

Conference Paper

Web-Based Billing and Collection System for a Municipal Water and Services Unit

Abel L. Pelandiana and Remedios G. Ado

Polytechnic University of the Philippines

Abstract

Web-Based Billing and Collection System for a Municipal Water and Services Unit is a system that sought to address the problem of a municipal water unit. Using the technology, meter reading will be paperless. It can be accessible through the Internet; end-users and water consumers/customers could connect and perform transactions enabling them to become efficient on their daily tasks whether in the office or at home. The head of the unit can make overall viewing of the status of daily transactions and can be viewed using desktop, laptop computers and android mobile devices connected to the internet. The water consumers/customers may receive email and short messaging system showing their current water consumption and water bill. Added/unique features such as graphical chart showing regular water consumptions on the end-users and consumers/customers dashboard as well as on their billing statements are provided. On the level of satisfaction of the respondents on the features of the proposed billing and collection system; result show that efficiency earned the highest weighted mean (4.43) interpreted as "satisfied". Functionality posed weighted arithmetic mean (4.33) verbally interpreted as "satisfied". Portability and reliability followed next. On the level of acceptance of the proposed billing and collection system; respondents' acceptance according to consumer accounts updating gauged at 4.35 weighted arithmetic mean with verbal interpretation of "acceptable". Auto-reminding the consumers for bills due for payment posed a 4.37 weighted arithmetic mean and was also "acceptable". According to billing statement printing and free format report generation, respondents recorded 4.45 weighted arithmetic mean and interpreted as "acceptable".

Keywords: billing system, ewater, municipal water, web-based billing, collection system.

1. Introduction

Technological revolution brought great changes to mankind, access to information becomes 24/7 anytime and anywhere. The internet described as network of networks

Corresponding Author:
Abel L. Pelandiana
alpelandiana@pup.edu.ph

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utilized by businesses, academe, government and private individuals connected and or using its services form part of the vast information superhighway.

Digital interactions among businesses and consumers through powerful information systems and omnipresent connected devices establish today's networked society. In this light, Service Science continues to take root as a research discipline that focuses on the integration of (digital) resources by service providers and service customers for value co-creation in service systems [4].

The researcher came to realize that a new system would be better to develop and to have it tried by the prospected respondents in order to see how it actually works. The researcher then chose Mulanay Water and Services Unit to become the respondents of this study. This Local Government Unit already have a billing system in a form of spreadsheet application. As result of thorough interview - it is very difficult to provide up-to-date reporting using their existing system. Finding and encoding customer's data specifically the meter readings of customer's water consumption was very tedious to the user. Another problem is the report generation; they could not provide it because it is hard for them to scan individual tables of customers.

The proposed system will then change the way the current system goes and may have impact on its current manpower, thus may result to acceptability or not by the end-users. In the long run, as they may see that process change is inevitable then the proponent is quite sure that the proposed system will be considered by its end-users.

The proposed system also embeds collection as billing and collection are not be separate entities. It is a system wherein transactions start with clients/applicant's registration process (includes submission of mandatory documents); approval and or assessment process; payment of registration and other fees and client/applicant activation.

The proposed system, Web-Based Billing and Collection System for a Municipal Water and Services Unit comprised the billing, collection, storing the records in a database and report generation. 1) The system generates billing statement that indicates the water consumed and its corresponding cost. 2) Collection covers the recording of consumers' payments and necessary for the report generation as required by treasurers' department of the said unit. 3) Transactions records are stored in the system's database. 4) Report generation as needed by the unit for decision making purposes and in monitoring the periodic transactions as required and or needed by the decision-making body of the local government.

2. Significance of the Study

The researcher believes that the proposed Web-Based Billing and Collection System for a Municipal Water and Services Unit will be a contributing factor to the growth and enhancement of services of the Local Government Unit of Mulanay to the community and its stakeholders.

This will serve as their stepping stone to future advances in information technology and for some institutions in the locality to do as well.

The administration of Mulanay, Quezon will be thankful if this proposed Web Based Billing and Collection System for a Municipal Water and Services Unit come into reality for this will be the key for more information technology development in the locality.

The stakeholders – the end users and the clients will soon be migrating into this new system thus making them more adhere to utilizing the technology thus uplifting the manual system into an internet driven system.

To the students of PUP Mulanay, Quezon Branch as it may serve as reference for their own research or capstone project especially to the Diploma in Information Communication Technology students.

3. Definition of Terms

3.1. Administrators

Refers to the end-users of the system, the administrator side that control, maintain and routinely perform duties as to improve utilization of the proposed billing system.

3.2. Consumers/Stakeholders

Refer to the target users of the proposed web based billing and collection system.

3.3. Efficiency

A set of attributes that bear on the relationship between the level of performance of the software and the amount of resources used, under stated conditions – time behavior and resource utilization.

3.4. Functionality

Set of attributes that bear on the existence of a set of functions and their specified properties – suitability, accuracy, interoperability and security.

3.5. Graphical user interface (GUI)

A type of user interface that allows users to interact with programs in more ways than typing such as computers. A *GUI* offers graphical icons, and visual indicators, as opposed to text-based interfaces, typed command labels or text navigation to fully represent the information and actions available to a user. The actions are usually performed through direct manipulation of the graphical elements.

3.6. Internet

A global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide.

3.7. Maintainability

A set of attributes that bear on the effort needed to make specified modifications – analyzability, changeability, stability and testability.

3.8. Portability

A set of attributes that bear on the ability of software to be transferred from one environment to another – adaptability, installability, coexistence and replaceability.

3.9. Prototype

Refers to the original design of a portal to be presented to the stakeholders.

3.10. Quezon

A province of the Philippines located in the CALABARZON region in Luzon. The province was named after Manuel L. Quezon, the second President of the Philippines, and its

capital is Lucena City. Quezon is located southeast of Metro Manila and it is surrounded by the provinces of Aurora to the north, Bulacan, Rizal, Laguna and Batangas to the west and the Camarines provinces to the east. Quezon lies on an isthmus separating the Bicol Peninsula from the main part of Luzon. The province also covers the Polillo Islands in the Philippine Sea.

3.11. Reliability

A set of attributes that bear on the capability of software to maintain its level of performance under stated conditions for a stated period of time – maturity, fault tolerance and recoverability.

3.12. Simplicity

The design of a website and all of its components wherein it is easy to explain, to understand in contrast with the word complicated.

3.13. Software

Refers to the program itself to be used in developing a website and its components

3.14. Usability

Refers to the elegance and clarity with which the interaction with a computer program or a web site is designed

3.15. Web-based billing and collection system

The proposed system that will serve as record keeping and monitoring system for the administration and end-users of the proposed real-time billing system.

