

Intelligent Web And Mobile Application Servicing System For MAPECON Cavite Highland

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Abstract— With the increasing volume of the company's customers, MAPECON has been experiencing problems in their manual operations including the difficulty of monitoring quarterly maintenance, slow process in making proposals or quotations for customers, inefficient scheduling of technicians, failure of technicians to get assignments on time, and delayed services resulting to customers' dissatisfaction. MAPECON changes the way it handles services by enhancing its current servicing system through the development of a real-time web and mobile application servicing system. Iterative model was used as system development approach because of its flexibility to adapt to possible changes in the process or requirements during the development phase. In order to develop the system, PHP, XAMPP, and MySQL were used for the web application, nexmo for SMS gateway, and SQLite and Android Studio for the mobile application. The web app lessens the tasks of service staff in monitoring customers' quarterly maintenance, automatically calculates the estimated price of the customers' inquiries, sends alert messages to the technicians regarding the assigned services, shortens the process of scheduling services to the service technicians via SMS technology, and tracks the sales status as well as sales projections. The integration of mobile application allows the agent and technician to view assigned schedules, evaluate the technician's performance, and monitor assigned maintenance schedules. The system was evaluated with a weighted average of 4.63 which means it has met the desired functionalities. Further improvements that can be made include integrating online payment, adding live chat support, and locating and tracking technicians' location.

Index Terms— Integration, Mobile Application, Pest Management, Scheduling Services, Servicing System.

1 INTRODUCTION

NEW technologies including internet, mobile phone and global delivery development have been transforming businesses more and more rapidly. As for now, one of the trends is to bring the business together with mobile application since mobile devices can link the people directly into the office while working in the field. [1] People around the world are using mobile devices for a variety of purposes. Available applications indicate that mobile phones are no longer exclusively used for telephone communication only but have other interesting features like service management application to automate businesses workflows and to connect workers from the field to the office to provide visibility into based what is happening in the field service [2]. The integration of technologies leads to a servicing system which will provide a bigger impact and will contribute a lot to the progress of all business classification. Internet web technologies with mobile application has been one of the most effective technologies used to deliver information that is used to manage quality customer service and services to the users. [3] Replacing the manual system with one that is accessible on the internet and android mobile phone, it is able to improve the services offered to customers. This involves processes such as scheduling, controlling documents, monitoring, recording and managing customers' information, and evaluation from the services rendered to increase service to the customer while systematically reducing costs. Each of these processes can be controlled and automated through web and mobile based servicing solutions [4]. Now more than ever, people have become more concerned about having a pest-free environment and are taking necessary steps to ensure that their homes are inspected to prevent it from damaging bugs [5]. When a pest infestation is established, it can often be difficult to remove it without the help of a professional pest management company like My Almighty's Plan to Exalt Christ Operates Now (MAPECON) [6][7]. MAPECON offers the best environment-friendly solutions for pest problems. These are 100% indigenous Filipino products which can ever be guaranteed pest-free environment. MAPECON Cavite Highland uses manual operation in making reports, retrieving data, rendering services, posting schedules, and confirming with agents to have an actual survey. Due to the increasing volume of the company's clientele, MAPECON employees and management

staff experience many problems in the current system, notably, customer service dissatisfaction. The problems encountered include: monitoring of quarterly maintenance required by the customers; manual estimation or slow process of making proposals or quotations to the customer; service staff not being able to schedule technicians in advance for automatic processing due to the current manual procedures of doing its services in which customers' data are listed on the logbook of agents which is handed to the service staff; slow report making specifically on the sales causing delays in decision making by the manager; and the technician finds difficulty in finding out the schedule of assignment of services that leads to delayed rendering of services resulting to dissatisfaction of customer.

To bring ease in the operations, the researchers developed a system that has an SMS notification that will deliver timely and important information directly to the customer and to the concerned personnel with the updated schedules that MAPECON needs to render, an automated quote generator allowing the system to generate quoted prices initially, and a mobile application wherein agents and technicians will be able to view their daily, weekly and monthly assigned schedules, detailed/ progress report of all the jobs held, records of work history, and attendance monitoring or a track of the service completion information by evaluating technician's performance.

