

A Development of a Management Information System for Home Appliance Repairing

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Abstract: Galaxy Ace Electronic Enterprise is a repair service centre has been taken as the case study of this project. Currently, this service centre applies and implements the manual system to manage its business operations. The problem of this service centre is the management for keeping the business records is poor and unsafe since all the documents are recorded in the logbook and paper, hence the data loss might be happened due to the missing or misplacing of paper. Therefore, a web-based home appliance repairing management system is developed to address these problems. The objectives of this project are to design, develop and test the home appliance repairing management system. The project scope focuses on helping this service centre to improve the management of all the business data. The system is developed by using the structured approach and waterfall model. The programming language used in this system is Hypertext Preprocessor (PHP), Hypertext Markup Language (HTML), Cascading Style Sheets (CSS). This system uses MySQL database server to store the data. The target users of this system are owner, staff, technician and customer. This system is expected to help the owner and staff to manage the customer records and repair requests easily and systematically. By using this system, the staff can create, retrieve, update and delete the business records. This system helps the service centre to automate its business activities effectively and manage data securely. This system also presents user-friendly functionality and provides convenience to the target users.

Keywords: Repairing management system, Web-based, PHP

1. Introduction

Galaxy Ace Electronic Enterprise is a repair service centre located at Klang, Selangor that provides the service of checking and repairing various brand of home appliances. This service centre now is using a manual system to record and manage its business operations. According to the existing process, this manual system suffers a slow and high error rate of management. This is because all the business records and documents are stored and handled manually by the staff. Therefore, the management for keeping the business records is poor and unsafe as the data loss might happen. There is a lack of an effective and reliable management system that allows the staff to manage the business records easily and safely. Moreover, data redundancy occurs when data is recorded repeatedly. This is also a time-

consuming for the staff as they need to spend a lot of time searching the information needed from a stack of paper.

Therefore, a web-based home appliance repairing management system is built and developed to this service centre to manage, facilitate, improve and enhance the business process and operation. The objectives are to design, develop and test the home appliance repairing management system by using the structured approach waterfall model. The project scope is to enhance the manual system. This home appliance repairing management system is expected to help the service centre to manage the business data easily, securely and systematically. By using this system, the staff and owner can manage, create, retrieve, update and delete the data recorded. In short, this system is developed based on the needs and demands of the service centre to provide the comprehensive solution such as enhance the management of data, update the progress in real-time, decrease the time-consuming of information searching and reduce the paper usage. Next section discusses the existing system and the comparison between existing system and developed system. After that, section 3 explains the methodology used to develop the system. Then, section 4 outlines the system analysis and design. Furthermore, section 5 illustrates the results of system implementation and testing.

2. Related Work

2.1 Case Study: Galaxy Ace Electronic Enterprise Service Centre

In this project, a case study had been conducted in Galaxy Ace Electronic Enterprise Panasonic Authorized Service Centre. The operation of this service centre is using a manual system to record and manage its business. The staff records the customer details in a logbook manually, including their appointment details and repair service requests. When the staff wants to find the information, they need to search line by line and page by page from the logbook. Whenever there is a repair job or appointment to be assigned to a technician, the staff inform them verbally. The technicians need to note down the repair job and appointment by themselves. The staff uses a bill book to create invoices by using the manual system. This manual system provides a simple procedure for this service centre to manage its business records. **Appendix A** shows the existing process of the service centre through the As-Is model.

Three existing systems has been investigated, which are Odoo repair management system[1], Repairer[2]and RepairDesk[3]. Through the comparison results as shown in table 1, all three existing system does not have the features such as appointment management, create quotation and WhatsApp notification, however these features were built into the developed system.

Table 1: Comparison of Three Existing Related Systems and Developed System

Features/System	Odoo repair management software	Repairer	RepairDesk	Home Appliance Repairing Management System
User Login	Yes	Yes	Yes	Yes
Customer Management	No	Yes	No	Yes
Appointment Management	No	No	No	Yes
Reparation Management	Yes	Yes	Yes	Yes
Create Quotation	No	No	No	Yes
Create Invoice	Yes	Yes	Yes	Yes
Generate Report	Yes	Yes	No	Yes
User Login	Yes	Yes	Yes	Yes
Notification by WhatsApp	No	No	No	Yes

Table 1: (Cont.)

