DEVELOPING A REPAIR MANAGEMENT SYSTEM WITH AN INTEGRATED PARTS INVENTORY STOCK HANDLING SYSTEM THROUGH THE USE OF AGILE METHODOLOGY

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ABSTRACT

The XYZ Company has been operating since 1996, and they already have many systems in place except for a system that properly manage the repair service aspect of the company. The process of their repair aspect is to manually input the information of repair service which included customer information and inventory stock information into a physical document. However, the downside of using this method resulted to service delays, data loss, inaccurate inventory tracking, and poor customer service. Thus, the objective of this study is to analyze the problems of the company's repair service and inventory processes and then develop a system using the agile methodology. The agile methodology is a software engineering method used to promote collaboration between developers and the client, and adaptability of the developers to change requirements during the development phase. The proposed system is designed to allow users to create repair service reports and track down the inventory stocks of parts to make the repair process more efficient and seamless so that the customers who purchase their motor vehicles are willing to avail for the repair services of the company. Also, the system will be able to create customer profiles, mechanic profiles, and supplier profiles so that all of the customer information, mechanic information, and supplier information are organized and easy to access for the users.

KEYWORDS – Repair Management, Inventory Management System, Agile Methodology

INTRODUCTION

The Company

The motor vehicle company was founded in 1996. The company was incorporated on May 16, 1996, for the purpose of selling motorcycle units, spare parts and accessories. Its operation started on 1997, when the motorcycle selling and financing were transferred from their other company, and operated under a trade name. The main head office of the business is located at Sultan Kudarat and its main branch business office address is located at Metro Manila. Another company was made which had an exclusive 3S shop of Honda. On the other hand, the older company continues to sell Honda units in all its branches, alongside with various brands such as Kawasaki, Yamaha, and Suzuki. It was in October 2009 that the first ever Yamaha 3S shop was opened in Manila and is still continuing to expand as it opens

more branches in Visayas and Mindanao. The organization's venture into the motorcycle business has really proven its potential as it has survived the fast race of the industry. A fact worth noting is that both the old and new company carved its name to the throne of top dealers in the motorcycle industry. Through time, expansions were inevitable and the company has saturated expanding their business in Luzon, Visayas, and Mindanao. Today, the organization has more than 200 branches.

Agile Methodology

Agile development emphasizes on the continuous delivery of system requirements, adaptability to change, and team development. The development of the system is separated into time boxed iteration called "Sprints" that lasts for 30 days. In each Sprint, the team must conduct a sprint review and a sprint retrospective. A sprint review is a meeting between the development team and the client in order to discuss the progression of the system being developed, and system changes that the client will suggest. [1] On the other hand, a sprint retrospective is a meeting between the development team and their Scrum Master, who manages the development team, where the discussion is about the performance of the development team and the team discuss the next set of deliverables in the next sprint.

Research Objective

The research objectives will be set based on the problems that the client explained to the researchers. These objectives will help the researchers in knowing what functions that the proposed system will have. Here are the following research objectives:

1. The system must manage the repair history for each motorcycle serviced.
2. The system must manage the customer information of all branches.
3. The system must manage the inventory of the motorcycle parts available in the branch and other branches.

LITERATURE REVIEW

Collecting storing and managing customer information about your customers, clients, and other stakeholders is essentially a necessity for most businesses. This strategy allows the business to better understand and analyze the needs of the customers and further enhancing customer relationship. This starts with collecting the needed information in a business process. [3] A simple way of recording customer information electronically through a spreadsheet is a common way for businesses but automated systems that perform the management of customer information and other business processes is more suitable.

Any repair shops will have difficulty in managing information of their repair services and the need of using a repair management system is recommended in order to lessen the workload of managing repair service information. One example of a repair management system is Woksen Management System. The company known as Woksen developed a flexible and reliable system for repair or workshop businesses which allows these businesses to generate reports for services and financials, create customer profiles, estimates finances, and tracks the customer's status. The system promotes information visibility among different branches because Woksen Management System is a centralized system. [5] Another example of a repair management system is Direct Shop by Identifix. Direct Shop is a shop management system that allows users to accurately track repair invoices and improve customer relations through the creation of customer profile that contains the information of the customer including the details of the vehicles that they owned. [6]