2 METHODOLOGY

2.1 System Development Process Model

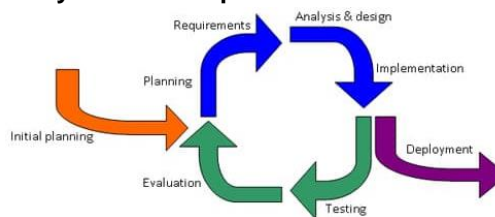


Fig. 1. Iterative Development Process Model

Fig. 1 is an iterative model used as the system development methodology applied in the development of the study. An iterative life cycle model is an implementation of a software development life cycle (SDLC) that focuses on an initial, simplified implementation, which then progressively gains more complexity and a broader feature set until the final

system is complete [8]. The development of this method begins in specifying and implementing requirements specifications partially. This process can be reviewed later to identify further requirements which produces a new version of the software and early during the software life cycle mode.

1) Planning and Requirements Phases

In initial planning and requirements phase, the researchers listed down ideas and tools that can be used for the next phases. The ideas include all the possible problems that MAPECON staff might be facing. It is very important for this stage because it tells the researchers what needs to be done. Among the tools listed were the hardware specifications and the software that will be used in the development of the system. Some of these software are PHP, XAMPP Server cross-platform web server to run online, MySQL for the database server, nexmo for SMS gateway for the web, and SQLite and Android Studio for the mobile application. Significantly, all the modules that are included in the developed system were identified and created by the researchers, namely: Login Management, Accounts, Services with Automated Quote Generator module, Workforce Management, Sales Analysis, and Reports Generation Module. Some aspects to improve and solve the problems encountered in software were determined. The researchers conducted an interview with MAPECON's authorized representative to gather information's including the processes starting from the customers' inquiry, how MAPECON staff set the survey to the customers' place or area of pest infested, the manual listing of records, and to the generation of the report. The data gathered served as the basis for the researchers to evaluate the problems they faced through their current operations and were scrutinized to specify the requirements, the needs of the user and solutions to certain problems following the flow of the process of developing web and mobile application that can solve the said problems. As part of the first step on creating the web and mobile application, the researchers also gathered data information from different published studies, books, the internet, and libraries that provide procedures needed in developing the system. Additionally, the researchers worked closely with the MAPECON's staff that will support in developing the application and identified the functionality, performance levels and other characteristics which the system must satisfy for it to be acceptable to the user.

2) Analysis and Design Phases

Analysis and design is a big factor that will affect the other phases like implementation and testing because this will be the foundation of the system. At first, the researchers visualized each actual method done by the person handling sales, services, and reports. The designing and visualization of web and mobile apps were considered. The researchers went on to visualizing the developed system environment and user-friendly interface for each module. The problems encountered by MAPECONs staff were graphically presented using data flow diagram. This is to represent how users will have an interaction with each module of the system.

3) Implementation Phase

The researchers start developing the system to show the clients and receive some feedbacks to improve and add the

other functionality, with portions of each module. All the modules coded were based on everything that was agreed upon in the planning and requirements phase. Every module was followed according to the conceptual framework and the research scope.

4) Testing Phase

MAPECON staff tested the functionality of the system. It involved testing of each module as this was the most efficient way to debug the errors at this stage. Each module that would be used in the system should be working appropriately. Every part of the developed system was tested for the modules to be error-free. Whenever developers saw errors while conducting this phase, debugging those errors became the developers' top priority. After debugging, the process was repeated until the developed system achieved its primary objectives.

5) Evaluation Phase

MAPECON assessed if each module met their specifications based on their requirements. MAPECON's users and the researchers reviewed the software. In case there were changes needed to be done, these were fixed immediately to make the system usable for the MAPECON. It is also where the reliability, robustness, efficiency, and maintainability of the system were evaluated. The developed system was then found to conform to the hardware and software specifications used by MAPECON including the mobile phones, internet connection, and some of the software that should be installed to use the system properly.

6) Deployment Phase

When all phases were done, the deployment phase was carried out to deploy the system made by the researchers. After the system was built, tested, evaluated and the requirements were met, the development of the final system was thoroughly evaluated and tested. Then the researchers released and prepared for the assembly and transferred it to MAPECON developed system. The installation and maintenance were applied.