Features/System	Odoo repair management software	Repairer	RepairDesk	Home Appliance Repairing Management System
Job Calendar	No	No	Yes	Yes
Update Job Progress/Status	Yes	Yes	Yes	Yes

2.2 Home Appliance Repairing Management System

Home Appliance Repairing Management System is developed in this project to enhance the current system (manual system) used by Galaxy Ace Electronic Enterprise. This system combines with MIS and web-based technology that can be widely used in the field of business to help the service centre to manage the business records in real-time[4]. This system involves four users which are the owner, staff, technician and customer. The owner is a system administrator that has the authority to manage all the accounts and manage all the data recorded in the system. Besides, the owner can generate reports for the use of decision-making. Better availability of information reduces risk and lets users produce more rational decisions based on reliable data [5]. Next, all the business details can be added, deleted or updated by the second system user which is staff. The third user is technician that can check and view their own repair job and customer's appointment. The technician is also allowed to update their job progress into the system. All the users are required to log-in by using their own username and password except the customer. The customer can only access the front-end system to check the reparation status. The system can save all the data in database and display it to the users. This system provides eight modules including log-in/log-out module, dashboard module, customer module, technician module, repair job module, payment module, report module and user management module/profile module. By using this system, the data loss can be prevented as it is web-based, and the data is stored in the database server. **Appendix B** shows the improved process of the service centre with the developed system through the To-Be model.

3. Methodology/Framework

In this project, the waterfall development model is used in this project. It provides a straightforward and simple approach for the systematic process which is suitable used to build and deliver a high-quality system to the users[6]. Figure 1 shows each phase in the waterfall model adapted from[7].

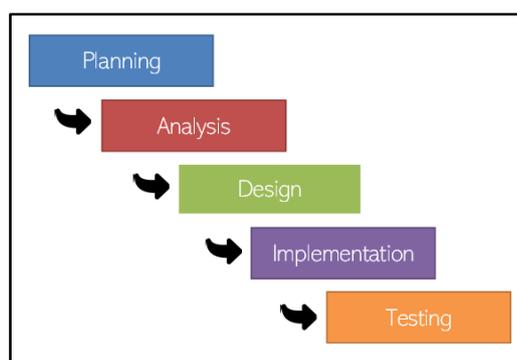


Figure 1: Waterfall Model

3.1 Waterfall model

Based on figure 1, waterfall model is divided into five phase. First, in planning phase, the interview has conducted with the owner of service centre. Through this interview, clear information collected as explained in section 1.0 to define solutions and fulfil the user requirements in system development. Second, in analysis phase, the As-is and To-be models was illustrated as shown in section 2.0. The

system functional requirements, non-functional requirements and user requirements was analysed and discussed in section 4.1. Furthermore, system analysis is also carried out. Context diagram (CD), data flow diagram (DFD), and entity-relationship diagram (ERD) was constructed as shown in section 4.2. Third, in design phase, it involves the system design, the user interface design was constructed as illustrated in section 4.3. Fourth, in implementation phase, all the information from the previous phase is transformed into the actual system using programming code. The code segment and module interface as shown in section 5.1. Last, in testing phase, the functional testing was carried out as explained in section 5.2.

4. Analysis and Design

This section discusses the analysis and design of the system.

4.1 System requirement analysis

System requirement analysis is the significant stage required in developing the system to identify and determine every requirement needed.

4.1.1 Functional Requirement Analysis

Table 2 shows the functional requirement of home appliance repairing management system.

Table 2: Functional requirement

No.	Module	Functional requirement	User
1.	Log-in and Log-out	The system should allow the users to log-in and log-out to the system. The system should not allow the users who enter the invalid username and password to log-in to the system.	Owner, Staff, Technician
2.	Dashboard module	The system should display the summary information to the users.	Owner, Staff, Technician
3.	Customer module	The system should allow the users to view, add, delete, update, save and search the customer data.	Owner, Staff
4.	Technician module	The system should allow the owner and staff to view, add, delete, update, save and search the technician data. The system should allow the technician to view the job schedule.	Owner, Staff, Technician
5.	Repair job module	The system should allow the owner and staff to view, add, delete, update, save and search the repair job data. The system should allow the technician to update the repair job status. The system should allow the customer and technician to receive the notification through WhatsApp. The system should allow the customer to check the repair status.	Owner, Staff, Technician, Customer
6.	Payment module	The system should allow the users to create auto-calculation quotation reports and invoice reports.	Owner, Staff
7.	Report module	The system should allow the users to generate reports.	Owner
8.	User management module/Profile module	The system should allow the owner to view, add a new user, and active or inactive the existing user's login. The system should allow the staff and technician to edit their account such as change the password.	Owner, Staff, Technician

4.1.2 Non-functional Requirement Analysis

Table 3 shows the non-functional requirement of home appliance repairing management system.

