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Me-Connect: An SMS Alert System for Online Pest Control Services

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Abstract: MAPECON Cavite Highlands provides environmentally friendly pest control solutions, necessitating the development of an integrated system to serve as a notification alert to customers and service technicians. MAPECON employees and management face challenges as the company's customer base expands, resulting in dissatisfaction with customer service. This newly developed system alters the way MAPECON handles services provided, reducing human error and improving its current servicing system. This servicing system has the following features: (1) a system that reduces the service staff's workload in monitoring the customer's quarterly maintenance; (2) an online scheduling system that allows the administrator to view the Technicians' daily service at a given point in time; (3) a system that sends alert messages to Technicians regarding the assigned services; (4) an online system that uses SMS technology to shorten the process of scheduling services for Service Technicians; and (5) a system that uses SMS technology to alert Technicians for required service in the future. The descriptive method of research was used in this study, which was created with PHP as its platform and MySQL for its database, while the Fourth Generation Technique software model was used due to its flexibility. Me-Connect, also known as MAPECON's E-Connect, sends real-time transactions to the appropriate personnel, which is critical for providing good service. Using ISO/IEC 9126 software product quality standards, the system received an average rating of 4.53 from respondents, indicating that it served its functions properly and met all of the required requirements.

Keywords: e-Connect, Automated, SMS alert, real-time transactions, pest control services

1. Introduction

The SMS Alert System [1] can send information or messages immediately or schedule them to be sent later for both internal and external communication [2-4]. This message can also be automated and delivered through other companies' software systems [5-7]. Technologies emerge to introduce new methods of advancement for pest control services [8]. One example of modern technology [9][10] is global customer service delivery, which is rapidly transforming businesses. Communication technology in service delivery has become an important part of modern society because it provides information

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security and assurance, which is an important competitive lever for modern firms [11][12]. It provides the company with an advanced alert notification system based on a dependable, efficient, and secure platform for rendering service communications [13]. With automated text messages, or scheduled Short Message Service (SMS) [14], sending is a connection that maintains customer relationships automatically [15]. It is a well-known method of notifying users about an event scheduled to take place within a specific time frame in the company. It also aids in communication when information must be submitted over long distances or when people cannot physically meet the concerned staff [12].

With the manual operations of MAPECON Cavite Highlands in rendering services and assigning and confirming schedules to the technicians, numerous issues such as: (1) difficulty monitoring quarterly maintenance for customers; (2) delays and time-consuming assignments of daily schedules, and (3) difficulties for technicians to know the time and assignment of services, resulting in customer dissatisfaction, are unavoidable.

Some applications are designed to entertain; others are designed to reduce human effort; still others are designed to reduce complexity and aid in decision-making; and still others are designed to automate manual systems [16][17]. Thus, the researcher came up with the system, which is an advantage for MAPECON Cavite Highlands and improves the quality of service that they provide to their customers. It has a real-time transaction for the concerned personnel, which is an important factor in providing good service. Therefore, the technician staff will be more productive and effective in providing services to customers.

The study gave more knowledge about online-based systems, such as how to explore, learn, improve design skills, and understand what can be done to make the system more useful to others, specifically to the: (a) Service Staff who have an easier time assigning Technicians their assigned daily schedule; (b) Accounting Staff who have an easier time generating the summary report because the system can generate reports showing the services that Technicians have rendered; (c) Technicians are now informed of their schedules via SMS, eliminating redundancy errors in all rendered services; (d) The owner/administrator can now monitor and oversee the day-to-day services of technicians; (e) Future Researchers who want to conduct similar studies can get background information from the results of this study, which will serve as a template for their research; and (f) MAPECON improves the productivity of its workplace and increases the overall performance of its staff in terms of services.