3.16. Website

A collection of related web pages, images, videos or other digital assets that are addressed relative to a common Uniform Resource Locator (URL), also refers to the site on the internet wherein the researcher intends to develop the system.

The study was deemed significance according to various readings of the researcher, some of them were “Freedom of connection with any application to any party is deep fundamental social basis of the internet. And now is the basis of the society to build on the internet. I hope the United State Congress can protect net neutrality, so I can continue to innovate in the internet space. I want to go on seeing the huge amount of innovations which are happening out there and which is so diverse and so exciting. I want to see that continue innovated. It is very important to avoid a short term corporate grid in trying to get a short term return of investment by thinking that you can make a small proprietary market that you keep with yourself because in fact what you will do is you may block the creation of a huge market” [3]. This idea and proposition of Mr. Berners-Lee led to the explosion of vast information using the World Wide Web. Berners-Lee launched the World Wide Web Foundation in order to advance the web to empower humanity by launching transformative programs that build local capacity to leverage the Web as a medium for positive change. This is another breakthrough in information technology as well as to the e-commerce industry bringing people together longing for a positive change not only in business but in some other aspects as well.

The City of Goose Creek [27] provides water service to almost 9,000 customers. Residents may visit City Hall or call 843-797-6220, ext. 0 to open an account. In order to open an account over the phone, residents must have a Visa, MasterCard, or American Express credit or debit card. The system also provides paperless billing, direct debit and online payment. The direct debit service is provided at no charge. Payments will be automatically debited from your account each month.

In a field note titled “Developing Effective Billing and Collection Practices” [1] states that improving billing and collection activities has an immediate impact on the revenue streams of a service provider that can, in turn, encourage commercial and operational efficiencies for aiding the expansion and delivery of improved, reliable, and sustainable services.

Effective billing and collections systems are a critical component for ensuring the viability of a service provider that can, in turn help the service provider in improving services. However, while effective billing and collections practices depend on many internal factors (including customer databases, the extent of metered and unmetered service provision, tariff and billing structures, delivery of bills, and facilities for customer payments), the institutional arrangements under which service providers operate and provide services determine whether such practices will remain sustainable in the long term. Efficient billing and collection practices can set incentives for the

provider to effectively charge and collect water bills while also fulfilling a commercial orientation to services.

Spot Billing Machine, a handheld computer in which the program is stored along with all the relevant data, for issue of electricity bills, right at the customer premises, immediately after the meter reading is read and input to Spot Billing Machine [21]. This features; immediate bill generation, collection of dues, through non-cash instruments, is performed in the field, variety of reports can be prepared such as utility bill with all relevant details, receipts against the bill, day end collection report and duplicate receipt.

Continental Utility Solutions, Inc., (CUSI) a company dedicated to providing innovative enterprise solutions to utilities, local governments and sub metering companies [5]. Experience technology and service have made CUSI the place where people go for utility billing and customer information systems. CUSI creates value by providing the tools to deliver world-class customer service and operational efficiency.

QuikWater provides a database solution that allows an unlimited number of customers, unlimited number of rate structures, and there is no limit by pricing structure to number of clients billed [19].

A commercial water billing software available on the web [22] was created specifically for the Utility with 1,000 active service addresses or less. Utility Data Systems, Inc. recognizes that even though a utility is small, the need for robust billing software is the same as that of a larger utility. The utility billing software is a response to the needs of a small utility software and affordable yet feature-rich water billing software written by people who came from the utility industry.

The Water & Sewer Billing and Collection Division manage the water and sewer accounts for residents in north Fulton County north of the Chattahoochee River. They also manage garbage collection accounts for residents who incurred charges prior to 1997 only. Their goal is to provide accurate and timely billing and collections for water and sewer service. They also seek to offer courteous and quality customer service [23].

LIWAD - Libmanan Water District is the premier potable water provider characterized by its viable, modern and affordable services towards a progressive, peaceful, sustainable and developed Libmanan by engaging its communities and its responsive consumers [13]. Billing system automatically handles recurring billing tasks. It is a recurring billing system with complete accounts receivables. This system ensures the integrity and reliability of data. Collection system provides support tools to maximize revenue collection that will ensure the efficient monitoring, billing, collection and recording and ensure accurate posting of transactions and generation of daily reports.

In an article titled: "Water district improves billing, collection system", [10] the Metro Roxas Water District is now implementing a new billing and collection system (BCS) to further improve its services. The new system, which features quick billing, introduces a new way to read consumptions, bill concessionaires and new data management of accounts of each customer. The system provided new electronic meter reading devices installed in the system that will be used by the meter readers and has a query keypad virtual option and passive stylus or finger operation with a built in Windows Operating System where a handheld printer can be attached.

Cabanatuan City Water District [24] provide consumer page to view information about water meter; water bill including bill number; due date; concessionaire information; billing address; meter reading including current, previous and consumption; previous balance; charges; total amount due and remarks. The site does not provide for client log in page.

Maynilad, an agent and contractor of the Metropolitan Waterworks and Sewerage System (MWSS), also provides opportunity for water consumers to enroll in their mywaterbill page wherein consumers may enroll to get free 24/7 secure online access to customer's account, review and pay bill online, view billing for the past twelve (12) months, reduce the use of paper and to download and print water bill [15]. The site also features selecting the rate classification and calculate estimated water bill. Called "My Water Bill," the program will also enable Maynilad customers to receive their statement of account (SOA) or water bill via electronic means—i.e., through SMS, email, or web portal.

iBCS / Integrated Billing and Collection System is an application designed and developed for water district utilities [12]. It incorporates concessionaires' account monitoring, billing and collection into an effective and efficient manner which is built on top of the current online and real-time technology.

In the proposed "Cloud-Based Billing and Monitoring System for an Electric Company [9] with the developed system, end-users perceived his study as incredibly good and the company wanted to use the proposed system in the future. The system according to the end-users and technical experts was highly responsive in tablets, smart phones, laptops and desktops. The researcher then also found out that the proposed system could be a good and acceptable solution to the problems of the company on their billing and monitoring activities.

Information and Communication Technology is expanding the possibilities of bringing the world closer making individuals and institutions to be part of the international markets. The Internet actually changes the way goods and services are delivered to

its recipients/stakeholders. A fast-growing number of individuals and businesses are connected digitally and are ready to become part and to contribute to the knowledge economy.

Foreign and local literature and studies presented rich information on billing and monitoring system and the utilization of the web/internet to deliver services to the end-users posed great challenge to the information users to dig further in order to advance and adapt to the fast-changing global community – the era to electronic age.