Table 3: Non-functional requirement

No.	Non-functional Requirement	Description
1.	Operational Requirement	The system must be connected to the internet and used in web browsers.
2.	Security Requirement	Owner, staff and technician require username and password to access the system.
3.	Availability Requirement	The system shall be available, be functioned and be used in 24/7 hours.

4.1.3 User Requirement Analysis

Table 4 shows the user requirement of home appliance repairing management system.

Table 4: User requirement

No.	User	Requirement
1.	Owner (System Administrator)	<ul style="list-style-type: none"> - Manage all system accounts include disable or enable user login. - Manage all data recorded (CRUD), including add, delete, update, edit, view and search the data. - Generate reports.
2.	Staff	<ul style="list-style-type: none"> - Add, delete, update, edit, view and search the customer data, technician data, and repair job data. - Create quotations and invoices. - Update repair job status, quotation status and invoice status.
3.	Technician	<ul style="list-style-type: none"> - View and search the own appointment data and repair job data. - View the job schedule and receive the notification from system. - Update the repair job status.
4.	Customer	<ul style="list-style-type: none"> - Check the repair job status.

4.2 System Analysis

This section is about the structured approach by using the CD, DFD and ERD[8].

4.2.1 Context Diagram (CD)

The entire system is Home Appliance Repairing Management System which holds the whole process as shown in figure 2. Based on the CD, four external entities are the owner (admin), staff, technician and customer. The diagram depicts the data flow includes the inputs and outputs in the system that stores and distributes the information between each external entity.

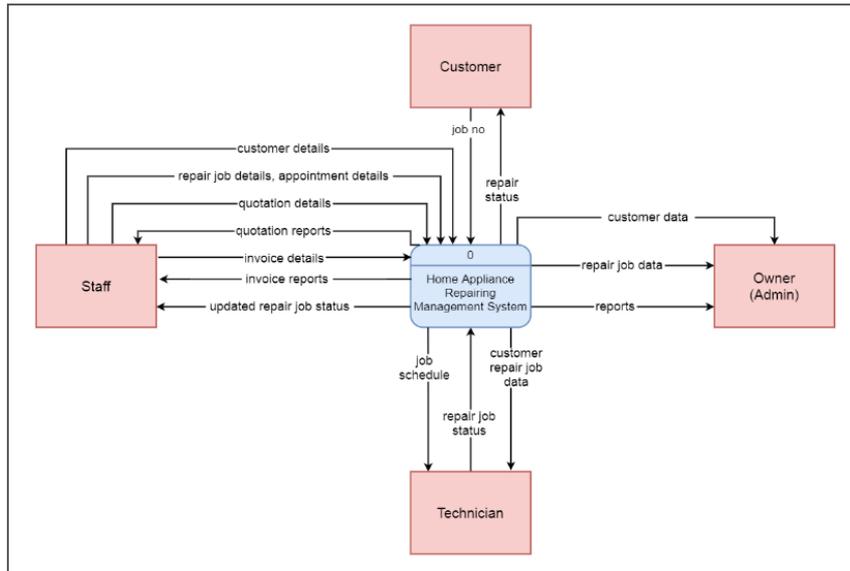


Figure 2: Context Diagram

4.2.2 Data Flow Diagram (DFD)

Appendix C shows the DFD of the home appliance repairing management system. Based on the DFD, it contains eight processes, four external entities and eight data stores. The initial process is to verify user where the owner, staff and technician need to input their username and password to log-in to the system. The further process is to manage customer, appointment, repair job, quotation, and invoice where the staff and owner can create, retrieve, update or delete the information. The next process is to check repair status where the customer can enter the job number into the system to check the repair status. Finally, the last process is to generate reports where the owner can create chart and table by using the stored information in the system.

4.2.3 Entity Relationship Diagram (ERD)

Figure 3 shows the ERD of the home appliance repairing management system. Based on the ERD, it involves ten entities.