2.2 System Architecture

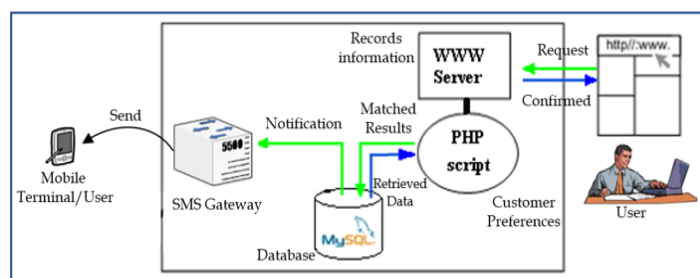


Fig. 2. System Architecture of IWMASS

Fig. 2 displays the structural design of IWMASS that connects to the database. All data including the sales, services and information of the customer are being saved. The system can be accessible in browser which is connected to the internet. The customers can visit the application for the rough estimation, where customers can also view and send information for their inquiry. After inputting the needed information for the actual survey of the agent, the system will directly send notification to the service staff account for the schedule of appointment. Service Staff then assigns the Agent

to have a free survey to the customer. Once customer agrees with the final price after actual survey of Agent, Agent updates the customer's records by editing the estimation and date of survey. Then, payment will be made. And finally, Service staff finalizes the schedule of Technician that will be entered into the system so that misinformation on the schedule will be prevented. Then, customer is notified through his smartphone and service staff for the quarterly maintenance schedule, and technicians regarding the assigned services. This SMS notification will automatically be sent without the need of MAPECON staff to send the notification manually. This can be accomplished once the service staff assigns the technicians to render the service/s to the specific customer. Customer's information will be stored in the same database servers

2.3 System Modules

For the web-application, it will keep the MAPECON's records and files obtained from the transactions and services which are stored online for accessibility and portability. The modules are:

1) Login Management Module

This is the authentication that users can access the system. It can be used by admin/ owner, service staff, service technician, manager, agent, customer and accounting staff.

2) Accounts Module

This is the system user management where in admin/owner can control the whole system. Admin can add/create users account, update and modify the system. Moreover, Admin can activate/deactivate accounts. Admin should have prior knowledge of the system. It is also providing information of different users. Customers can view their own records. And, customers can take appointment online once registered.

3) Sales Analysis Module

In this module, manager keeps track of what is happening with MAPECON's sales everyday as well as projections. It will have an interactive dashboard that allows for quick filtering and analysis for quick insight for accurate decisions through charts. It will also allow to analyze and visualize sales that can help a manager track and manage most services acquired by the customer, current deals, contact list, and sales forecasting.

4) Reports Generation Module

In this module, users can generate reports about services and transactions and other related reports. Reports can often be distributed using printed documents.

5) Workforce Management Module

This module is about management of services for customer where the staff can add and update customer's services and information. Customer's details can be viewed in this module, and can check declined, approved survey and pending request. When a customer agrees with the final price after actual survey of Agent, the Agent updates the customer's records by editing the estimation and date of survey. Payment will be made after. Lastly, Service staff finalizes the schedule of Technician that will be entered in the system so that

misinformation on the schedule will be avoided.

6) Appointment Module

Customers can take appointments or inquiries online by entering all needed information to determine the type and extent of pest infestation. The system notifies the people responsible like the service staff who can then approve the request and verify the information. The date and time will be given to the Agent to meet with the customer to conduct a free survey and to discuss options for extermination.

7) Automated Quote Generator

The system automatically calculates the rough estimate price. Automated Quote Generator facilitates the collection of complete and consistent data for the advanced estimation of rough estimate price quotation. It will simplify and speed up the process to send request for free survey.

8) SMS Notification Module

The system also provides SMS notification feature to be sent to the customer and service staff for the quarterly maintenance schedule, and technicians regarding the assigned services.

Lastly, the manager can view the technician's daily service at a given point in time once evaluations are done. Data will be secured in the database to provide accurate information and reliable updates on the information stored in the database.

