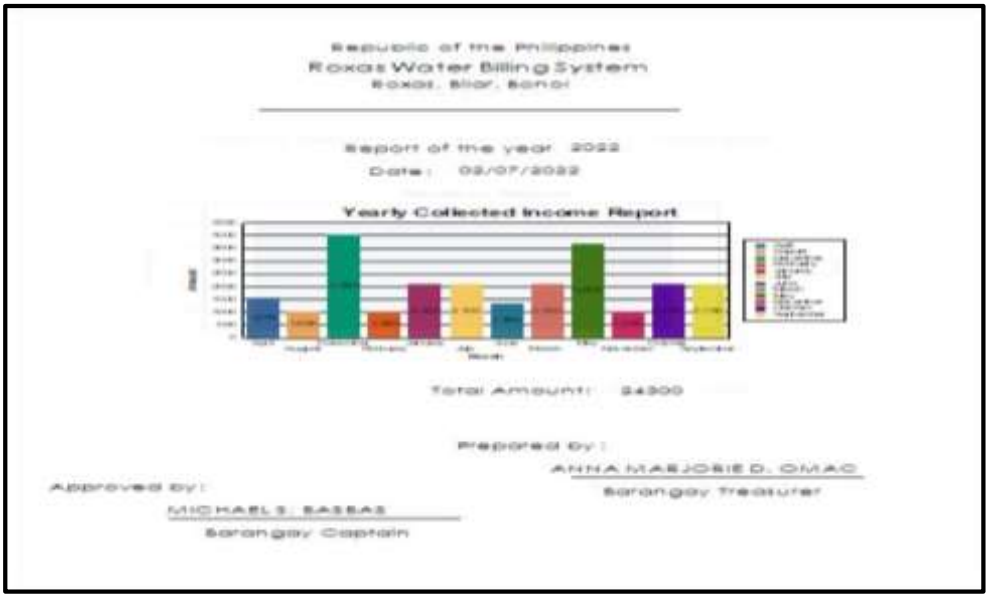
Preview 2. Collected Income Report

Preview 3 is the graphical representation of uncollected report of the month.



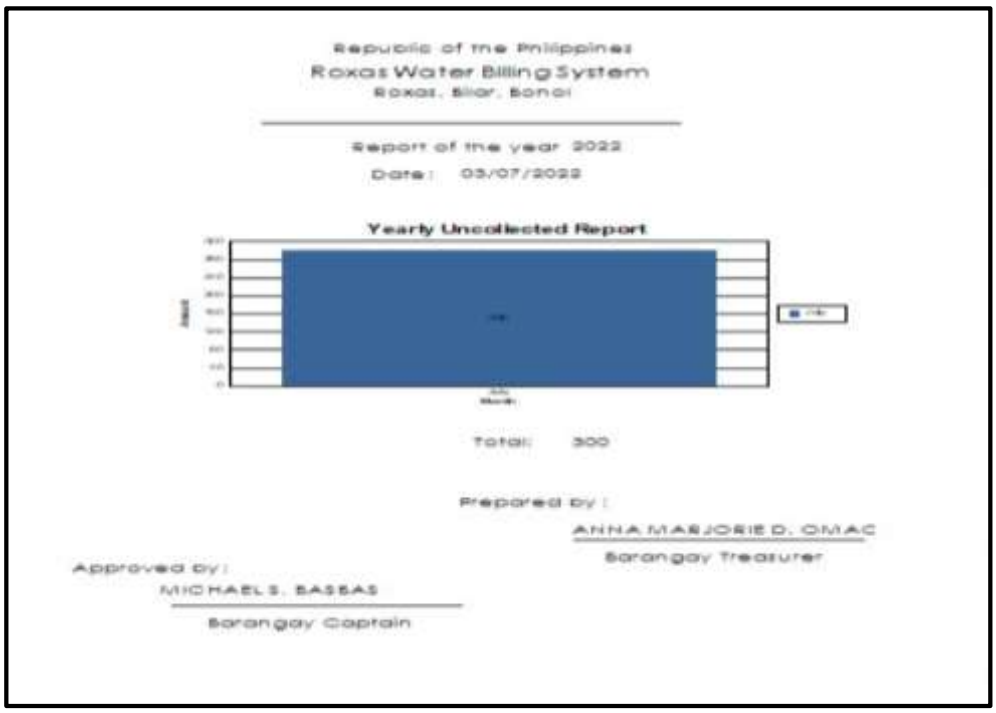
Preview 3. Uncollected Report of the Month

Preview 4 is the graphical representation of collected yearly income report of specific year.