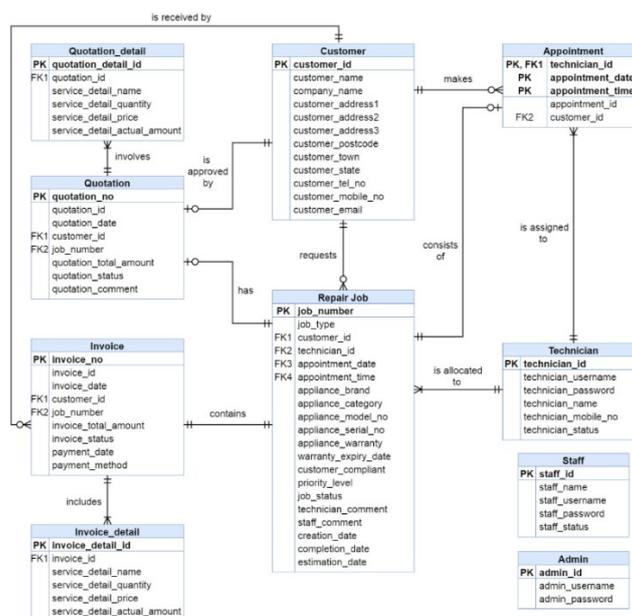


Figure 3: Entity Relationship Diagram

4.3 Interface Design

This section is about the interface design of the system includes the input interface and output interface. Figure 4 shows the main page of the system. There are four input buttons where the users need to select the button based on the role. For example, if the role is customer, then the user can click “check reparation status” button. Other than that, if the role is admin, staff or technician, the users need to click the login button correspondingly. After the admin click on the “admin login” button, the user enters the login page as shown in figure 5. In the login page, there are two input boxes for the users to enter the username and password. Then, the users need to click on the “login button” to log-in the system. Once the log-in details are wrong, an error message displays as shown in figure 6.

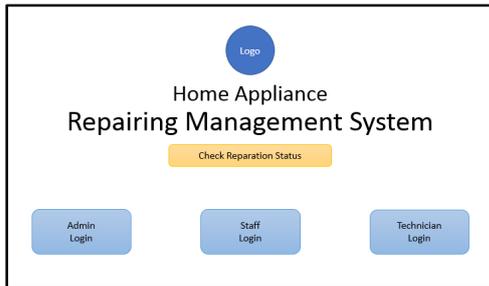


Figure 4: Main page

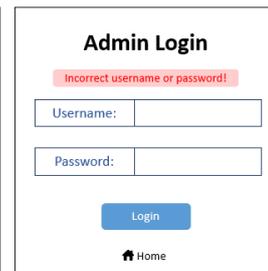


Figure 5: Login page Figure 6: Error message

5. Implementation and Testing

This section mentions the implementation and testing phase of the system that has been developed.

5.1 Implementation

Figure 7 shows the code segment and figure 8 displays the dashboard module. This module presents some summary information of the system by using some cards, graphs, and tables. Besides, this module also shows the menu bar that the users can click on the modules buttons to enter the modules page.

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Figure 7: Code segment for dashboard module

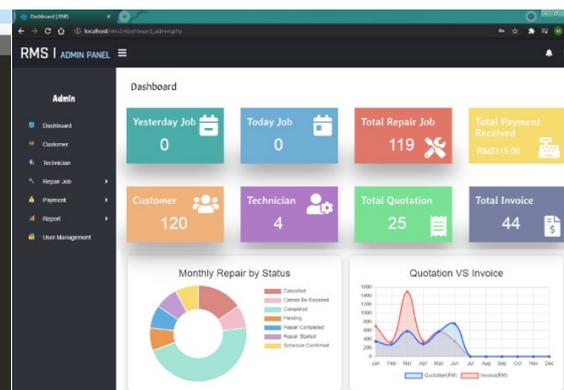


Figure 8: Dashboard module interface

Figure 9 shows the code segment of repair job module and figure 10 displays the interface of repair job module. This module allows the users to filter the repair job data based on the date range. There are two buttons which are “print” and “excel” button to let the users print the repair job list or download the list in excel file. Moreover, the users can view, edit, delete the single repair job data. The users can also update status of repair job, upload repair image and view or print in PDF format by clicking the icon.

```
<?php
$stmtement = $connect->prepare("SELECT * FROM job NATURAL JOIN customer NATURAL JOIN technician ORDER BY job_id DESC");
$stmtement->execute();
?>
```