Inventory tracking systems have developed over a lot of time. Many years ago we've known the process of inventory tracking systems as manually writing down each inventory transaction on a file card which they call a cardex. [2] "Today, inventory management systems track the movement of inventory with surgical precision. Today's systems can track inventory from point of origin to final customer delivery." Although systems may have differences in functionality, each one seeks to provide a critical decision-making information for the users. The significance of having an inventory is that every business that runs has this kind of system whether manually or computerized. Some companies' buys inventory from others to resell while other companies make their own inventory called components to use in the making of the finished products. As Hamlet said, "Whichever category a company falls under, inventory represents a significant capital investment for most businesses. "[4]

METHODOLOGY

For methodology of the project, the researchers will make use of two different methods which are the descriptive approach research design, and the agile development approach. In order for the researchers to gather data that will be used to design the system, the researchers must look into the operations and processes of the company. The researchers were able to gain permission from the company to study their organizational structure and business processes, and conduct interviews with the CEO, branch managers, IT department employees, and branch employees of the company regarding the issues of their current business processes. The company also provided the researchers their organizational chart and diagrams that are useful in understanding how the company performs and reacts to different situations. During the interviews conducted, the researchers gained insights and ideas on what kind of system the company needs. After several months of data gathering, the researchers have decided to develop a repair management and inventory system for the company because they do not have a system that maximizes the efficiency of their repair process.

For the development of the system, the researchers will make use of the agile methodology because the method emphasizes on development and implementing changes. The development of the system will start at the 1st week of August until the 2nd week of December. The researchers will separate the development into three Sprints which last for 30 days. At the end of each Sprint, the researchers will need to conduct a sprint retrospective with the client and then meet up with their Scrum Master to discuss the performance of the team in the Sprint and assign the next set of deliverables for the next Sprint.

RESULTS

Client's Comments

At the end of each Sprint, the researchers must visit the client to show the progress of the system and then listen to comments and suggestions of the client for future improvements. The tables below show all of the comments of the client recorded during the sprint retrospective meeting.

Table 1. Client's Comment for Sprint 1

Comments about the Repair Reports:
- Change the term 'Repair' to 'Service' in the Repair History List   - Add a sort function in the Repair History   - There should be an auto-calculation of Repair Service prices prior to the Repair Part Used and the Type of Service availed by the Customer   - Add an image file upload to the viewing of Repair Service Report for proof of security

In Sprint 1, the client was impressed with the work done because the client is satisfied with functionalities for customer profile, mechanic profile, supplier profiles, system accounts, and repair history. However, the client has noticed that there are some elements in the repair service functionality that are not present such as a sort function, image upload, and an auto calculation of repair services.

Table 2. Client's Comment for Sprint 2

Comments about the Repair Parts: - View Portion: Repair Parts Used should be a pair -tabular look -per part used needs price -more than one   **Comments about the Repair Reports**   - Create Repair Assessment: - add a total time consumed input for a repair service   **Comments about other system issues**   - Landing Page: -Reminder if customer needs to go back

In Sprint 2, the client was overall impressed with the changes that the researchers made into the system. Also, the client was satisfied with all of the repair report and repair parts functionalities and requested a few revisions regarding the repair assessment and repair parts used functions.

Table 3. Client's Comment for Sprint 3

Comments about the entire system: ● Our client was satisfied with the entire system. ● All functionalities were completed.

In Sprint 3, the researchers presented the remaining revisions and add-ons that was requested by the client. Overall, the client is satisfied with the work of the researchers and then discusses with the team for its deployment in the company.

Client Evaluation

The table below shows the client's evaluation of the proposed system. The scorer of the client evaluation is the IT head of the company. The evaluation will be scored based on the system's usability, performance, and its available functionalities. There are eight criteria that the scorer will judge on which are mean ease of use, nice UI, reliable, secure, efficient, complete function, all features, and ready for deployment. The highest score for each criteria is 5 while the lowest score is 1.

Table 4. Client Evaluation of the Proposed System

Criteria	Score
Mean Ease of Use	4.67
Nice UI	4.67
Reliable	4
Secure	4.67
Efficient	5
Complete Function	4.33
All Features	4.33
Ready for Deployment	4.67

Based from the scores given by the client, the researchers were able to develop the system that the client demanded. This result proves that using the Agile Methodology is the most appropriate method in software development since it allows developers to be adaptable to any changes that will be occurred through continuous communication with the client during the development phase.