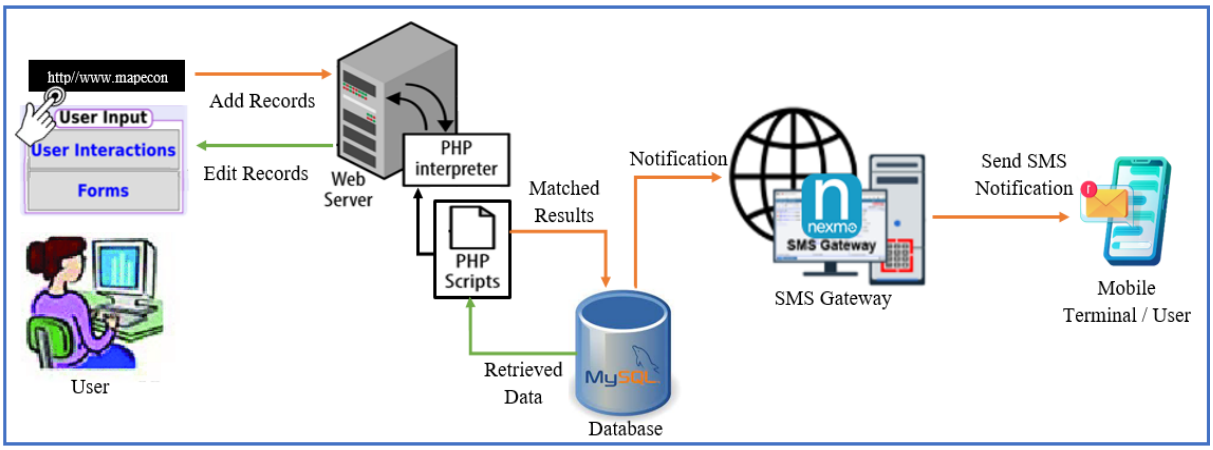

Figure 1. System Architecture

Figure 1 depicts the structural design of MAPECON's E-Connect, which connects to the database. All data is saved, including sales, services, and customer information. A browser that is connected to the Internet can be used to access the system. Owner/administrator, accounting, and service staff are the

system's three primary accounts. The owner and administrator have complete access to the system. Customers' services can be added, edited, and updated by the service staff. The service staff can also generate reports about the services. Accounting staff processes payments for transactions and generates reports on services and transactions. After encoding all necessary information, including the services availed by the customer, the system will send text messages or a notification alert to customers and technicians regarding the assigned services via any cellphone network. All users can change their own password after logging in. Passwords should have a minimum of seven characters, including alpha and numeric characters, letters, numbers, and special characters, to ensure privacy in the online system. The system will use SMS, which is the transmission of short text messages to a mobile phone [18], to send notices to employees. Messages will be no more than 160 alpha-numeric characters long and will not include any images or graphics. In addition, the system includes a manual update feature for backing up files and transactions.

The tool used to manage the database is MySQL Server, which is an open source application that is widely used because of its high performance and strong data protection. As for the programming language, the researcher used PHP or Hypertext Preprocessor, which is very popular when creating dynamic web pages.

Limitations, on the other hand, are issues and occurrences that arise during a study that are beyond the researcher's control, including: (1) the system cannot accept landline numbers in registration as their contact number because SMS notifications can be sent only to mobile numbers; (2) payment cannot be made online; and (3) the system cannot be used for conversation and is only for sending text messages. If the receiver responds to the system, no transaction occurs.

2. Materials and Methods

An interview with MAPECON's authorized representative was conducted to gather information, including the processes beginning with the customers' inquiry, how MAPECON staff tailored the survey [14] to the customers' location or area of pest infestation, manual record listing, and report generation. The collected data served as the foundation for the researchers to evaluate the problems they encountered during their current operations, and it was scrutinized to specify the requirements, user needs, and solutions to specific problems as the process of developing web and mobile applications to solve the said problems flowed.

2.1 Research and System Design

This study utilized the descriptive research method. The descriptive research method is defined as gathering quantifiable information that is used for statistical inference on the target audience through data analysis, followed by observation to determine the learnability of the system while being used by respondents, a survey to determine whether the system is functional, and testing to uncover errors and determine possible system improvements [19].

The system development methodology used in the study was a Fourth Generation Technique (4GT), as shown in Figure 2. The 4GT Model [20] emphasizes the ability to specify software using specialized language forms or a graphic notation that describes the problem to be solved in customer-friendly terms [21]. This methodological paradigm, when combined with component-based design approaches, emerges as the dominant method for developing software.