Figure 9: Code segment for repair job module

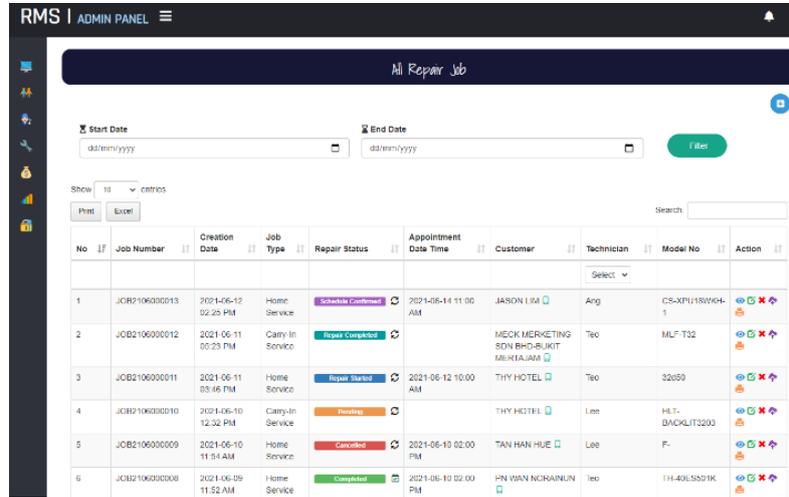


Figure 10: Repair job module interface

Figure 11 shows the code segment of report module (sales report) and figure 12 displays the interface of report module (sales report). This module allows the users to select the year to create the sales report. After select the year, the report in chart and table are displayed based on the selected year. In addition, this system allows the users to generate reports such as frequency report based on the date range as shown in Appendix D.

```
50 <div class="card">
51 <?php
52
53 $statement = $connect->prepare("SELECT DISTINCT YEAR(payment_date) AS year FROM payment");
54 $statement->execute();
55 $options = $statement->fetchAll();
56
57 ?>
58 <select name="year" id="year" class="form-control">
59 <?php
60 echo "option value='<----Select Year----</option>";
61 foreach($options as $option){ ?>
62 <option value="<?php echo $option['year']; ?>"><?php echo $option['year']; ?></option>
63 }
64 ?>
65 </select>
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Figure 11: Code segment for report module (sales report)