DISCUSSION

Problems Encountered

The researchers have conducted several interviews with client including their branch employees to understand the problems and how these problems did occur. This be helpful for the researchers in analyzing these problems and how will the researchers develop the proposed system. Table 5 shows the list of problems that were mentioned.

Table 5. Problems of the Client

Repair Service Management Issues	
1. The branch stores most of the repair service information in physical files.	● This method of recording data can lead to data inaccuracy. ● Prone to data loss. ● Difficult to look for a specific repair service report especially if the files are stored in multiple folders or file storages.
2. The branch have a difficult time in managing their customers for repair services.	● Prone to bottlenecks in servicing their customers. ● No reservations, only walk-ins
Inventory Issues	
1. The branch records the number of new parts in an excel spreadsheet.	● Prone to data inaccuracy and data manipulation. ● Difficult to track which motorcycle parts are still in stock or out of stock.

Based from the observations of the researchers, the clients are having a difficult time in accommodating their customers especially for returning customer because there are some repairs that will require 2 or more days to complete depending on how damaged the customer's bike is. In their current process, the employees are not informed of when the customer will come back to the branch because they do not accept reservations which causes bottlenecks in servicing their customers. Also, the clients are manually writing the information of the repair service into physical document which are susceptible to data inaccuracy and data loss. Due to this process, their mechanics are repeatedly performing diagnostics each time a motorcycle parks into a service bay in which reduces the amount of time needed to repair the motorcycle. As for the inventory, the records of incoming stocks of new parts are stored in an excel spreadsheet in which is not a good practice because it will be difficult for the employees to track down parts that are low in stock.

Architectural Diagram

In Figure 1, it shows the overall architecture of the system. The front end is developed using a combination of Bootstrap, CSS, and JQuery. The backend structure has also been updated because of the inclusion of utility where all of the other advanced error handling such as input regex, id generator, and password encryption. Also, there is a database framework where all of the credentials for connecting to the database are stored. There are no changes for the database side of the architectural structure.

Bootstrap + CSS + JQuery					
JSP			JSTL		
Filters	Servlet	IO	Bean	Utility	Database Framework
Database (MySQL)					
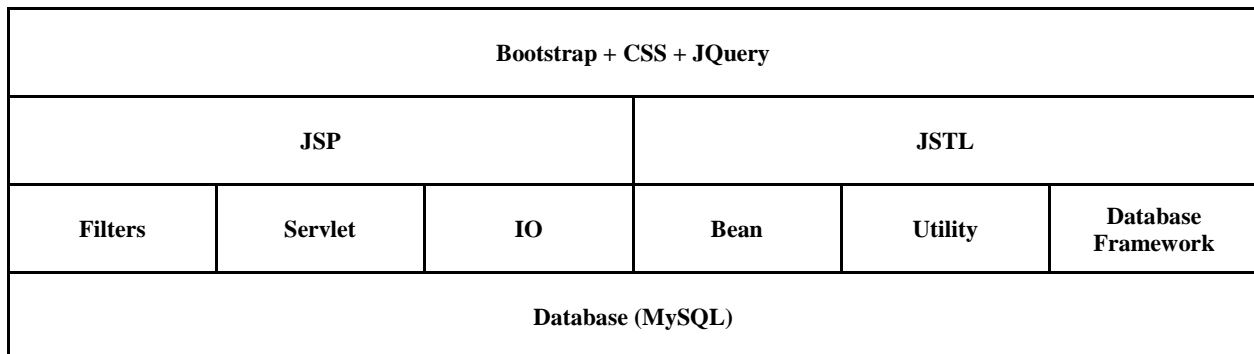
Figure 1. Architectural Diagram

CONCLUSIONS

In conclusion, the researchers determined that the company lacked a system to properly encode and manage the data that was being given after a repair processes. This caused many inefficient data storing methods as well as making

these data useful to the company. The researchers created a system wherein it not only satisfies the data logging and retrieving of data but also created functionalities that would improve the customer service that the employees can give due to functionalities such as notification of due services and notification of inventory restock. The researchers were able to successfully satisfy the company's need by following the business process and finding the weakest link that can be improved.

ACKNOWLEDGEMENT

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