Individuals, whether businesses or other entities deemed that utilization and enhancement of available technological tools to date will enable us/them to answer / give solutions to their/our problems in order to cope with the demand of today's rapid technological and management change and or processes. Proposed system will then ease the stakeholders/end-users burden of day to day transacting with the customers and vice-versa if fully utilized / integrated into their management process.

The developed web based billing and collection system is unique compared to the existing system in terms of:

1. **Compatibility and Portability.** It is compatible to be browsed by major browsers and at the same time on different devices such as personal computer – laptop, android tablet and even smart/android phones. The existing system being utilized by the Municipal Water Sanitation and Services Unit is software dependent – that it relies on spreadsheet software in order to open/run the workbook. Different screen shots were provided to show that the developed system by the researcher features compatibility.
2. **Simplicity.** The developed system is very simple as it does not need any additional devices like the other system that uses meter reading devices such as spot billing machine and/or personal digital assistants (PDAs).
3. **Customizability.** Since it was a product of a thorough research, though it may have features found on the existing commercial systems in the market but the uniqueness it may have were those that being recommended/suggested by the panel as the study and the system underwent through series of defenses – e.g. proposal and pre-oral. Features may be seen on screen shots from Figures 10 to 67, the system dashboard for admin/end users, clients and the sample printout of billing statement.

As an idiom goes “There is nothing new under the sun” [11]. Also in the bible, it says “What has happened before will happen again. What has been done before will be

done again. There is nothing new in the whole world [8].” That means everything that we see and use were already developed. What we are doing now were all modifications, enhancements, adding unique features to the existing one, and that is what the researcher did in his proposed system – adding unique features so as not to plagiarize or copying what existed in the market. And for those features that maybe existed on the other software or studies, due or proper recognition were extended to them through citations and proper referencing.

4. Objectives of the Study

The study aimed to develop a Web-Based Billing and Collection System for a Municipal Water and Services Unit. The study sought answers to the following sub-problems: 1. What is the level of agreement of the respondents on the issues and challenges faced by the Municipal Water Sanitation and Services Unit administration using the existing billing system in terms of; 1.1 Consumers’ account updating and; 1.2 free format report generation. 2. What is the level of satisfaction of the respondents on the features of the proposed billing and collection system in terms of the following: 2.1 functionality; 2.2 usability; 2.3 reliability; 2.4 portability, and 2.5 efficiency. 3. What is the level of acceptance of the proposed billing and collection system as perceived by the respondents in terms of; 3.1 Consumers’ account updating; 3.2 auto-reminding the consumers for bills due for payment; and 3.3 billing statement printing and free format report generation.

5. Materials and Methods

The study used the descriptive research method, to describe the procedures from meter reading to encoding to the spreadsheet billing system that the local government unit is currently using. Descriptive because it is also used to evaluate the proposed system in terms of software functionality, usability, reliability, portability, and efficiency. The actual users of the spreadsheet billing system on the administrator side and the staff of Mulanay Water Sanitation and Services Unit consisting of six (6) persons were the first group of respondents. All of them were purposively selected as respondents of the study. For the second group of the respondents, 81 out of 102 household water consumers were the second group of respondents. Simple random technique was utilized in selecting the clients/household consumers. Simple random refers to a subset of individuals (samples) for a larger set (population). Each individual is chosen randomly and entirely by chance, such that individuals have the same probability of being chosen

at any stage during the sampling process. A simple random sampling is an unbiased surveying technique. In finding the sample size, the researcher employed the Slovin’s formula for the computation of the sample size to identify the number of household consumers. Following were the several techniques employed by the researcher to gather pertinent data regarding the study.

6. Research Instrument

Interviews. Often interviews with the respondents were conducted by means of oral, phone call and even exchanging text messages in order to elicit information that will suffice in the development of the proposed system.

Questionnaire. The researcher formulated questionnaire based on his readings and searching on the web on how to evaluate a system. The questionnaire was employed to retrieve respondents’ feedback about their current system and the proposed system.

In getting the level of agreement of the respondents on the issues and challenges faced by the Municipal Water Sanitation and Services Unit administration using the existing billing system in terms of consumers’ account updating and free format report generation, the Likert scale below was used.

TABLE 1: Rating Scale for Sub-Problem 1.

Likert Scale	Numerical rating	Equivalent
5	4.51 - 5.00	Strongly Agree
4	3.51 - 4.50	Agree
3	2.51 - 3.50	Moderately Agree
2	1.51 - 2.50	Disagree
1	1.00 - 1.50	Strongly Disagree

In evaluating the level of satisfaction of the respondents on the features of the proposed billing and collection system in terms of functionality, usability, reliability, portability and efficiency the Likert scale below was used.

In evaluating the level of acceptance of the proposed billing and collection system as perceived by the respondents in terms of consumers accounts updating, water bill printing, auto-reminding the consumers for bills due for payment, and free format report generation the Likert scale below was utilized.

TABLE 2: Rating Scale Criteria for Sub-Problem 2.

Likert Scale	Numerical rating	Equivalent
5	4.51 - 5.00	Highly Satisfied
4	3.51 - 4.50	Satisfied
3	2.51 - 3.50	Moderately Satisfied
2	1.51 - 2.50	Slightly Satisfied
1	1.00 - 1.50	Not Satisfied

TABLE 3: Rating Scale Criteria for Sub-Problem 3.

Likert Scale	Numerical rating	Equivalent
5	4.51 - 5.00	Highly Acceptable
4	3.51 - 4.50	Acceptable
3	2.51 - 3.50	Moderately Acceptable
2	1.51 - 2.50	Fairly Acceptable
1	1.00 - 1.50	Not Acceptable

The researcher also employed observation on the existing or current billing system more so with scanning or going through the documents, forms, billing statements, schedule of payments and other pertinent data needed in the realization of the proposed system.

7. Description of the Respondents

The first group of respondents consisting of the administrative staff of Mulanay Water Sanitation and Services Unit. The second group was the household consumers chosen using simple random technique.

TABLE 4: Breakdown of the Respondents.