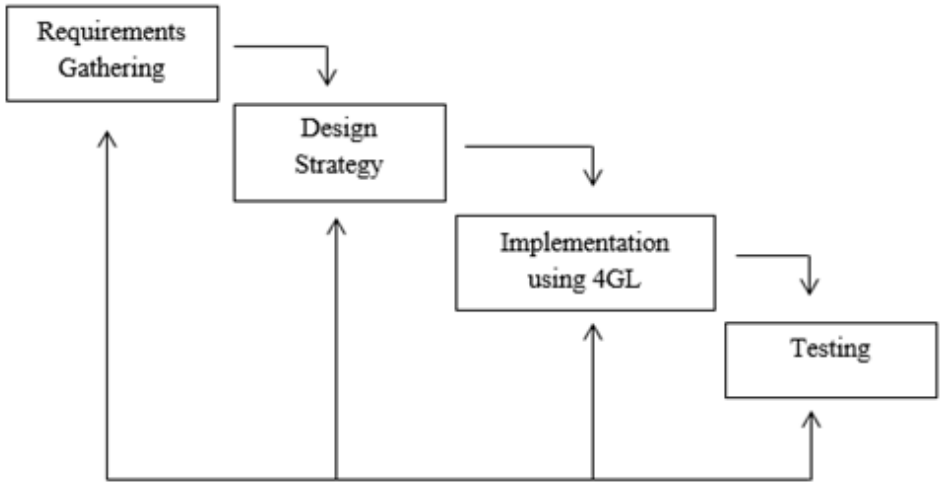

Figure 2. Fourth Generation Techniques Model

Data were collected from various published studies, books, and the Internet that provided the procedures required in developing the system with knowledge of existing problems, the need for the product, and how it assisted with the incoming alert notification-based security solution. An interview and a survey were conducted with MAPECON Cavite Highlands employees and customers. A program that uses system architecture was developed to represent the program's flow in the system, show how the inputs transform into the desired output, and allow the user to see a monitor screen display of how the program interacts with the environment. PHP, the XAMPP Server cross-platform web server to run online, the MySQL tool to manage the database for high performance and strong data protection, Nexmo for SMS gateway for the web, and SQLite and Android Studio for the mobile application were used to implement a new or improved system. Furthermore, employees and customers of MAPECON Cavite Highlands evaluated and tested the system to see if the new or improved system performed its specific function. A thorough test was performed in order to identify prominent bugs that would undermine the system's robustness. The system demonstration provides users' feedback to the researcher in order to improve the system's performance.

2.2 Population and Sampling

This study's 39 respondents include technicians, sales agent staff, administrative staff, customers, and IT experts. Based on ISO/IEC 9126 [22], they evaluated the system to determine if there were areas for improvement and if the system functions as intended in terms of software accuracy, suitability, interoperability, compliance, and security. The survey sample was drawn using the purposive sampling technique.

Table 1. 5-point scale, mean range, and interpretation

SCORE	RANGE OF WEIGHTED MEAN	INTERPRETATION
5	4.51-5.00	Strongly agree
4	3.51-4.50	Agree
3	2.51-3.50	Undecided
2	1.51-2.50	Disagree
1	1.50 and below	Strongly disagree

Table 1 depicts the pointing system for system evaluation. The researcher generated an overall interpretation of the mean score of each item in the evaluation questionnaire using a Likert scale [23]. Each item is scored on a 5-point scale, and the data is statistically interpreted and analyzed using the mean and standard deviation formulas [24][25].

Percentage determines the frequency counts and percentage distribution of respondents' personal-related variables.

$$\% = \frac{f}{n} \text{ X } 100 \quad (1)$$

Where:

% = mean

f = frequency

n = total number of respondents

The mean is the average score of a sample on a given variable.

$$\bar{x} = \frac{\sum_{i=1}^{n} Xi}{n} \quad (2)$$

Where:

$\bar{x}$ = mean

X_i = representation of each observation from respondents

n = total number of respondents

The standard deviation measures the spread (variability) of the sample's scores on a given variable [26].

$$s = \sqrt{\frac{\sum_{i=1}^{n} (Xi - \bar{x})^2}{n-1}} \quad (3)$$

Where:

$\bar{x}$ = mean

X_i = representation of each observation from respondents

n = number of respondents

s = sample standard deviation

3. Results and Discussion

The evaluation of MAPECON's E-Connect developed system was carried out at the MAPECON Cavite Highlands office, where the researcher also distributed an evaluation questionnaire to respondents and evaluated the system, eventually proving its ability and capability. MAPECON's staff, employees, and customers who were available at the time were also evaluated. Each respondent was given an evaluation form that included questions about the system's functionality, reliability, efficiency, maintainability, portability, and usability based on ISO/IEC 9126 international software standards.