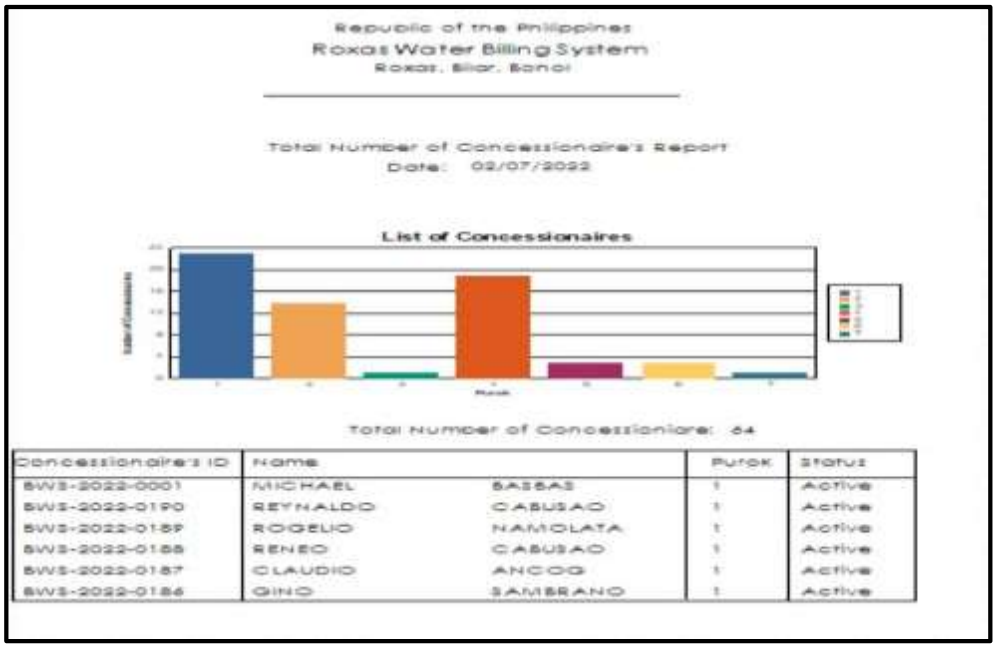
Preview 4. Yearly Income Report

Preview 5 is the graphical representation of uncollected yearly report of specific year.



Preview 5. Uncollected Yearly Report

Preview 6 is the graphical representation of the list of concessionaires.



Preview 6. List of Concessionaires

Screen Layout

One of the numerous aspects of the system's user friendliness is screen layout. It should be developed in such a way that users can navigate the system quickly and easily, and it should provide a clear recognition of the work that the users must do.

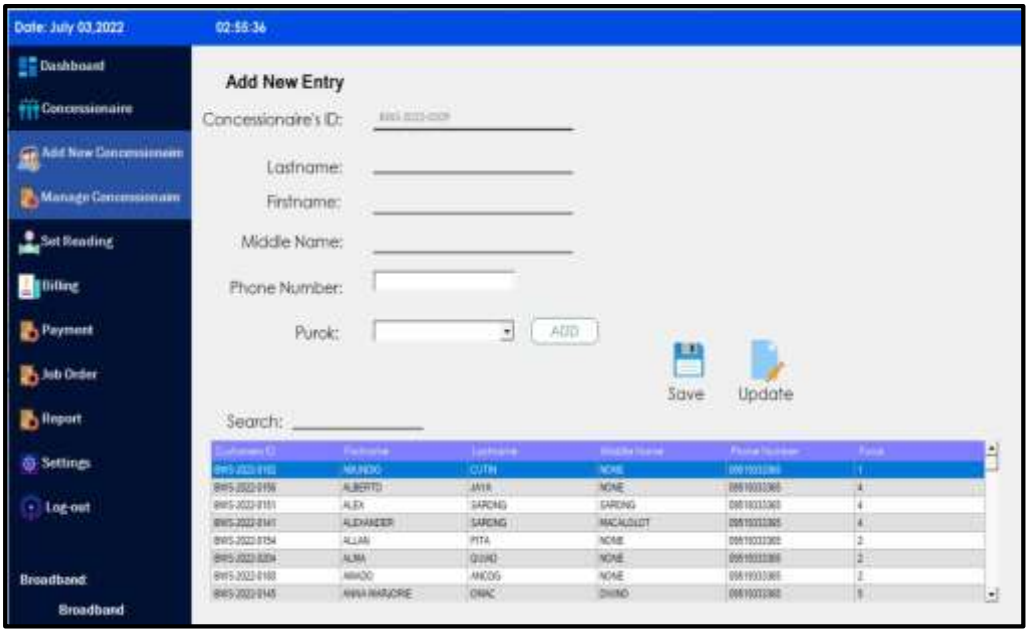
Preview 7 below shows the log in category of the user who manage the system.

Preview 7. Log in Form

Preview 8 shows the dashboard of the system where the total active, pending, and terminated concessionaires are shown and warning for termination also be seen.