Respondents	Frequency	Percent	Rank
Admin / End Users	6	6.90	2
Clients / Household Consumers	81	93.10	1
TOTAL	87	100.00	

In evaluating the developed system, the ISO 9126 - International Organization for Standardization were utilized, depicted in figure as shown below;

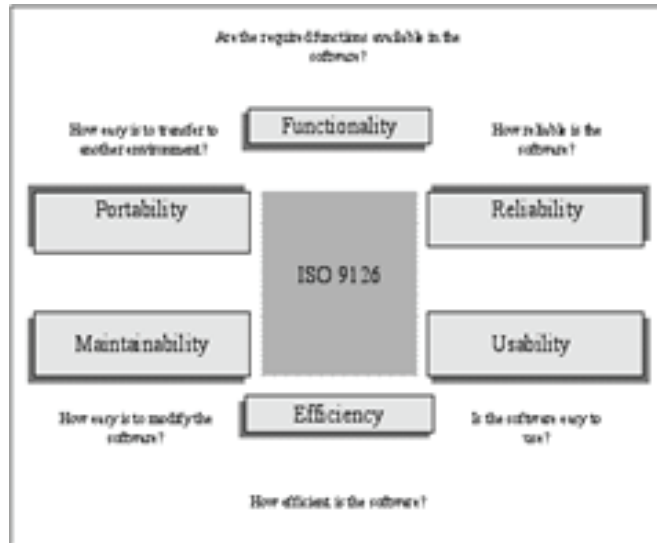


Figure 1: ISO 9126.

7.1. System Architecture

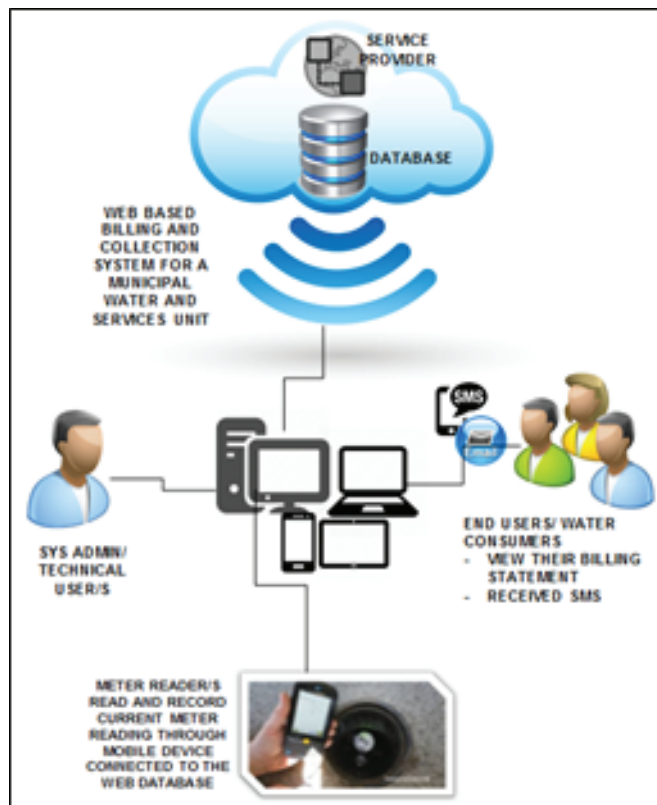


Figure 2: System Framework.

The system framework will depend on the connection of web services in the Internet as the researcher will subscribe to host the online application and the database system.

8. Software Prototype Model

Software prototyping is becoming very popular as a software development model, as it enables to understand customer requirements at an early stage of development. It helps get valuable feedback from the customer and helps the researcher understand about what exactly is expected of the system to be developed.

Following is the stepwise approach to design a software prototype:

9. Basic Requirement Identification

This step involves understanding the very basics of product requirements especially in terms of user interface. The more intricate details of the internal design and external aspects like performance and security can be ignored at this stage.

10. Developing the Initial Prototype

This is the stage where the initial prototype is developed, where the very basic requirements are showcased and user interfaces are provided. These features may not exactly work the same manner internally in the actual software developed and the workarounds are used to give the same look and feel to the end-users in the prototype developed.

11. Review of the Prototype

The prototype developed is then presented to the end-users and the other important stakeholders in the study. The feedback is collected in an organized manner and used for further enhancements in the system under development.

12. Revise and Enhance the Prototype

The feedback and the review comments are discussed during this stage and some negotiations happen with the end-user based on factors like, time and budget constraints and technical feasibility of actual implementation. The changes accepted are

again incorporated in the new prototype developed and the cycle repeats until end-users expectations are met [20].

13. Data Gathering Procedure

Actual interview to the water and services unit personnel and administration of the formal questionnaire was administered by the researcher.

With regard to the household consumers, the researcher then provided questionnaires and sought the help of his college students for the easy and massive distribution of the questionnaire to the respondents, and also for the technical assistance while the respondents tried/evaluated the proposed system.

The researcher then requested the volunteer students to bring with them an android/smartphone that were capable of connecting and browsing the web specifically the uniform resource locator (url) of the proposed water billing system. The researcher then provided them with cash to load their mobile devices then connect to the internet. He demonstrated to the data gatherers how the proposed system works specifically the clients' side of the system. The researcher then had an actual demonstration of the system to a certain group of respondents in order to speedily conduct and retrieve the survey instrument.

The researcher also let the admin/end users to try the proposed billing system allowing them to try it. He even provided a wireless broadband, laptop and android phone just to show to the end users the actual capabilities of the proposed system.

The system was evaluated carefully by the end respondents with regard to the evaluation form and guide / user's manual.

The results were tabulated and computed using mean, frequency, percentage and ranking to conclude if the system is acceptable.

14. Internet

The researcher used the information super hi-way, the World Wide Web to gather accurate data and document that is significant to the study critically in the field of Information and Communication Technology before, specifically on matters related to a computer-based testing system.

15. Library Research Method

The researcher used the library research method to gather data about past studies, literature or projects that were similar to the proposed system. The researched materials then helped the researcher to formulate survey instruments, present statistical data and research format.

16. Observations

Observation was done when the users were using the proposed system's prototype.

17. Development Tools

The researcher used MySQL as a database engine, PHP for web development and other plug-ins as need arises.

MySQL is the world's most popular open source database. With its proven performance, reliability and ease-of-use, MySQL has become the leading database choice for web-based applications, used by high profile web properties including Facebook, Twitter, YouTube, Yahoo! and many more.

Oracle drives MySQL innovation, delivering new capabilities to power next generation web, cloud, mobile and embedded applications [14].

The PHP Hypertext Preprocessor (PHP) is a programming language that allows web developers to create dynamic content that interacts with databases. PHP is basically used for developing web based software applications. This tutorial helps you to build your base with PHP. It is a server side scripting language that is embedded in HTML. It is used to manage dynamic content, databases, session tracking, even build entire e-commerce sites. It is also integrated with a number of popular databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server [27].

CodeIgniter is a powerful open-source PHP framework with a very small footprint, created by Rick Ellis in 2006. CodeIgniter was born from Expression Engine, essentially a collection of refactored classes originally written for Ellis Lab's flagship CMS. Stripped of the application-specific functionality, CodeIgniter was made to be a simple and elegant toolkit, enabling rapid development of both web sites and web applications, attracting thousands of talented PHP developers.