Table 2. Types of Evaluators

Evaluator	Quantity	Percentage
Customer	29	74%
MAPECON Staff	5	13%
IT Experts	5	13%
Total	39	100%

Table 2 shows that thirty-nine (39) respondents took part in the system evaluation. Five (5), or 13%, were IT experts: two (2) from the College of Engineering and Information Technology, the other two (2) from the project local, and one (1) from the IT industry. In addition, there were five (5) or 13% of MAPECON's staff and twenty-nine (29) or 74% of the customers.

Table 3. Respondents' evaluations of system functionality

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
The information is clear, concise, and informative to the intended audience.	4.50	0.75	Agree	4.60	0.58	Agree	4.80	0.5	Agree	4.63	0.59	Strongly agree
The software provides accurate and correct data.	4.50	0.71	Agree	4.73	0.6	Strongly agree	4.60	0.6	Strongly agree	4.61	0.62	Strongly agree
The modules are interconnected with each other and function as a whole.	4.44	0.75	Agree	4.63	0.6	Strongly agree	4.40	0.9	Agree	4.49	0.73	Agree
The system does not interfere with the intended audience' security.	4.38	0.9	Agree	4.60	0.6	Strongly agree	4.20	0.8	Agree	4.39	0.78	Agree
Average	**4.46**	**0.78**	**Agree**	**4.64**	**0.58**	**Strongly agree**	**4.50**	**0.68**	**Agree**	**4.53**	**0.68**	**Strongly agree**

Table 3 shows how respondents evaluated the system in terms of functionality. The average obtained from the MAPECON staff was a mean of 4.46 and a standard deviation of 0.78; a mean of 4.64 and a standard deviation of 0.58 from its customers; and a mean of 4.50 and a standard deviation of 0.68 from an IT expert. Overall, respondents strongly agreed that the system is functional because it can send alert messages to customers and technicians and can generate a summary report containing the services that technicians have rendered, as indicated by a mean average of 4.53 and a standard deviation of 0.68.

Table 4. Respondents' evaluations of the system's reliability

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
The software is reliable in normal use.	4.56	0.61	Strongly agree	4.68	0.53	Strongly agree	4.56	0.6	Strongly agree	4.60	0.58	Strongly agree
Software is bug free.	4.26	0.79	Agree	4.57	0.7	Strongly agree	4.26	0.8	Agree	4.36	0.75	Agree
The system uses standard equipment that is reliable, widely available, and applicable to a variety of uses.	4.47	0.71	Agree	4.53	0.7	Strongly agree	4.47	0.7	Agree	4.49	0.71	Agree
Average	**4.43**	**0.70**	**Agree**	**4.59**	**0.64**	**Strongly agree**	**4.43**	**0.70**	**Agree**	**4.48**	**0.68**	**Agree**

Table 4 shows how respondents evaluated the system in terms of reliability. The average obtained from the MAPECON staff was a mean of 4.43 and a standard deviation of 0.70; a mean of 4.59 and a standard deviation of 0.64 from its customers; and a mean of 4.43 and a standard deviation of 0.70 from an IT expert. Overall, respondents agreed that the system is functional because it can recover data if the network fails and send SMS alerts to customers and technicians within five (5) seconds. The system can recover, store, and update all customer information at any time, as indicated by a mean average of 4.48 and a standard deviation of 0.68.

Table 5. Respondents' evaluations of the system's efficiency

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
The program requires special equipment, the requirements are minimal and clearly stated by the researcher.	4.47	0.71	Agree	4.67	0.67	Strongly agree	4.80	0.5	Strongly agree	4.65	0.61	Strongly agree
The program does not consume a large amount of memory that can slow down the processing of the system.	4.30	0.89	Agree	4.20	0.8	Agree	4.40	0.6	Agree	4.30	0.74	Agree
The program can easily identify what is the cause of failure within the software.	4.47	0.71	Agree	4.27	0.9	Agree	4.60	0.6	Strongly agree	4.45	0.72	Agree
Average	**4.41**	**0.77**	**Agree**	**4.38**	**0.78**	**Strongly agree**	**4.60**	**0.52**	**Agree**	**4.46**	**0.69**	**Agree**

Table 5 shows how respondents evaluated the system in terms of efficiency. The average obtained from the MAPECON staff was a mean of 4.41 and a standard deviation of 0.77; a mean of 4.38 and a standard deviation of 0.78 from its customers; and a mean of 4.60 and a standard deviation of 0.52 from an IT expert. Overall, respondents agreed that the system is efficient due to its performance, which influences its usability because it responds quickly, as indicated by a mean average of 4.46 and a standard deviation of 0.69.