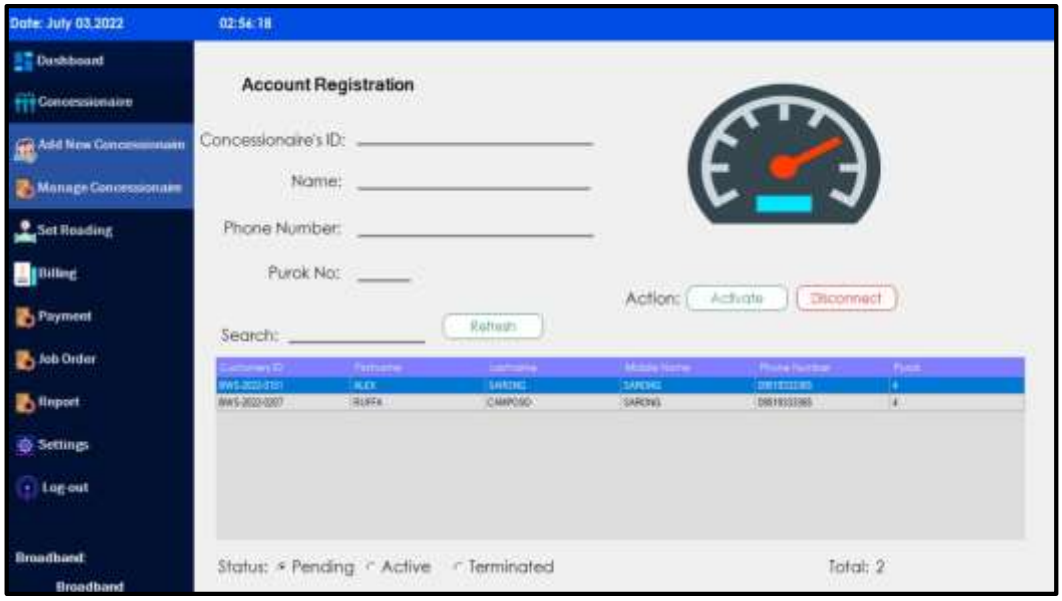
Preview 8. Dashboard

Preview 9 shows the adding of new concessionaire that wants to avail the waterworks of Roxas.



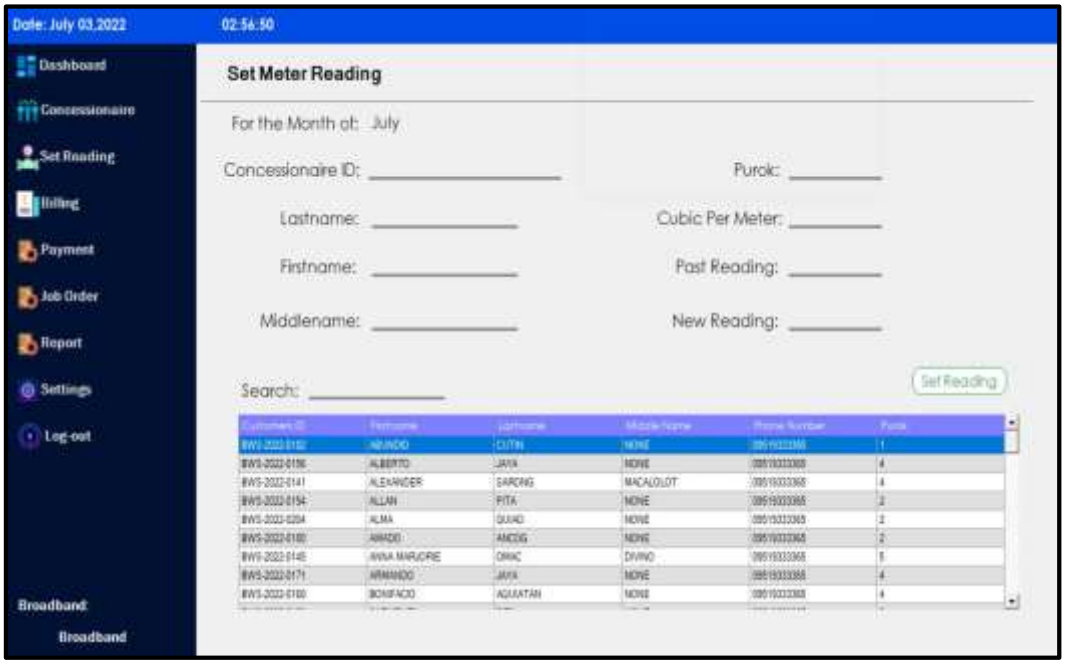
Preview 9. Add new Entry

Preview 10 shows the managing modules of the concessionaires that can activate and terminated account.



Preview 10. Manage Concessionaires

Preview 11 shows the set reading modules of the concessionaires that can set their monthly reading consumption and send SMS.