In an environment now saturated with PHP frameworks, CodeIgniter was for a long time the only solid choice for a developer who lived in the real world of shared hosting accounts and clients with deadlines. CodeIgniter flew in the face of ponderously large and thoroughly undocumented frameworks, leading PHP's creator Rasmus Lerdorf, an outspoken critic of frameworks, to praise CodeIgniter [7].

18. Statistical Treatment of Data

The researcher utilized the following statistical tools for the treatment of the gathered data.

1. **Percentage** – this was also utilized because it was the commonly used with nominal variables and in frequency tables.

$$p = \frac{f}{n} \times 100$$

where:

p = percentage

f = frequency

n = total population

2. **Mean.** The researcher utilized this because it was the easiest and simplest way of evaluating the proposed system.

$$\bar{x} = \frac{\sum x}{n}$$

where:

\bar{x} = Average of the total respondents rating in each criteria

x = average of respondents responses

n = total number of respondents

3. **RANK.AVG** (Excel Statistical Function) Returns the rank of a number in a list of numbers: its size relative to other values in the list; if more than one value has the same rank, the average rank is returned.

RANK.AVG (number,ref,order)

where:

Number (Required). The number whose rank you want to find.

Ref (Required). An array of, or a reference to, a list of numbers. Nonnumeric values in ref are ignored.

Order (Optional). A number specifying how to rank number.

If order is 0 (zero) or omitted, Microsoft Excel ranks number as if ref were a list sorted in descending order.

If order is any nonzero value, Microsoft Excel ranks number as if ref were a list sorted in ascending order.

- Weighted Arithmetic Mean** - arithmetic mean computed by considering relative importance of each items [26].

$$\bar{X}_w = \frac{\sum wx}{\sum w}$$

Where:

\bar{X}_w Stands for weighted arithmetic mean.

x Stands for values of the items and

w Stands for weight of the item

19. Results and Discussion

TABLE 5: Summary of the results of responses in Sub-Problem 1 on Issues and Challenges faced by the respondents.

Issues/ Challenges	Weighted Arithmetic Mean	Rank	Interpretation
Consumers' account updating	4.75	1	Strongly Agree
Free Format Report generation	3.83	2	Agree

Legend:				
5	-	4.51 - 5.00	-	Strongly Agree (SA)
4	-	3.51 - 4.50	-	Agree (A)
3	-	2.51 - 3.50	-	Moderately Agree (MA)
2	-	1.51 - 2.50	-	Disagree (D)
1	-	1.00 - 1.50	-	Strongly Disagree (SD)

Table 5 shows the summary results. Based on the weighted arithmetic mean of each issues and challenges; consumers' account updating posed the highest which is 4.75

and rank first (1) interpreted as “Strongly Agree” means it is the main problem of the respondents; rank second (2) is report generation with average weighted mean of 3.83 interpreted as Agree.

TABLE 6: Summary results on the level of satisfaction on the proposed billing and collection system.

Software Criteria	Weighted Arithmetic Mean	Rank	Interpretation
Functionality	4.33	2	Satisfied
Usability	4.19	5	Satisfied
Reliability	4.22	4	Satisfied
Portability	4.29	3	Satisfied
Efficiency	4.43	1	Satisfied

Legend:				
5	-	4.51 - 5.00	-	Highly Satisfied (HS)
4	-	3.51 - 4.50	-	Satisfied (S)
3	-	2.51 - 3.50	-	Moderately Satisfied (MS)
2	-	1.51 - 2.50	-	Slightly Satisfied (SS)
1	-	1.00 - 1.50	-	Not Satisfied (NS)

Based on the weighted arithmetic mean posted in Table 6 all of them were rated with verbal interpretation of “Satisfied” with Efficiency - rank 1; Functionality – rank 2; Portability – rank 3; Reliability – rank 4 and Usability – rank 5. Satisfaction result means the system may fit to the needs of the respondents.

First in ranking is item #3 – billing statement printing and free format report generation with weighted arithmetic mean of 4.45 and interpreted as “Acceptable”; second (2) is auto-reminding the consumers for bills due for payment with weighted arithmetic mean rating of 4.37 interpreted as “Acceptable”; third (3) is consumers account updating with 4.35 mean rating and interpreted as “Acceptable”. With these results it is observed that the system will be of help to the end users.

20. Conclusion and Recommendation

On the underlying results mentioned in the findings of the study, the researcher concludes that:

TABLE 7: Summary of the results of responses in Sub-Problem 3 on the level of acceptance on the proposed billing and collection system.

Items	Weighted Arithmetic Mean	Rank	Interpretation
consumers account updating	4.35	3	Acceptable
auto-reminding the consumers for bills due for payment	4.37	2	Acceptable
billing statement printing and free format report generation	4.45	1	Acceptable

Legend:				
5	-	4.51 - 5.00	-	Highly Acceptable (HA)
4	-	3.51 - 4.50	-	Acceptable (A)
3	-	2.51 - 3.50	-	Moderately Acceptable (MA)
2	-	1.51 - 2.50	-	Fairly Acceptable (FA)
1	-	1.00 - 1.50	-	Not Acceptable (NA)

1. The existing billing system though being utilized by the admin/end users is not accepted as it posed "Strongly Agree" in favor of the negative statements in sub-problem 1.
2. The respondents were satisfied on the software criteria, namely; functionality, usability, reliability, portability and efficiency with regard to the situations/statements provided within each criteria.
3. As the results revealed a satisfied condition were obtained as to the respondents' perception on their level of satisfaction on the features of the proposed billing and collection system.

21. Recommendations

Though there were no exact or perfect system, further enhancement and studies were done 24/7 to improve the functionality of every system in any institution, that is why a

never-ending work for IT manpower and greater opportunities to come for the would-be IT enthusiasts.

1. Based on the result of sub-problem 1 without bias it is hereby recommended to change and or upgrade their existing billing system.
2. Though respondents' perceptions were satisfied, there is a need to aim at highly satisfied results that is why enhancement and or modification needs to be employed in order to suit end-users' preference.
3. Respondents' acceptance on the statements posed in sub-problem 3 though all of them were accepted implies a need to focus on some functionalities and/or capabilities of the system which are not mentioned in this study.
4. Further study and enhancement of the system is deemed necessary; practitioners and other researchers may use this as reference for the enhancement and adding unique features in their own system.

Appendix

Appendix A. Admin/ End Users' Operations Manual

Welcome to the Web Based Billing and Collection System for a Municipal Water and Services Unit. The screen shots and the instructions below will help you to maintain and accomplish transactions Menus and sub-menus as displayed in the navigation bar.