Table 6. Respondents' evaluations of the system's portability

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
The effort required to install the system is minimal.	4.83	0.38	Strongly agree	4.70	0.64	Strongly agree	4.80	0.45	Strongly agree	4.78	0.49	Strongly agree
The program is usable on many computers with little or no modification.	4.55	0.59	Strongly agree	4.30	0.64	Agree	4.80	0.45	Strongly agree	4.55	0.56	Strongly agree
The system has the ability to adapt to new specifications or operating environments.	4.70	0.56	Strongly agree	4.90	0.30	Strongly agree	4.60	0.55	Strongly agree	4.73	0.47	Strongly agree
Average	**4.69**	**0.51**	**Agree**	**4.63**	**0.53**	**Strongly agree**	**4.73**	**0.48**	**Agree**	**4.69**	**0.51**	**Strongly agree**

Table 6 shows how respondents evaluated the system in terms of portability. The average obtained from the MAPECON staff was a mean of 4.69 and a standard deviation of 0.51; a mean of 4.63 and a standard deviation of 0.53 from its customers; and a mean of 4.73 and a standard deviation of 0.48 from an IT expert. Overall, respondents strongly agreed that the system is portable because it can run in

different web browsers such as Google Chrome, Mozilla Firefox, Internet Explorer, *etc.*, and that the system can be installed within five minutes, as indicated by a mean average of 4.69 and a standard deviation of 0.51.

Table 7. Respondents' evaluations of the system's usability

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
Information about controls is understandable and available to the users.	4.62	0.65	Strongly agree	4.43	0.80	Agree	5.00	0.00	Strongly agree	4.68	0.48	Strongly agree
The language is non-discriminatory. Content is free from race, ethnic, gender, age, and other stereotypes.	4.76	0.50	Strongly agree	4.43	0.80	Agree	5.00	0.00	Strongly agree	4.73	0.43	Strongly agree
The content is free from spelling and grammatical errors.	4.53	0.71	Strongly agree	4.33	0.91	Agree	4.60	0.55	Strongly agree	4.49	0.72	Agree
Average	**4.64**	**0.62**	**Agree**	**4.40**	**0.84**	**Strongly agree**	**4.87**	**0.18**	**Agree**	**4.63**	**0.55**	**Strongly agree**

Table 7 shows how respondents evaluated the system in terms of usability. The average obtained from the MAPECON staff was a mean of 4.64 and a standard deviation of 0.62; a mean of 4.40 and a standard deviation of 0.84 from its customers; and a mean of 4.87 and a standard deviation of 0.18 from an IT expert. Overall, respondents strongly agreed that the system is usable because it responds quickly, is easily learned due to its menu-driven interface, and the system modules and functions are easily understood and remembered, as indicated by a mean average of 4.63 and a standard deviation of 0.55.

Table 8. Respondents' evaluations of the system's maintainability

Criteria	Staff			Customer			IT Expert			Mean Ave	SD Ave	Inter pretation
	Mean	SD	Inter pretation	Mean	SD	Inter pretation	Mean	SD	Inter pretation			
The effort required to change the systems' functions is minimal.	4.27	0.9	Agree	4.40	0.8	Agree	4.20	0.5	Agree	4.29	0.70	Agree
The program is stable that and when something is changed, it will not affect the processing of the system.	4.53	0.7	Strongly agree	4.20	0.8	Agree	4.40	0.6	Agree	4.38	0.69	Aagree
The effort needed to test the system is minimal.	4.57	0.7	Strongly agree	4.50	0.7	Agree	4.50	0.6	Agree	4.52	0.65	Strongly agree
Average	**4.46**	**0.76**	**Agree**	**4.37**	**0.76**	**Strongly agree**	**4.37**	**0.52**	**Agree**	**4.40**	**0.68**	**Agree**

Table 8 shows how respondents evaluated the system in terms of maintainability. The average obtained from the MAPECON staff was a mean of 4.46 and a standard deviation of 0.76; a mean of 4.37 and a standard deviation of 0.76 from its customers; and a mean of 4.37 and a standard deviation of 0.52 from an IT expert. Overall, respondents agreed that the system is maintained because it is easily modified and the error handlers can easily detect failures when they occur, as indicated by a mean average of 4.40 and a standard deviation of 0.68.