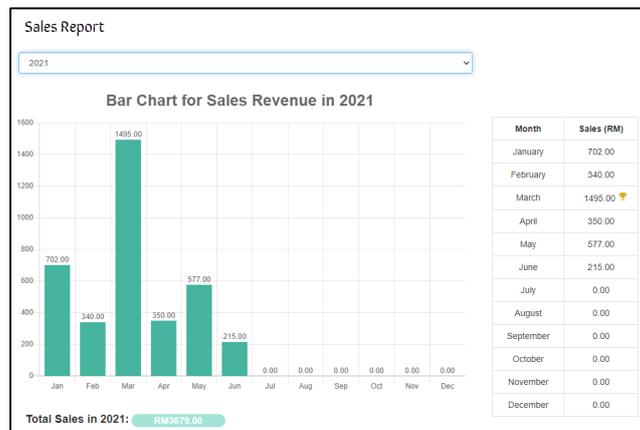


Figure 12: Report module interface (sales report)

5.2 Testing

5.2.1 Functional testing

This testing is used to examine the functionality of the system[7]. System functional testing of the eight modules has created. Table 5.1 shows the results of the functional testing for all modules.

Table 4: Functional testing results

Test Modules	Expected Result	Actual Result	Success/Fail
Login module	- If username and password are correct, then enter dashboard module, else display error message.	- User login successfully enter dashboard module, else show error messages on login form and user need to re-input username and password.	Success
Dashboard module	- Display the summary information.	- The system shows the summary information in graph and table successfully.	Success
Customer module	- Users can create, view, update and delete customer data.	- The customer data is saved, shown, updated, or deleted successfully.	Success
Technician module	- Users can create, view, update and delete technician data.	- The technician data is saved, shown, updated, or deleted successfully.	Success