Getting Started

1. Run/Open browser (i.e. Google Chrome, Internet Explorer or Mozilla Firefox) then type ewater.pupqc.net in the address bar, hit enter to continue. A login screen will appear as shown below.
2. Type Username and Password to Login to the System.
3. Index page will be displayed after clicking Sign In.
4. Proceed to Cashier Payment, Select Counter then search or click the applicant name in the Accounts List Table.
5. Once saved, an Official Receipt in.pdf is generated and you have the option to save or print it.

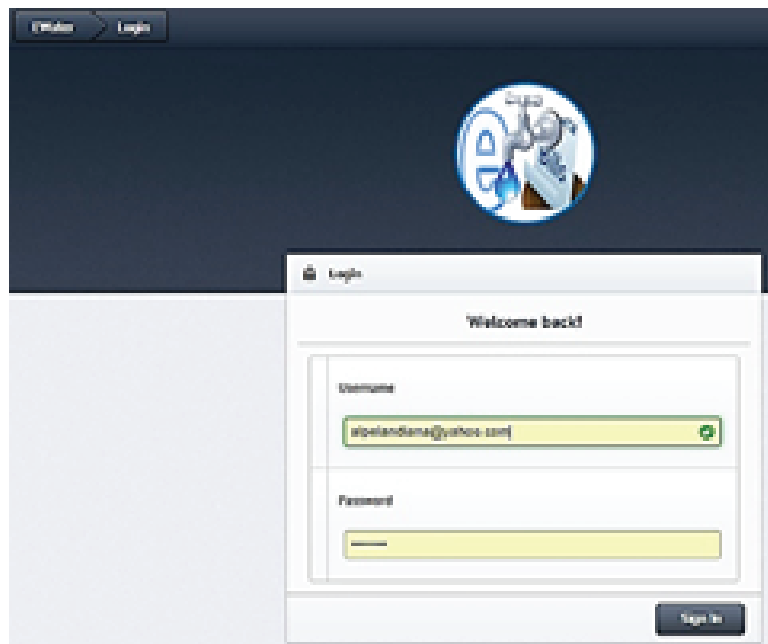


Figure 3: Users Login Screen.

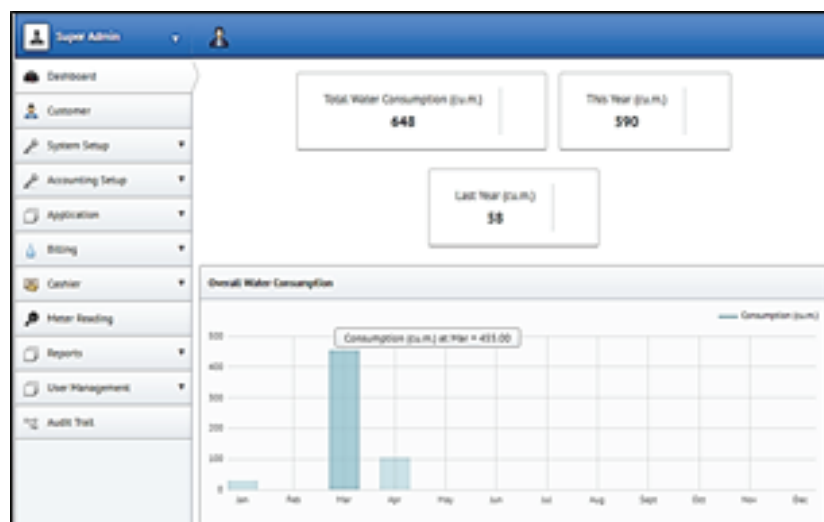


Figure 4: The index page/dashboard with super admin account.

6. **Billing->New Account** – When the new account is tagged For Payment triggered on the Application Process->Inspection, we may now generate the Account's first billing statement from here. From here we can assess the total charges on the Account's first bill. Meter Installation can be paid using instalment for 3 or 6 months. After Assessment, the cashier will have to process the payment for the assessed billing statement. When Assessed, the Administrator will have to go back to the Application Process to Activate the Service (SERVICE ACTIVATION)

Please select a counter below

Counter:

Accounts List:

Search:

Account ID	Name	Meter Serial No.	Account Status
A-000004	Emérico G Vhvar	909889	Activated
A-000005	Gino Ortiz	909898	Activated
A-000006	Cesar Ian Garit	909898	Activated
A-000007	Alko Abe	909899	Activated
A-000008	Riza Michelle Jumola		For Payment

Figure 5: Cashier – Payment Section.

EWater Sanitation and Services Unit
Phase 5 Block 11, Brgy. Mulanay, Quezon
NCR/NAAT Reg. TIN 001-798-870-002

OFFICIAL RECEIPT

No.: 000894-0
Date: 03/07/2016

Received From: Riza Michelle Jumola
Address: Block 12 Don Dabian, Quezon City, Metro Manila A-000008
Amount: Two thousand, Five hundred and zero cents (2,500.00)
In payment for: Registration

Form of Payment: Cash: AP, Bank: _____
Check No.: _____, Date: _____

Received by: Yovichi Perez

*THIS OFFICIAL RECEIPT SHALL BE VALID FOR FIVE(5) YEARS FROM THE DATE OF ATP.

Figure 6: Sample Official Receipt in portable document format(.pdf).

7. **Meter Reading** – When the account has been fully activated, we can start reading the monthly consumption of the user.

Meter reading can be accomplished using personal computer and an android mobile device. To record meter reading, follow these steps:

- (a) Click Meter Reading then type Meter Number or Customer Name.
- (b) Once account has been located, Click plus (+) icon under Action column to record meter reading for the selected customer.

Meter Reading for Riza Michelle Jumola (909991)

Last Reading	<input type="text" value="0"/>
Last Reading Date	<input type="text" value="03/07/2016"/>
Current Reading	<input type="text" value="5"/> ✓
Date of Reading	<input type="text" value="03/31/2016"/> ✓
Total Consumption cum.	<input type="text" value="5"/>

Buttons: Cancel, Submit

Figure 7: Meter Reading Input Dialogue Box.

Billing Statement

Account Number: A-00000
 Customer Name: Riza Michelle Jumola
 Billing Address: Gendak Haka, Cor. Javan Sea Works, Nauru

Billing Period: 03/01/2016 - 03/31/2016
 Present Reading: 5
 Previous Reading: 0
 Meter Consumption: 5 cum.

Particulars	Unit Used	Amount	TOTAL
A. Water Bill			
Minimum Service Charge	0	200.00	200.00
Additional Service Charge	0	0.00	0.00
		Sub-total	200.00
B. Payment for Water Meter			
		Sub-total	0.00
C. Other Charges			
Statement Fee		00.00	00.00
D. Discounts			
		Sub-total	0.00
Total			Php 200.00

TOTAL AMOUNT ON/BEFORE DUE DATE Php 200.00
 PENALTY Php 125.00
 TOTAL AMOUNT AFTER DUE DATE Php 325.00

Figure 8: Sample of New Billing Statement.