The mobile application has the following modules:

1) Login Module

This allows authentication to enable users who are technicians and agents to access the mobile app.

2) My Schedule Module

This is where the user can view and search the updated assigned schedules daily, weekly and monthly without reporting in the company.

3) Job History Module

This is where agents will be able to view their detailed/ progress report of all the jobs performed, records of work history, and attendance monitoring or a track of the service completion information.

4) Evaluation Module

This is the part of application which customer uses to evaluate technicians when work has been done. The evaluation process can be done as customer activates the generated code sent to the customer through SMS notification.

5) Profile Module

This is where users can manage their account, update and modify the information. .

2.4 Data Flow Diagram

Data Flow Diagram (DFD) is a graphical representation for specifying, constructing and visualizing the model of a system. It is used in requirements definition in a graphical view. It also shows the analysis and logical flow of data through a system when or in what sequence the information takes the input and output of data [3].

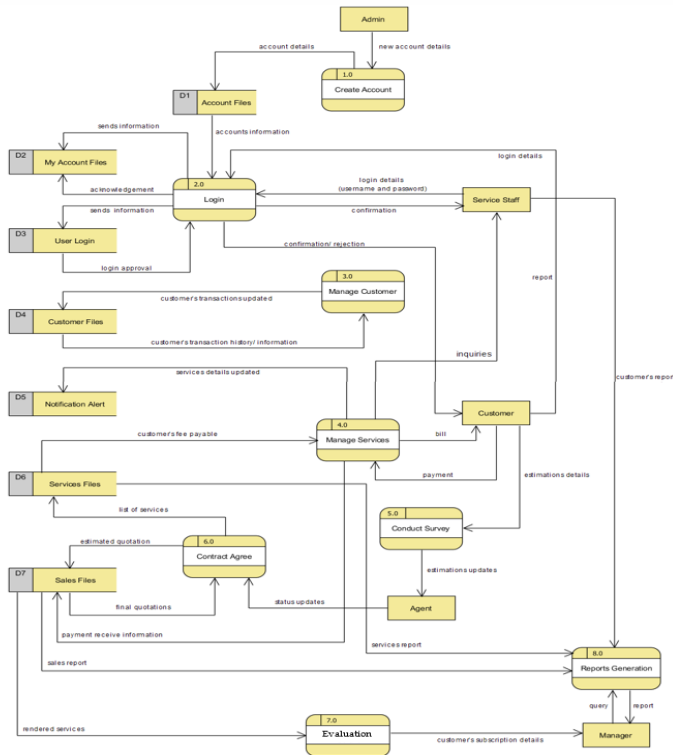


Fig. 3. Data Flow Diagram of IWMASS

Fig. 3 represents the data flow diagram of the web and mobile application servicing system for MAPECON. It represents the data flow diagram of the developed system, composed of the admin, manager, service staff, accounting staff, technician, agent and the customers. The admin can access all the modules. The service staff manages the customer information, management file, booking file, and sends SMS. The technician uses the mobile application for evaluation to be done from the customer. The accounting staff generates sales report and stocks report to be forwarded to the manager and admin. The service staff confirms the customer inquiry and processes the customer’s survey information while the customers input the services needed and assigns agent to conduct an actual free survey. Entities and output of this system include processing MAPECON records, generating reports, processing booking records, and rendering services and payment. The researchers used Visual Paradigm developing the Data Flow Diagram.

2.5 Sampling and Sampling Technique

There are 32 respondents of this study consist of technicians, sales agent staff, admin staff, customers and IT experts. They evaluated the system to find out if there were areas of

improvement and if the system functions as it was intended to in terms of software’s accuracy, suitability, interoperability, compliance and security based from ISO/IEC 9126. The purposive sampling technique was the sampling technique used in the survey

2.6 Statistical Treatment

The mean (x) is computed to determine the average value obtained by each variable in the questionnaire.

The formula for mean of ungrouped data is

$$\bar{x} = \frac{\sum fx}{n} \tag{1}$$

where \bar{x} is the mean, f is the frequency of each data point, n is the total frequency.