Repair job module	- Users can create, update and delete repair job data. - Users can view and print all there repair job. - Users can update status of repair job. - Users can upload repair details in image format.	- The repair job data is saved, updated, or deleted successfully. - All the repair job is shown and can download in excel and pdf. - The repair job status is updated successfully. - The repair details are uploaded successfully.	Success
Payment module	- Users can create, update and delete quotation or invoice data. - Users can view the quotation or invoice in PDF format. - Users can update status of quotation or invoice.	- The quotation or invoice data is saved, updated, or deleted successfully. - The quotation or invoice report can print or save in PDF. - The quotation or invoice status is updated successfully.	Success
Report module	- Generate various report includes sales report and frequency report. - Report can be viewed print in PDF format.	- Display report in graph and table successfully. - The report includes chart and table can print or save in PDF.	Success

6. Conclusion

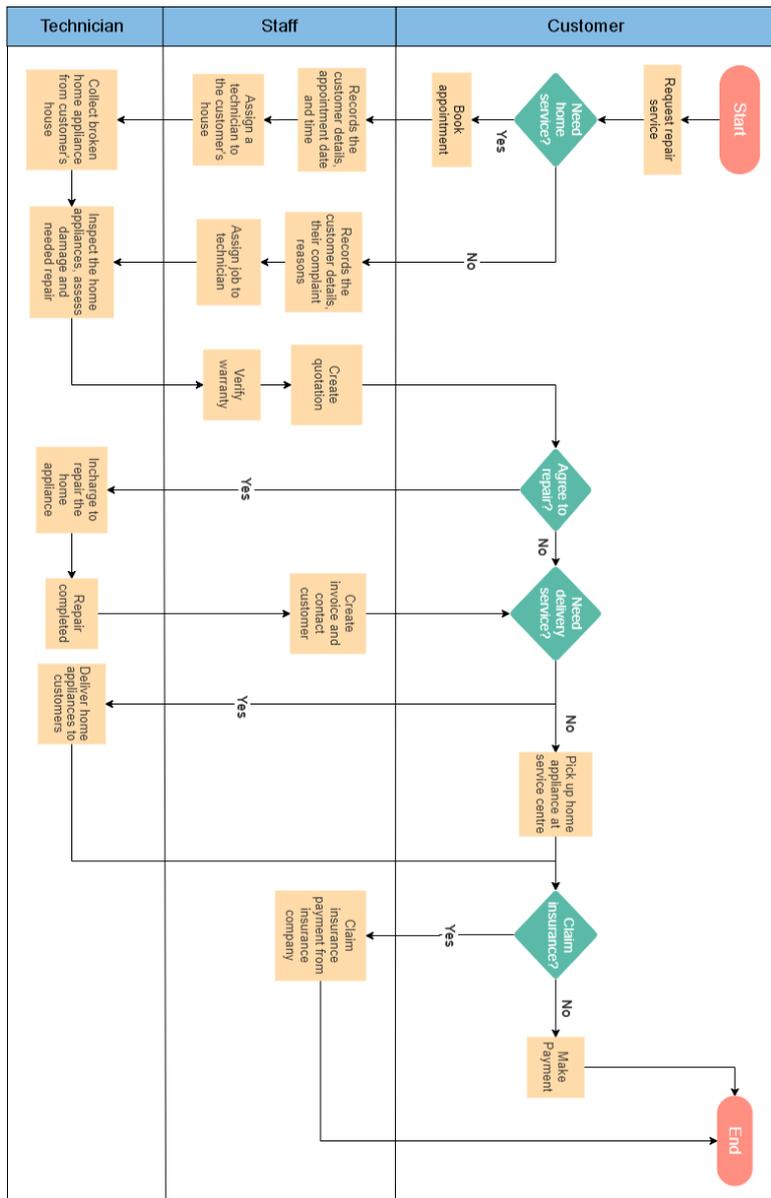