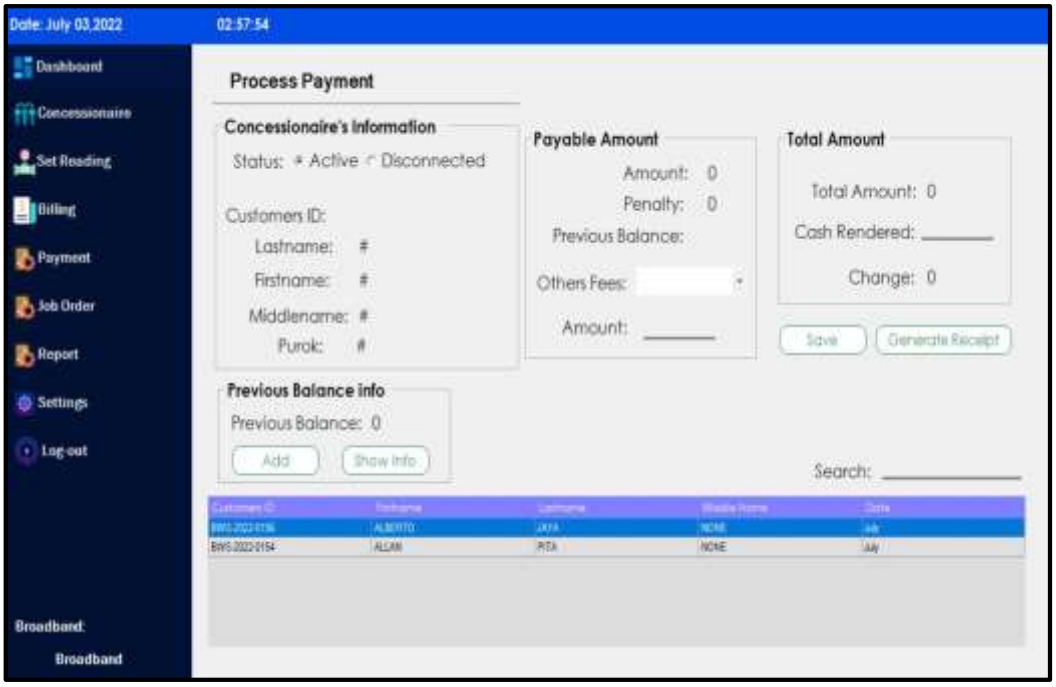


Preview 11. Set Meter Reading

Preview 12 shows the billing modules of the concessionaires.

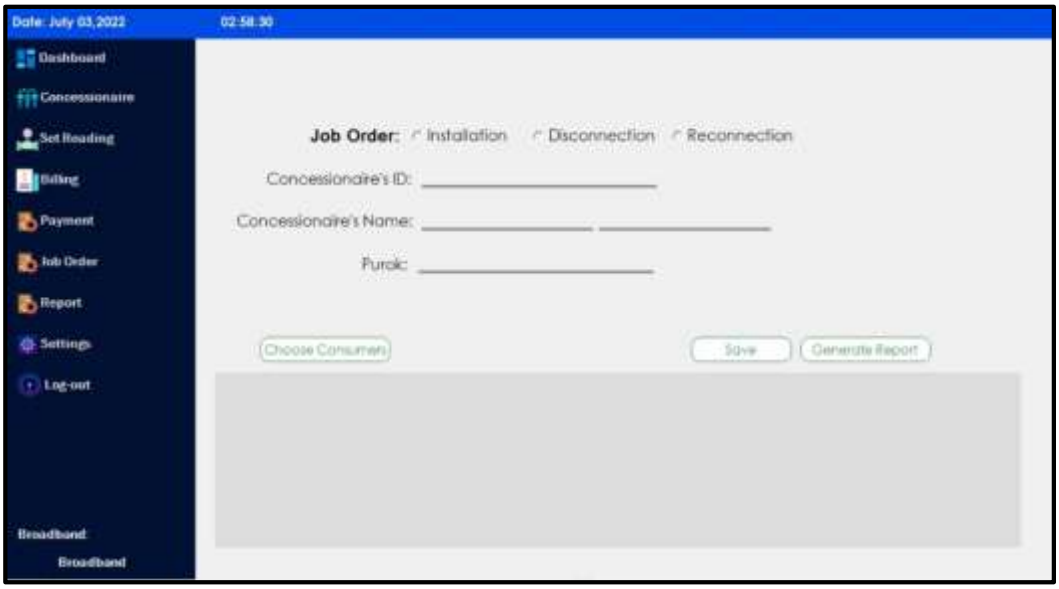
Preview 12. Billing

Preview 13 shows the payment modules of the concessionaires.



Preview 13. Payments

Preview 14 shows the job order modules of the concessionaires that can generate report for installation, disconnection and reconnection.