TABLE I. INTERPRETATION OF MEAN VALUES

Range of Mean Values	Scale Values	Interpretation
4.51 – 5.00	5	Excellent
3.51 – 4.50	4	Above Average
2.51 – 3.50	3	Average
1.51 – 2.50	2	Below Average
1.00 – 1.50	1	Poor

Table I shows the range of mean values used by the researchers to interpret the obtained data while the scale values is used by the respondents to rate the system based on the criteria set by the researchers.

3 RESULTS AND DISCUSSIONS

3.1 The Developed System

IWMASS is a custom information system that is used for free survey appointments of MAPECON Cavite Highland and for the management of multiple customers availing the services. This system is integrated with web services with the following features: SMS notification that delivers timely and important information directly to the customer and to the concerned personnel with the updated schedules that MAPECON needs to render; automated quote generator allowing the system to generate quoted prices initially to make the free survey where in the user can see the various inquiries of the customer; confirmation of inquiries and update of quoted prices as needed; a mobile application wherein agents and technicians are able to view their daily, weekly and monthly assigned schedules; detailed or progress report of all the jobs they have held; records of work history; and attendance monitoring or a track of the service completion information as well as evaluation of technician’s performance given by the customers.

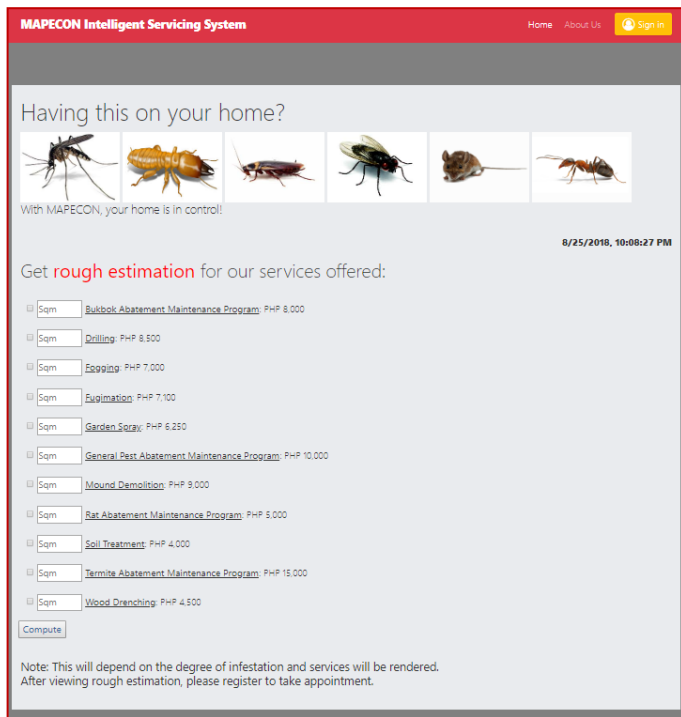


Fig. 4. Pre-Computation of Price

Fig. 4 shows the pre-computation of the price after clicking the Compute button. When customer visits the website, the customer can choose multiple services by inputting the area of the pest infected in square foot and getting a rough estimate of the total price of the pest services that the customer wants to avail.

Sales charts designed to visualize sales goals of MAPECON so that manager can always see where they stand; Services Availed that shows list of services related to what the customer avails of most; Payment Chart that displays the mode of payment the customer uses which is cash or partial; Booking Inquiries which identifies what month the customer makes the most number of appointments; Inquiry Status that shows the customers' inquiry status as approved or declined; Customers' Area that can help manager visually see what cities or places have the most availed services; and Visitors Monthly which identifies in what month there are more returning users or people visiting or interacting with the site.

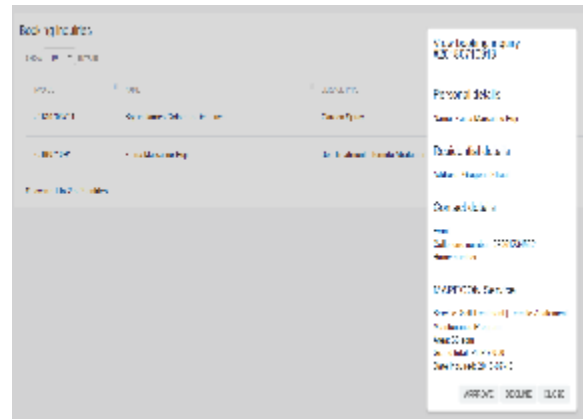


Fig. 6. Booking Inquiries

Fig. 6 shows the booking inquiries of the customer. Once the customers are done with the online appointments, all the inquiry details of the customers will be displayed in this module. Service staff is the one who can approve or decline the request. If the staff approves, the transaction will be sent to the Approved folder and assigning of agent to conduct actual free survey will then be processed. If declined, the transaction will be stored in the transaction as Declined.