In conclusion, a web-based home appliance repairing management system has been developed to overcome those problems such as data redundancy and time-consuming. Finally, this system has been developed successfully based on the user requirements and functional and non-functional requirements. This system offers some strengths which are easy to track repair job progress, real-time, user-friendly, send notification through WhatsApp, has responsive web design and can generate various type of reports. However, there are some improvements can be added in the future works. The recommended improvements such as improve add repair job form that allows users to insert multiple repair job records simultaneously, develop a customer panel to let the customers can request repair job service online and

build a countdown timer function to remind the technician for the due time of repair job can be carried out to make the system more powerful and efficient in the future.

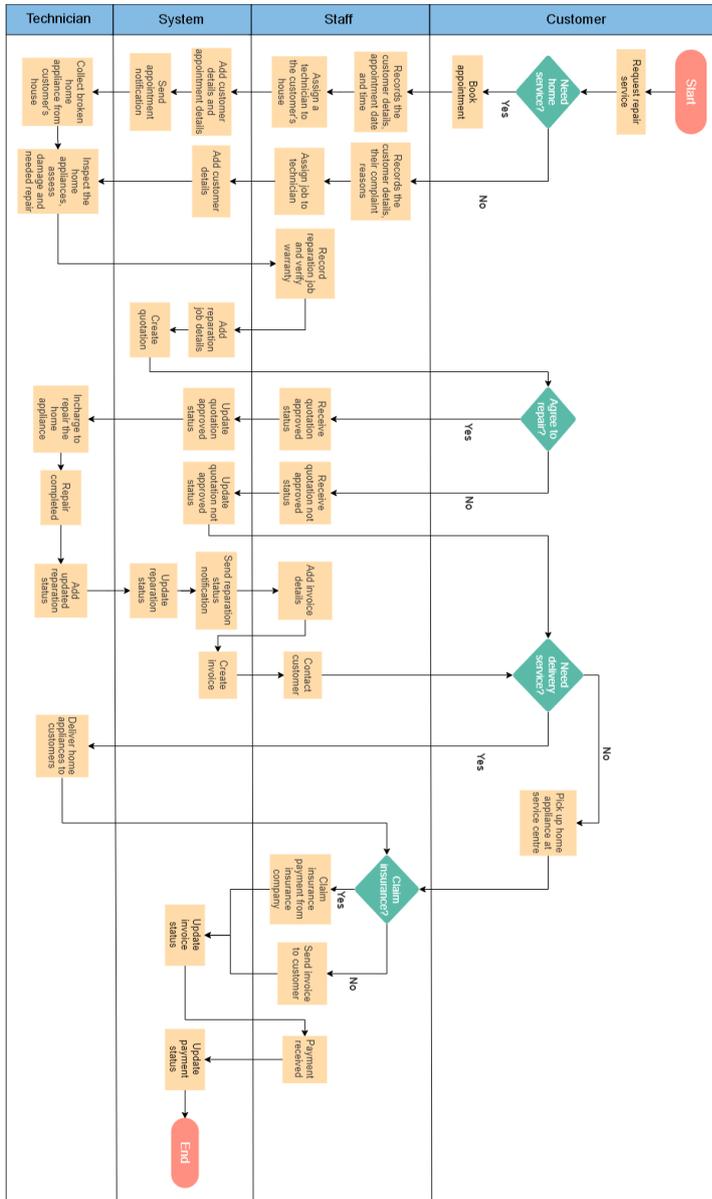
Acknowledgement

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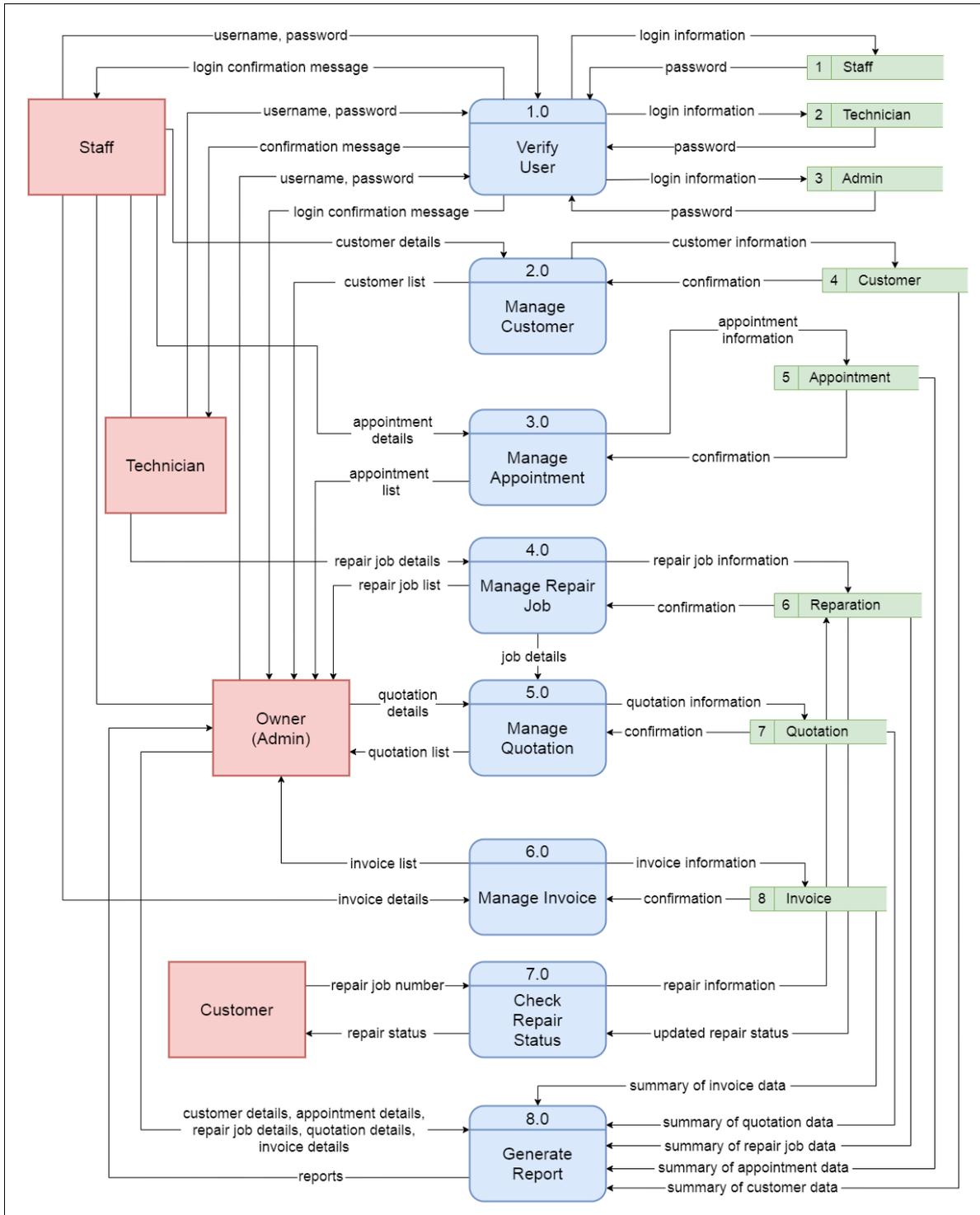
Appendix A



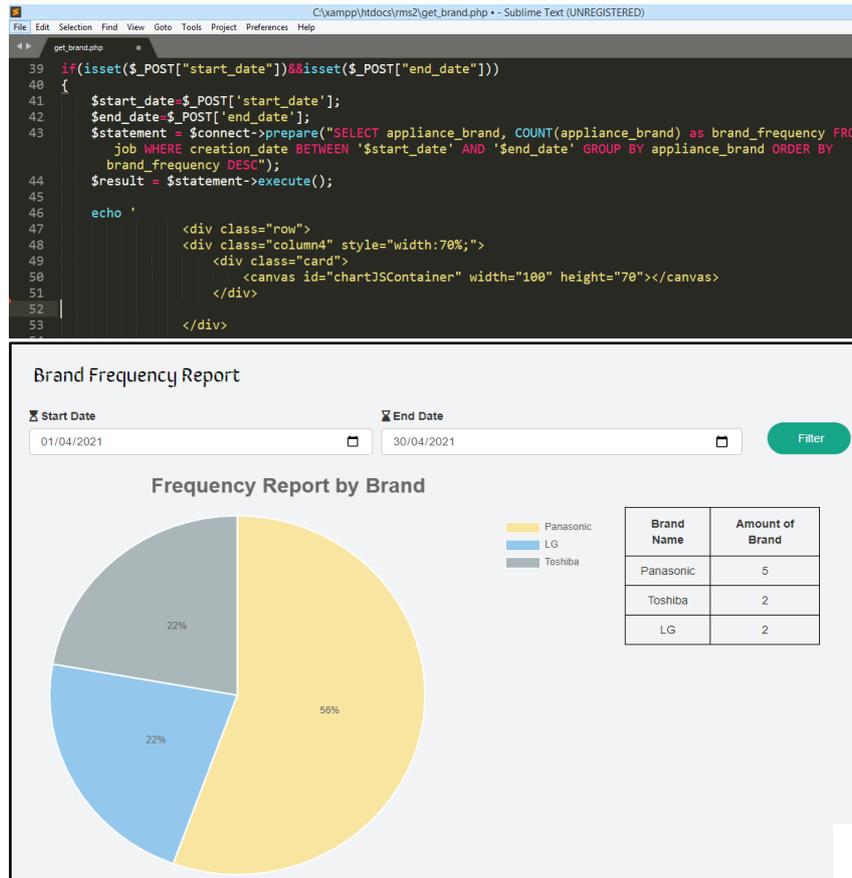
Appendix B



Appendix C



Appendix D



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