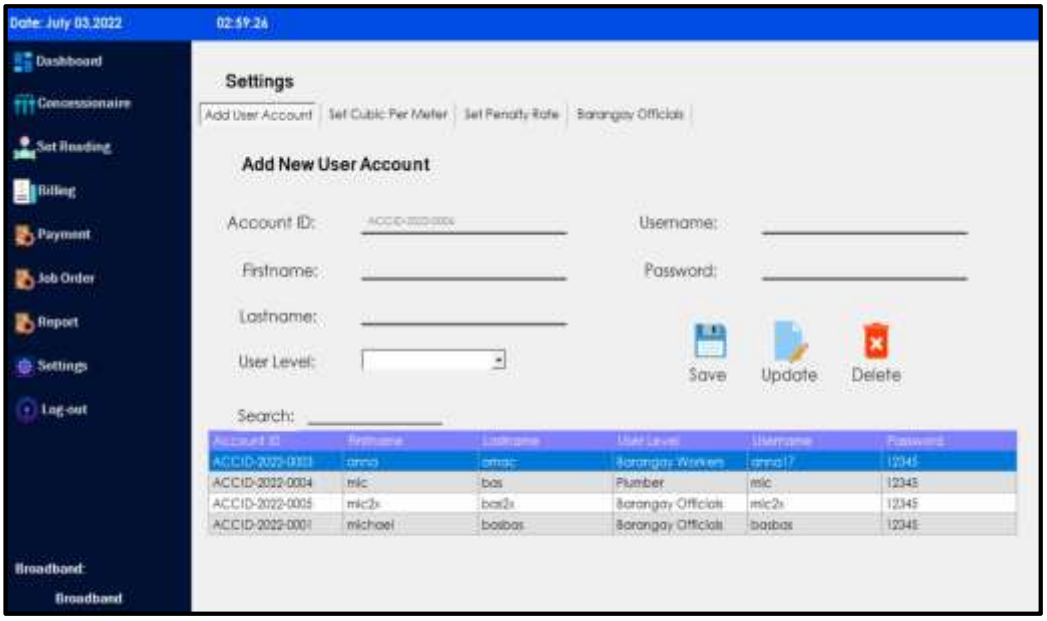


Preview 14. Job Order

Preview 15 shows the reports modules that can generate concessionaire's list, income report, uncollected reports, meter-consumed and meter reading report.

Preview 15. Reports

Preview 16 shows the settings modules of the concessionaires that add user account, set cubic per meter, set penalty rate and set officials.



Preview 16. Settings

Testing and Evaluation

Testing and evaluation were performed to determine the functionality of the system, particularly on the provision of expected output, time/period of the information processing, the volume of information handled, and the proper response of user inputs. This is also the process of judging the performance of the system in general. In this study, system usability was evaluated to determine its technical performance as perceived by the targets.

System Usability

The researchers adopted a system usability questionnaire by Lewis, J. R. (1995). Computer Usability Satisfaction Questionnaire: Psychometric Evaluation

and Instructions for use. To assess the acceptability of the developed system, a survey of the system usability was performed. The test was done last May 22, 2022 at around 1:00 to 3:30 in the afternoon. It took 2.5 hours to demonstrate and do a hands- on activity on the system usability. The system operation and features was presented to the target users, the barangay officials and barangay workers at Roxas, Bilar, Bohol. A system demonstration was conducted to the respondents for them to familiarize the system features. The users were allowed to do a hands-on activity.

The system usability result is shown in the table on the following page. The weighted mean was used to compute the tabular results. The weighted mean and interpretation of each statement are shown in the table on the following page. The system usability questionnaire's average weighted mean was 6.3, with the interpretation "Agree." The developers select 10 respondents to complete the system usability questionnaire. These findings also indicate that the system delivers satisfaction to the responders. Similarly, it demonstrates that the system was extremely basic and straightforward to use, as well as effective, efficient, simple to grasp, and clear. Furthermore, this suggests that the majority of respondents strongly agree with the established system's capabilities, functionalities, and ease of use.

Table 12

System Usability Assessment Result

Criteria for System Usability	Weighted Mean	Rating
1.Overall, I am satisfied it with how easy it is to this system	6.6	Strongly Agree
2. It was simple to use this system	6.1	Agree
3. I can effectively complete my work using this system	6.4	Strongly Agree
4. I am a able to complete my work quickly using this system	6.3	Agree
5. I am able to efficiently complete my work using this system	6.3	Agree
6. I feel comfortable using this system	6.4	Strongly Agree
7. It was easy to learn to use this system	6.0	Agree
8. I believe I became productive using this system	6.3	Agree
9. The system gives error messages that clearly tell me how to fix problem	6.3	Agree
10. Whenever I make mistake using the system, I recover easily and quickly	6.1	Agree
11. The information (such as online help, on-screen messages, and other documentation) provided with this system is clear	6.3	Agree
12. It is easy to find the information I needed	6.5	Strongly Agree
13. The information provided for the system is easy to understand	6.1	Agree
14. The information is effective in helping me complete the tasks and scenarios	6.2	Agree
15. The organization of information on the system screens is clear	6.5	Strongly Agree
16. The interface of this system is pleasant	6.2	Agree
17. I like using the interface of this system	6.4	Strongly Agree
18. This system has all the functions and capabilities I expect it to have	6.4	Strongly Agree
19. Overall, I am satisfied with this system	6.4	Strongly Agree
AVERAGE WIEGHTED MEAN	**6.3**	**Agree**

Legend:

6.4 – 7.0	Strongly Agree
5.5 – 6.3	Agree
4.6 – 5.4	Tend to Agree
3.7 – 4.5	Neither Agree nor Disagree
2.8 – 3.6	Tend to Disagree
1.9 – 2.7	Disagree
1.0 – 1.8	Strongly Disagree

Chapter 3

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary of Findings

The concept and development of Roxas Waterworks' computerized water billing system is presented in this paper. This project seeks to design and implement the following modules: a) billing, b) acquisition, c) administration, and d) reports and business intelligence techniques for decision support in Barangay Roxas. The system is utilized by barangay authorities, plumbers, and barangay employees.