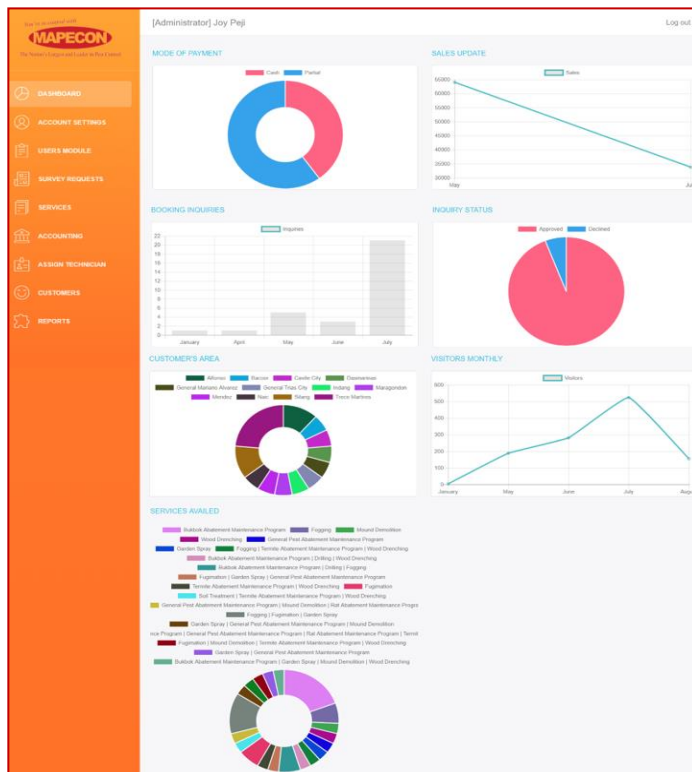


Fig. 5. Main Navigation

Fig. 5 shows the main navigation of the system. The admin can navigate the following: Dashboard for visualization of

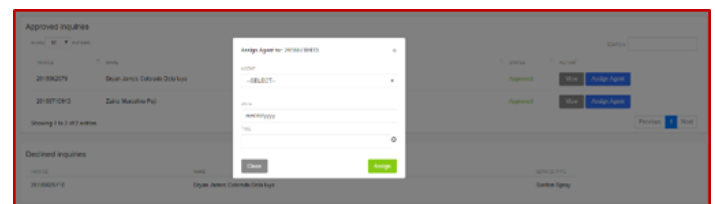


Fig. 7. Assigning Agents

Fig. 7 shows where the assigning of agent by the service staff is done to meet the customer and conduct the actual survey.

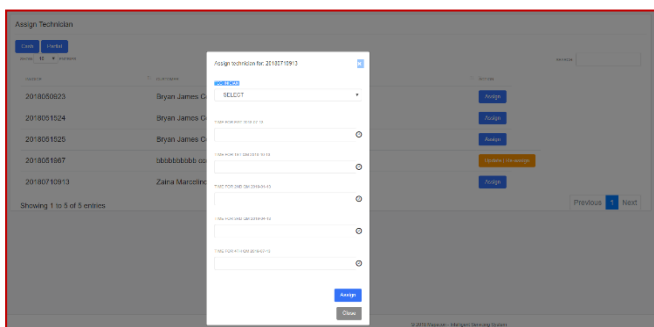


Fig. 8. Assigning Technician Schedule

Fig. 8 shows how service staff assigns schedules of the technician to a specific customer. It includes the time and date for the first general treatment and for the quarterly maintenance.