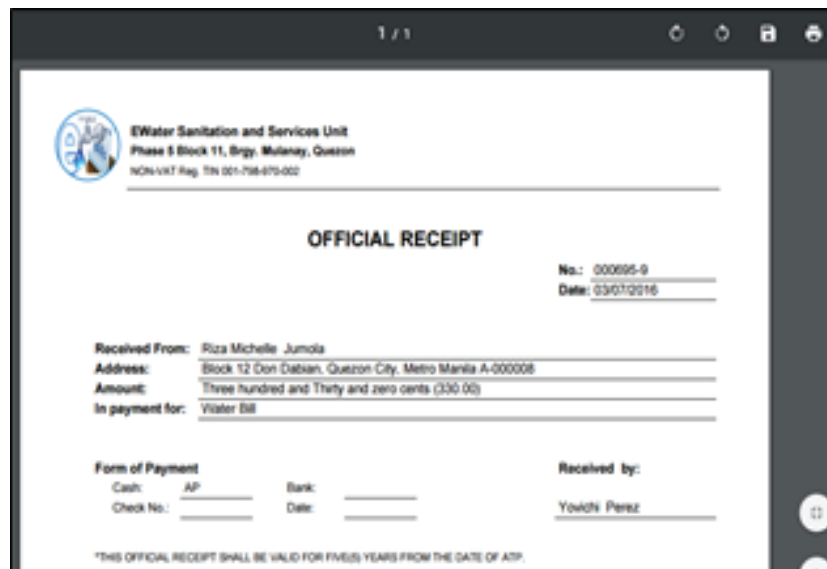


Figure 9: Sample Official Receipt Generated.

Account ID	Name	Address	Meter No	Date Started	Customer Type	Status
A-000004	Genaro G Vitor	402 Kalyaan St. Newalibon, Quezon City West Manila	30995	12/10/2016	Household	Activated
A-000005	Concepcion Garcia	4012 Balaan Hill, Quezon City, Metro Manila	30996	05/02/2016	Household	Activated
A-000007	Alice Aba	Block 11 Gamaso West, San Jose Del Monte, Bulacan	30999	05/02/2016	Household	Activated
A-000008	Riza Michelle Jumala	Block 12 Don Dabian, Quezon City West Manila	30991	05/02/2016	Household	Activated
A-000009	Aber Lorena Patandana	402 P. Bugan Street Brgy 4 Paltasan, Mubay, Quezon	30990	05/02/2016	Household	Activated
A-000010	Fernando T. Bantua	P. Bugan Street Brgy 4, Mubay, Quezon	01,5401190231	05/02/2016	Household	Activated
A-000011	Michelle N. Rosales	San Patrocinio Brgy 4, Mubay, Quezon	01,5400002507	05/02/2016	Household	Activated
A-000012	Andrea K. Rosales	P. Bugan Brgy 4, Mubay, Quezon	30987	05/02/2016	Household	Activated
A-000013	Josefin F. Rosales	P. Bugan St. Brgy 4, Mubay, Quezon	01,5400007129	05/02/2016	Household	Activated
A-000014	Wenanda G. Aza	Stumental St. Brgy 4, Mubay, Quezon	01,5400712229	04/23/2016	Household	Activated
A-000015	Clarita R. Rosales	J.P. Rizal St. Brgy 4, Mubay, Quezon	30985	05/02/2016	Household	Activated
A-000016	Solena S. Parilla	P. Bugan St. Brgy 4, Mubay, Quezon	01,5401007044	05/02/2016	Household	Activated
A-000017	Clarita C. Palao	San Patrocinio Brgy 4, Mubay, Quezon	01,5400002506	05/02/2016	Household	Activated
A-000018	Remedio S. Aza	Stumental St. Brgy 4, Mubay, Quezon	01,5400712224	05/02/2016	Household	Activated
A-000019	Ma. Teresa R. Caballero	Rizal St. Brgy 4, Mubay, Quezon	01,5400007024	05/02/2016	Household	Activated
A-000020	Clark S. Garcia	San Patrocinio Poblacion, Mubay, Quezon	100005	05/02/2016	Household	Activated
A-000021	Thelma R. Espino	J.P. Rizal St. Poblacion, Mubay, Quezon	01,5400000020	05/02/2016	Household	Activated
A-000022	Felix Jaramila	J.P. Rizal Poblacion, Mubay, Quezon	01,5401007034	05/02/2016	Household	Activated
A-000023	Roberto P. Bantua	Stumental St. Brgy 4, Mubay, Quezon	01,5400007011	05/02/2016	Household	Activated
A-000024	Elizabeth B. Jaramila	J.P. Rizal Poblacion, Mubay, Quezon	01,5400007030	05/02/2016	Household	Activated
A-000025	Concepcion M. Medina	J.P. Rizal St. Brgy 4, Mubay, Quezon	01,5400000447	05/02/2016	Household	Activated
A-000027	David M. Rojas	San Patrocinio St. Brgy 4, Mubay, Quezon	100199	05/02/2016	Household	Activated
A-000028	Armagar R. Tugte	James St. Brgy 4, Mubay, Quezon	100198	05/02/2016	Household	Activated
A-000031	Roberto A. Tugte	P. Bugan St. Brgy 4, Mubay, Quezon	100197	05/02/2016	Household	Activated
A-000034	John F. Parilla	Rizal Poblacion, Mubay, Quezon	100195	05/02/2016	Household	Activated
A-000036	María Fe Patricia E. Aza	San Patrocinio Poblacion, Mubay, Quezon	100194	05/02/2016	Household	Activated
A-000037	Armando S. Jaramila	J.P. Rizal Poblacion, Mubay, Quezon	100193	05/02/2016	Household	Activated

Figure 10: List of Accounts (.pdf) generated report file.

Appendix B. Clients/Household Consumers Manual

Once Login, screen as shown below will be displayed. Client dashboard shows the Total Water Consumption (cu.m.), This Year and Last year water consumption in cubic meter.

You may view all your paid invoices as well as pending one. Click View Invoice under Action column to display a.pdf copy on the screen.

If clients have Frequently Asked Questions. They may click FAQ to show some of the Frequently Asked Questions.

Clients may open their email account to view notifications.