The following questions as to what processes are involved in the existing Roxas water billing and recording system, the requirements of the Barangay Roxas employees in charge of the Roxas water billing and recording system, the system's economic performance in terms of initial investment and annual operating costs, and how the current system be enhanced to address the stated issues are the objectives of the study.

The research was limited to the Roxas waterworks' routine operations and procedures. The system's users were limited to the treasurer, the meter reader/plumber, and the Barangay Captain. The waterworks concessionaire is the primary benefactor of this study.

The methodology employed was Rapid Application Development (RAD), namely prototyping. Windows 10 Ultimate 64 Bit, Visual Basic Programming

Language 2012, MySQL, 5.1.0, Crystal report, Microsoft Visual Studio, and Wamp server were the technologies utilized in the construction of Roxas Water Billing System.

During the testing and evaluation, the researcher asked respondents to complete system usability surveys. The respondents include the barangay chairman, councillors, and the plumber. Several tools were utilized to examine the various features of the system that were required in order to meet the research objectives.

The following problems were determined after the study of the Roxas water billing system.

The current system is semi-manual. Personnel employ a semi-manual technique of recording, processing, and storing information, which has a higher risk of difficulties such as separate recording of the concessionaire file, loss of records, manual reporting, lack of security and storage, and time consuming.

Accounting professionals record concessionaire files using Excel Office. Their issues are that they have a distinct technique of documenting the account receivable transaction, which makes it difficult to determine the whole transaction of the employee.

The introduction of the Roxas water billing system would alleviate the challenges that the current system is experiencing. It will help to reduce redundancy in the monitoring and recording of concessionaires' transactions,

reduce the client's workload, provide accessible information, security, and rapid and reliable task completion.

The average weighted mean of the system usability 6.3 with the interpretation of "Agree" was then determined based on the survey results. This suggests that the system's usability is really high. According to the findings, the system delivers satisfaction to the respondents. It also demonstrates that the system is extremely basic and easy to use, effective, efficient, informative, simple to grasp, and straightforward. Furthermore, this suggests that the respondents highly agree and regarded the capabilities, functionalities, and convenience of use of the proposed system to be good.

Conclusions

The developed system was founded to be highly useful for the business. In terms of usability and accessibility, the "Automated Water Billing System with Short Message Service Notification" is excellent. The waterworks administrators and other intended users are optimistic about the system's usability. It offers capabilities and features that the intended users find very appealing. The technology allows the waterworks administrator to manage and arrange billing procedures and transactions in order to make better business decisions.

The developing system significantly improves the performance of the current system, particularly during the searching and retrieval of records and the recording operation. It makes system billing easier, which is a critical step for the

system. The system send messages that can inform the concessionaires of their monthly bill. The system is mostly secure.

The reports are generated fast and without difficulty. Summative data is imported and created automatically. Modules are designed to be customizable, making it simple for users to understand and use the system. Forms are meant to provide fields that are important to the user, and errors and redundancy are eliminated.

Recommendations

The researchers proposed resolving the limits found by the present system after studying it. It is strongly advised that the proposed method be implemented specifically in Roxas, Bilar, Bohol. The following guidelines should be followed to ensure the successful deployment of the proposed system:

1. Barangay Roxas must adopt the system to improve the automated water billing system with short message notification and to identify possible system bugs and errors.
2. Concessionaire’s files of barangay Roxas should be stored in electronic databases for speedier retrieving and updating of data. They should have back up files on CD tapes or flash devices to protect data security and loss.
3. There should be an intensive hands-on training for potential users of the barangay Roxas to increase their understanding of the system's capabilities and features conducted by the researchers.

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APPENDICES

APPENDIX A

GUIDE QUESTIONS FOR THE PRESENT SYSTEM

1. What are the requirements needed in applying water service?
2. How to avail the water services?
3. How the installation, disconnection and reconnection process done?
4. How much is the fee for installation, application, reconnection & meter transfer?
5. How much is the rates of the water consume?
6. When is the meter reading done?
7. When is the monthly bill done?
8. Who is responsible for collecting payments?
9. Is there a penalty for late paying?
10. How many are the current concessionaires?
11. What are the requirement in installation & meter transfer?

Letter of Intent

Republic of the Philippines
Bohol Island State University
Bilar Campus
Zamora, Bilar, Bohol

March 28, 2022

HON. TERESITA C. BAYRON
Barangay Captain
Roxas, Bilar, Bohol

Ma'am:

Good day!