Table 9. Summary evaluation by respondents

Category	Criteria	Average
Functionality	The information is clear, concise, and informative to the intended audience.	4.63
	The software provides accurate and correct data.	4.61
	The modules are interconnected with each other and function as a whole.	4.49
	The system does not interfere with the intended audience' security.	4.39
		4.53
Reliability	The software is reliable in normal use.	4.60
	Software is bug free.	4.36
	The system uses standard equipment that is reliable, widely available, and applicable to a variety of uses.	4.49
		4.48
Efficiency	The program requires special equipment, the requirements are minimal and clearly stated by the researcher.	4.65
	The program does not consume a large amount of memory that can slow down the processing of the system.	4.30
	The program can easily identify what is the cause of failure within the software.	4.45
		4.46
Portability	The effort required to install the system is minimal.	4.78
	The program is usable on many computers with little or no modification.	4.55
	The system has the ability to adapt to new specifications or operating environments.	4.73
		4.69
Usability	Information about controls is understandable and available to the users.	4.68
	The language is non-discriminatory. Content is free from race, ethnic, gender, age, and other stereotypes.	4.73
	The content is free from spelling and grammatical errors.	4.49
		4.63
Maintainability	The effort required to change the systems' functions is minimal.	4.29
	The program is stable that and when something is changed, it will not affect the processing of the system.	4.38
	The effort needed to test the system is minimal.	4.52
		4.40
Composite Mean		**4.53**

Table 9 shows a summary of the overall system evaluation of Me-Connect, which received a composite average rating of 4.53, indicating that the system fully satisfied and attained all of the objectives.

4. Conclusions and Recommendations

The primary goal of this study was to develop a system that would aid MAPECON Cavite Highlands employees and customers in changing the way the company handles and provides services. Currently, MAPECON uses manual operation in rendering services, posting schedules, and confirming with technicians. The company experiences many problems in the current system, such as difficulty in monitoring the quarterly maintenance to the customers, delays and time-consuming when assigning a daily schedule, difficulties for the technician to know the time and assignment of services, delayed services rendered resulting in dissatisfaction from the customer, and because of the current processes for performing these services, service staff are unable to assign a schedule to technicians for automatic processing in the future without causing conflicts.

In this study, an online pest control service that uses SMS alert notification for MAPECON Cavite Highlands was successfully developed, allowing the company to use it in everyday transactions and enhancing the current manual system that is being used by the company while bringing customer satisfaction by providing good quality customer service.

As a result, the system's implementation reduces human errors and improves MAPECON's current servicing system, as respondents rated the system with an average of 4.53, indicating that respondents agree with the system's functionality, reliability, usability, efficiency, maintainability, and portability, such as:

1. lessens the service staff's tasks in monitoring the customer’s quarterly maintenance, since the researcher provided an SMS notification feature that allows the service staff to view services that will send the duties online, which minimizes their time and effort;
2. allows the administrator to view the technicians' daily service at a given point in time since the system can store, organize, and secure all data in the database, providing accurate information;
3. sends alert messages to the technicians regarding the assigned schedules without reporting to the company;
4. shortens the process of scheduling services for the service technicians now and in the future via SMS technology by giving reliable updates on the information stored in the database; and
5. provide a backup file in the database and is capable of a backup feature that will serve as a secure copy of information about the services rendered.

However, following the conclusion that the study was significant, the researcher would like to make some recommendations for future researchers to improve the research, which are:

1. adding a voice call feature for customers who wish to contact service personnel;
2. integrate the use of more secure hashing algorithms for user passwords, as this will increase the security of each user; and
3. include a feature that allows the system to import a CSV file, allowing the user to easily register large numbers of customers in the system at once.

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