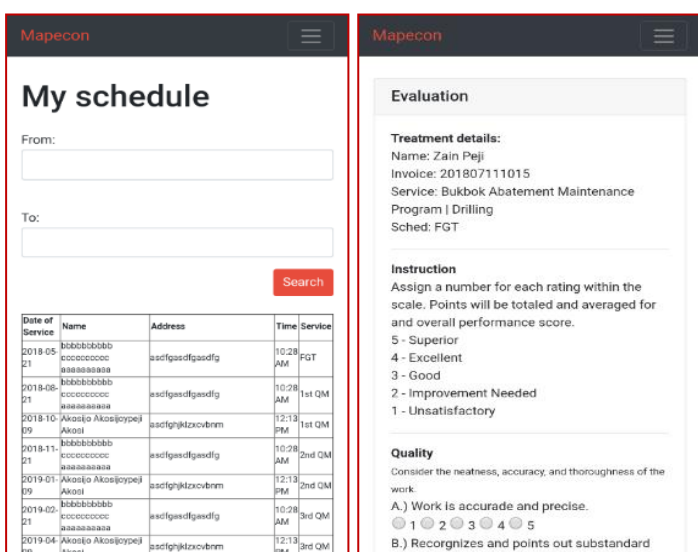


Fig. 9. Mobile Application Viewing of Schedules (left) and Evaluation of Technician (right)

Fig. 9 shows the assigned quarterly maintenance schedules of technicians and the content of the evaluation form in the mobile application that will be filled out by the customer after the technician's work is done.

3.2 SUMMARY OF FINDINGS

Table II presents the summary of the perception of the respondents in the system in terms of the sub-characteristics of Functionality namely accuracy, suitability, interoperability, compliance and security. Accuracy and Suitability have the highest composite averages with 4.82 and 4.83, respectively which are interpreted as Excellent. It means that the designed functionalities were met successfully based on the needs of the company and the customers. The respondents assessed interoperability with a mean of 4.32 which means it can work with other products with high satisfaction. The sub-characteristics, Compliance and Security, received a computed means of 4.68 and 4.53 respectively, which means the system was able to comply with the standards and meet the existing requirements excellently. The over-all assessment of the respondents to the system is Excellent with a composite

RESPONDENTS IN THE SYSTEM IN TERMS OF THE SUB-CHARACTERISTICS OF FUNCTIONALITY

Criteria		Ave
Accuracy		
1	The system does what was proposed correctly.	4.90
2	The system is precise in executing its functions.	4.70
3	The system is precise in its expected results.	4.85
		4.82
Suitability		
4	The system has the required functions as	4.80
5	The system does what is appropriate for the	4.93
6	The system performs the required tasks.	4.75
		4.83
Interoperability		
7	The system can interact with other software.	4.40
8	The system can interact with the specified	4.45
9	The system has the capacity for multi-user	4.10
		4.32
Compliance		
10	The system complies standards or conventions	4.60
11	The system meet the existing requirements.	4.85
12	The system complies with different software	4.58
		4.68
Security		
13	The system is protected from unauthorized	4.60
14	The system is equipped with acceptable	4.45
15	The system has secure access through	4.55
		4.53
Composite Mean		4.63

mean of 4.63 which means the system was able to incorporate all the necessary functions needed and it is capable of presenting, processing and producing accurate information.

4 CONCLUSIONS AND FUTURE WORKS

The developed IWMASS met all the requirements set and functionalities that it has to perform. The web application was able to provide a real-time accurate quotation that computes for the total price of the services requested by the customer. The developed system is able to successfully manage maintenance schedules of the technicians ahead of time and maintenance schedule for customer until such customer's contract ends while also assigning schedules to technicians. In addition, the system was able to track the sales status as well as sales projections in an efficient way due to an interactive dashboard that allows analysis and sales visualization. In this way, it promotes more effective MAPECON's marketing campaigns, decision making and overall management, and provides less time for analyzing the MAPECON's revenue and profit. The mobile application was able to make the technicians perform effectively and accurately because they can view their assigned schedules, the customer can evaluate them, and the manager can monitor the assigned maintenance schedule of the technician.

ACKNOWLEDGMENT

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TABLE II. SUMMARY OF THE PERCEPTION OF THE

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