We, the 4th Year Students of Bachelor of Science in Computer Science of Bohol Island State University Bilar Campus will conduct a System Development project (Thesis) as requirements for graduation for the degree of Bachelor of Science in Computer Science.

In this regard, we would like to ask your good office to allow us to conduct system study base on the process of water billing in your barangay.

We assure you that we shall honor secrecy and privacy to all data and information we shall be handling during our data collection which include interview, observation and document review. As we go along with our study, your approval will be a great help to the success of our study.

We anticipate your favorable response regarding this matter.

Thank you very much and more power!

Respectfully yours,

MICHAEL S. BASBAS
ALEXANDER SARONG
LADY MAE CABANLIT
Researchers

Noted by:

RENANTE S. DIGAMON, PhD
Subject Instructor

REX VINCENT TEJADA
Thesis Adviser

Recommended by:

SHEILA G. TABUNO
Chairperson, DCoS

Endorsed by:

ARLEN B. GUDMALIN, PhD
Dean, CTAS

Approved by:

HON. TERESITA C. BAYRON
Barangay Captain

Letter of Approval of the Proposed System

Republic of the Philippines
Bohol Island State University
Bilar Campus
Zamora, Bilar, Bohol

May 4, 2022

HON. TERESITA C. BAYRON
Barangay Captain
Roxas, Bilar, Bohol

Ma'am:

Greetings!

It is our pleasure to inform you that the system "AUTOMATED WATER BILLING SYSTEM WITH SHORT MESSAGE SERVICE NOTIFICATION IN ROXAS, BILAR, BOHOL" is now in its final phase. With this, we would like to conduct benchmarking activities as part of implementation.

This will be conducted on May 5, 2022 in your office at any time of your convenience. This activity will allow you to assess our developed system and give feedback as well.

By this time, we would like to express our gratitude for allowing us to conduct our thesis study. We are hoping for future collaboration with you our dear client.

May the good Lord continually bless you and your office.

Thank you very much and more power!

Respectfully yours,

MICHAEL S. BASBAS

ALEXANDER M. SARONG JR.

LADY MAE A. CABANLIT
Researchers

Noted by:

RENANTE S. DIGAMON, PhD
Subject Instructor

REX VINCENT TEJADA
Thesis Adviser

Recommended by:

SHEILA G. TABUNO
Chairperson, DCoS

Endorsed by:

ARLEN B. GUDMALIN, PhD
Dean, CTAS

Approved by:

HON. TERESITA C. BAYRON
Barangay Captain

APPENDIX B

System Usability Questionnaire

Instructions:

- Please rate the usability questionnaire
- Try to respond to all the items
- For items that are not applicable, use N/A
- Make sure these fields are filled in

Rating Scale:

7 – Strongly Agree

6 – Agree

5 – Tend to Agree

4 – Neither Agree or Disagree

3 – Tend to disagree

2 – Disagree

1 – Strongly Disagree

Criteria for System Usability	Rating
1.Overall, I am satisfied it with how easy it is to this system	
2. It was simple to use this system	
3. I can effectively complete my work using this system	
4. I am a able to complete my work quickly using this system	
5. I am able to efficiently complete my work using this system	
6. I feel comfortable using this system	
7. It was easy to learn to use this system	
8. I believe I became productive using this system	
9. The system gives error messages that clearly tell me how to fix problem	
10. Whenever I make mistake using the system, I recover easily and quickly	

11. The information (such as online help, on-screen messages, and other documentation) provided with this system is clear	
12. It is easy to find the information I needed	
13. The information provided for the system is easy to understand	
14. The information is effective in helping me complete the tasks and scenarios	
15. The organization of information on the system screens is clear	
16. The interface of this system is pleasant	
17. I like using the interface of this system	
18. This system has all the functions and capabilities I expect it to have	
19. Overall, I am satisfied with this system	
AVERAGE WIEGHTED MEAN	
20. Please list the three things you liked most about this system software: 1. 2. 3.	
21. Please list the three things you liked least about this system software: 1. 2. 3.	

Based on Lewis J. R. (1995) IBM Computer Usability Satisfaction

Questionnaires: Psychometric Evaluation & Instructions for Use.

APPENDIX C

User Manual

Accessing the system

Barangay Official account

Steps:

1. Input username and password in the textboxes and select “Barangay Official” in the combo box.
2. Then click “Login”.
3. Confirmation “Welcome User!”

Barangay Worker

Steps:

1. Input username and password in the textboxes and select “Barangay Worker” in the combo box.
2. Then click “Login”.
3. Confirmation “Welcome User!”

Plumber

Steps:

1. Input username and password in the textboxes and select “Plumber” in the combo box.
2. Then click “Login”.
3. Confirmation “Welcome User!”

View Dashboard

Steps:

1. On the main menu, click “Dashboard” click “Generate Report”.

Adding New Concessionaire

Steps:

2. On the main menu, click “Concessionaire” then choose “Add New Concessionaire. Then fill up the detailed information. click “Save”.