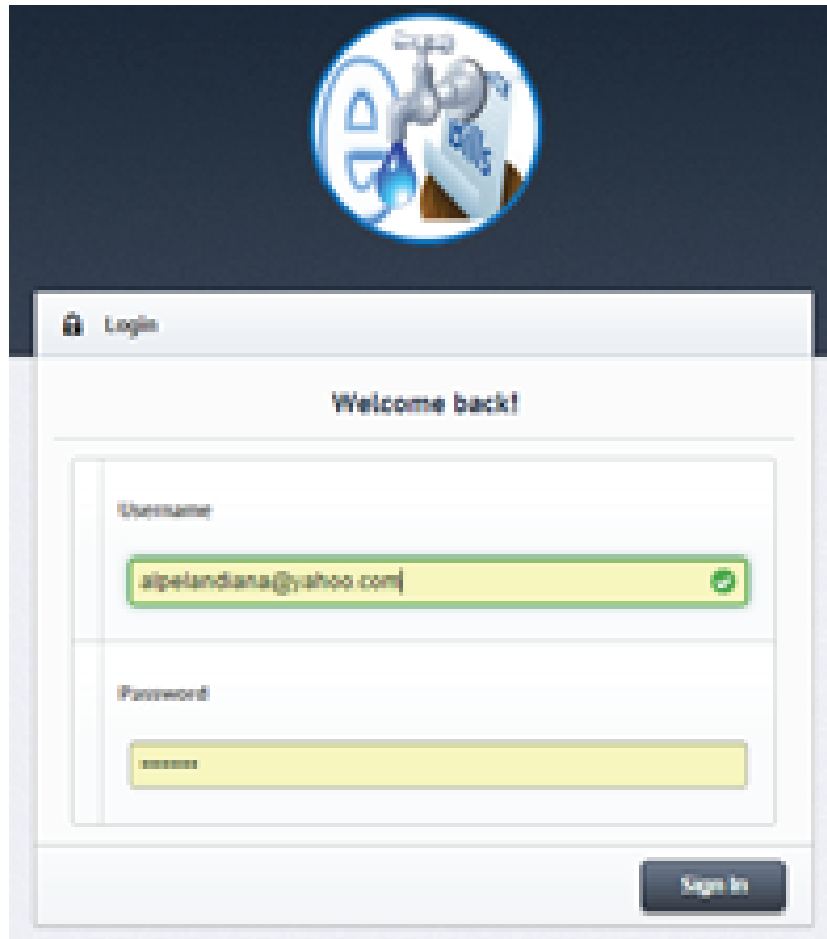


Figure 11: Client Login Screen.

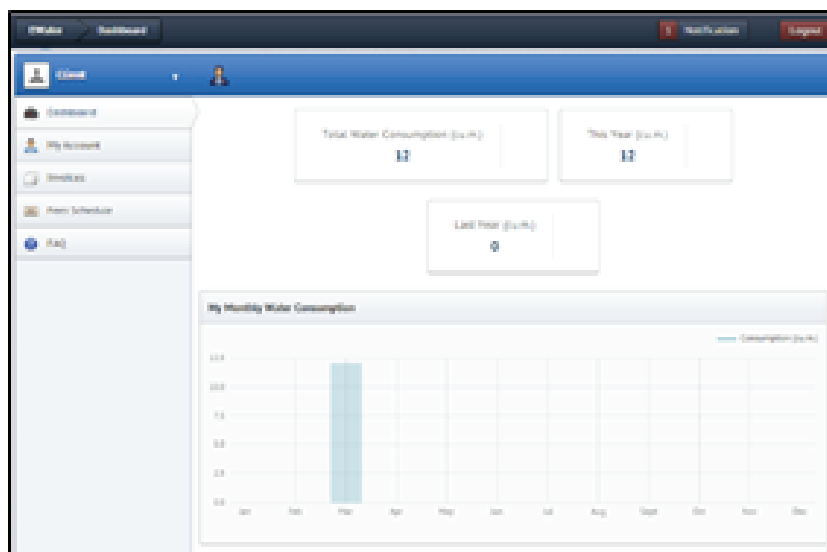


Figure 12: Client Account Dashboard.

Once client's transaction is complete, Click Logout to end session.

Invoice ID	Amount Before Tax	Amount After Tax	Billing Date	Start Date	Disconnection Date	Billing Fee	Status	Action
000000-0	2 500.00		05/04/2018	05/15/2018		Registration	Paid	[X]
000000-0	9 00.00	857.90	05/04/2018	05/15/2018	05/04/2018	Water Bill	Current Over	[X]
000000-0	785.00	701.00	05/04/2018	05/15/2018	05/04/2018	Water Bill	Current Over	[X]
000000-0	3 241.00	3 067.70	05/04/2018	05/15/2018	05/04/2018	Water Bill	Pending	[X]

Figure 13: Client Invoices Table.

EWater Services
Mulanay, Quezon
(047)-319-0990

Billing Statement

Account Number: A-000007
Customer Name: Gilmore M. Analla
Billing Address: Brgy. Area 1, Tanyag Pkwy., San Jose Del Monte, Bulacan
Billing Period: 05/15/2018 - 05/14/2018
Present Reading: 18
Previous Reading: 15
Water Consumption: 3 cu.m.

PARTICULARS	cu.m. used	Amount	TOTAL
A. Water Bill			
Balance from 05/04/2018	3	300.00	300.00
Balance from 05/04/2018	3	300.00	300.00
Minimum Service Charge	1	200.00	200.00
Additional Service Charge	0	0.00	0.00
		Sub-total	800.00
B. Payment for Water Meter			
		Sub-total	0.00
C. Other Charges			
		Sub-total	0.00
D. Discounts			
		Sub-total	0.00
Total			Php 800.00

TOTAL AMOUNT ON/BEFORE DUE DATE: Php 800.00
PENALTY: Php 20.00
TOTAL AMOUNT AFTER DUE DATE: Php 820.00

Figure 14: Sample Client Billing Statement.

Frequently Asked Questions (FAQ)

Below are the list of Frequently Asked Questions. If you feel that the information stated below for your question does not fulfill your needs, please don't hesitate to call us on our Hotline Number for further details.

How to Detect Leaks?

Switch all the faucets off and check if the Water Meter continues to read. If so, trace the pipeline from the water meter to the faucets.

How to read Water Bill?

The billing statement displays all the charges incurred on the account. The PARTICULARS column is meant for the FEE DESCRIPTION. Cubic Meter is defined and the total cost of the consumption.

How to report illegal connection?

Call our customer support hotline number (044)-098-0990 or drop by at your nearest service center.

Figure 15: Frequently Asked Questions.

Author's Note

Abel Lorenia Pelandiana, MSIT is a full-time faculty of the Polytechnic University of the Philippines Mulanay, Quezon Branch.

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