Manage the Concessionaire

Steps:

1. On the main menu, click “Concessionaire” then choose “Manage Concessionaire”. Then “Search” for the name. Double click on the name. Then choose “Activate” or “Terminate”.

Set Reading

Steps:

1. On the main menu, click “Set Reading”. Search for the name, double click the name. then input value for the “New Reading”. Click “Set Reading”.

Billing

Steps:

1. On the main menu, click “Billing”. Then search for the name of concessionaire. Double click the name.
2. Input value for “Cash Rendered”. Click “Calculate”. click “Save” and then” Generate Receipt”

Job Order

Steps:

1. On the main menu, click “Job Order” then choose “Installation”,” Disconnection” or “Reconnection”. Then click “Choose Consumers” double click the name, click “Save” and then “Generate Report”.

Report

Steps:

1. On the main menu, click “Report” choose “Concessionaire’s List” click “Load” then “Generate Report”.
2. On the main menu, click “Report” Choose “Income Report” then select Coverage “Month”, “Monthly”, “Yearly”. Then “Load” and then click “Generate Report”.
3. On the main menu, click “Report” Choose “Meter Consumed Report” Choose “Concessionaire’s Cubic Consume Report” or Cubic Meter Consumed Report” then Click “Choose Concessionaire” then double click the name. select year from the Combo box then click “Generate Report”.
4. On the main menu, click “Report” Choose “Meter Reading Report”.

Setting

Steps:

1. On the main menu, click “Setting” then choose “Add User Account” fill up the Account Information Then Click “Save”
2. On the main menu, click “Setting” then choose “Set Cubic Per Meter” doubled click the datagirdview and input the new amount value then click “Update”.

3. On the main menu, click “Setting” then choose “Set Penalty Rate” doubled click the datagirdview and input the amount of Penalty Rate then click “Update”.
4. On the main menu, click “Setting” then choose “Barangay Officials” doubled click the datagirdview and input the new barangay officials then click “Update”.
5. On the main menu, click “Setting” then choose “Back-up” click the button generate backup to download the database of the system.

DEVELOPER'S DATA

Name : Michael S. Basbas

Nickname : "Chael"

Date of Birth : January 17, 1997

Place of Birth : Cabacnitan, Bilar, Bohol

Age : 25

Home Address : Cabacnitan, Bilar, Bohol

Email Address : michaelbasbas23@gmail,com

Religion : Roman Catholic

Citizenship : Filipino

Father's Name : Florencio B. Basbas

Mother's Name : Ressureccion S. Basbas

EDUCATIONAL BACKGROUND

Elementary : Cabacnitan Elementary School

: Cabacnitan, Bilar, Bohol

Secondary : Bilar National High School

: Yanaya, Bilar, Bohol

Tertiary : Bohol Island State University- Bilar Campus

: Zamora, Bilar, Bohol

Degree Earned : Bachelor of Science in Computer Science

Worked Experience : On the Job Training

: Bisu Bilar Campus

: Zamora, Bilar, Bohol

DEVELOPER'S DATA

Name : Lady Mae A. Cabanlit

Nickname : "Gagers"

Date of Birth : August 9, 1998

Place of Birth : Villa Aurora Bilar, Bohol

Age : 23

Home Address : Villa Aurora, Bilar, Bohol

Email Address : ladymaecabanlit@gmail.com

Religion : Roman Catholic

Citizenship : Filipino

Father's Name : Inocencio P. Cabanlit

Mother's Name : Lilia L. Amodiong

EDUCATIONAL BACKGROUND

Elementary : Bilar Central Elementary School

: Poblacion, Bilar, Bohol

Secondary : Bilar National High School

: Yanaya, Bilar, Bohol

Tertiary : Bohol Island State University- Bilar Campus

: Zamora, Bilar, Bohol

Degree Earned : Bachelor of Science in Computer Science (BSCS)

Work Experienced : On the Job Training

: PNP Bilar Station

: Poblacion, Bilar, Bohol

DEVELOPER'S DATA

Name : Alexander M. Sarong Jr.

Nickname : "Alex"

Date of Birth : June 19, 1997

Place of Birth : Riverside, Bilar, Bohol

Age : 24

Home Address : Quezon, Bilar, Bohol

Email Address : alexandersarong@gmail.com

Religion : Roman Catholic

Citizenship : Filipino

Father's Name : Alexander D. Sarong Sr.

Mother's Name : Clarita M. Sarong

EDUCATIONAL BACKGROUND

Elementary : Bilar Central Elementary School

: Poblacion, Bilar, Bohol

Secondary : Bilar National High School

: Yanaya, Bilar, Bohol

Tertiary : Bohol Island State University- Bilar Campus

: Zamora, Bilar, Bohol

Degree Earned : Bachelor of Science in Computer Science (BSCS)

Work Experienced : On the Job Training

: Local Government Unit (LGU)

: Poblacion, Bilar, Bohol