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Damaged and Defect Inventory Management System using Mobile Application

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Abstract: Any retail outlets typically consist of various products sold the company to consumers. Retail outlets that are popular typically consists of various branches in different locations that sells the same products as its other outlets. Despite having multiple branches, the products sold at each branch typically comes from a single central warehouse that stores all the products sold in big batches. This warehouse usually receives shipments from various factory and suppliers both locally andomestic. Due to the warehouse receiving various huge batches of products shipments, it is common to expects that not all the products receive will arrive in good condition. In such cases, the workers in the warehouse are required to make a statement on the damaged or defects product to later be used by the management. The method implemented to record and store such statements are currently done manually using paper and filling. As such, this method is proving to be outdated and not up to modern standard. Some of the problems that may occur with the usage of this method are such as creating a report can be time consuming and ineffective. Besides that, the reports upon creation are stored in file cases which may lead to problems such as misplace of file and data loss. Searching for a report can be time consuming since there will be many reports in total. The purpose of this project is to develop an Android application that can assist in recording and storing such reports easily from the staff smartphones. The objectives set out to achieve throughout the development of this project are to design android application to create such reports from the staff smartphones, to develop the android application and to finally test the android application upon completed development. At the end of this project, the damage and defect inventory management system will be completely developed. The system can then be used to create, read, edit and delete any reports in the system. With the development of this system, the overall work flow and efficiency of the business can be improved. Some recommendations that can be implemented to improve the system in the future are such as to back up the data in another remote database and also to develop the system for iOS environment.

Keywords: Android, Damage and Defect, Inventory System, Firebase

1. Introduction

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A regular retail shop typically has a variety of product and such product will require shipment and delivery to constantly keep the product stock available. However, it is quite common that not all the product received during the shipment adheres to the standard condition before being sold to consumers. As such, these products will be separated before delivering to the respected outlet for selling purposes. The defected or damaged products will now either be dispose or shipped back to its suppliers depending on the situation. To complete this process, several crucial steps are required to be conducted. Firstly, the damaged product must be properly inspected with confirmation that the product is damaged or defected. Next, the details of the damaged product must be recorded in detail in report so that the report can later be used as a written proof of the damaged product and also evidence when notifying the supplier. Finally, the detailed report of the damage product will then be required to be stored safely aside for future references.

The purpose of this project is to develop an android application that can assist in recording and storing such reports easily from the staff smartphones. Currently, the process to make such report are done manually which is outdated with the current times. Some problems that will highly occur are firstly the overall process of creating the reports are time consuming and ineffective. Next, the reports will be stored ain various files which may lead to problems such as misplace of files and data loss. The process of searching for a specific report will also be time consuming upon the accumulation of a huge collection of reports in various files cases. With this application, it can help to simply the process even further which will overall improve the efficient of the work flow. The objectives that will be require to achieve in order to determine the success of this project are to design an android application to create such reports from a staff smartphone, to successfully complete the development process of the application and finally to test the functions of the android application such that it fulfils the purpose to solve the issue presented at hand.

2.   Related Work

2.1   Management Information System

Management Information Systems (MIS) is the study of the relationship between people, in an organization and the relationship of it with technology [1]. A typically MIS consists of both hardware and software components that helps support the operations of an organization [2]. The main goal or purpose of any MIS are to gather various important data in an organization and help visualize the relationship form from the data. Through this visualization, various tactics and strategy can be implemented to further improve the process or overcome any issue with it.

2.2   Inventory Management System

An inventory management system (IMS) or commonly known as inventory system is a system that is responsible for keeping track of a product through its entire process that is from the ordering the product from the supplier until the product is put up for end sale to the consumer [3]. A typical inventory system consists of both hardware and software components. IMS are popularly used by both small and big organization for various purpose such as managing a company assets inventories, products for sale inventory and also various components or materials required to build a product. A reliable and efficient IMS can improve the overall work flow process in an organization.

2.3   Damage and Defect System

A damage and defect system are used in listing and storing various damaged or defect products of an organization [4]. The system function almost similarly like an inventory system however, this system will mainly be used for specific product that are deemed not up to standard for usage and selling purpose. The goal of this system is to keep track of all damaged and defect products in order to be used by the organization for future purposes such as determining the product most commonly found to be damaged or defect.

3.   Methodology/Framework

The Damaged and Defect Inventory Management System using Mobile Application is developed using object-oriented software development life cycle model (OOSDLC) [5]. The phase begins with the requirement analysis phase, design phase, implementation phase and testing phase. The OOSDLC model was chosen as the methodology for the system development was because the object-oriented approach better suits the overall development process.

3.1   Requirement Analysis Phase

The requirement analysis phase is the phase where all the requirements of a system are identified and documented. The process of obtaining the requirements can be done through various methods such as interviews, observations and previous documentations review. Once the initial requirements are obtained, a project proposal is developed. The proposal is then sent to the stakeholders to be verified. The system functional and non-functional requirements are also identified in this phase. Besides that, to have a better understanding of the system, UML diagram and use-case diagram are done to further visualize the system requirements specifications.

3.2   Design Phase

At this phase, the requirement specification that was discovered will be studied carefully in detail. Based on that study, a system design will be prepared accordingly. A flow chart and DFD diagram will be created to visualize the system process flow. At the end of this phase, the overall system architecture will be obtained.

3.3   Implementation Phase

The software development of the system will begin at this phase. In this phase, the system will be programmed and develop according to the system architecture constructed at the previous phase. Each of the system modules will be developed using the suitable programming language and tool while the system interface will be developed to better suit the system environment. At the end of this phase, a prototype of the system will be obtained which will then proceed to be tested at the next phase.

3.4   Testing Phase

The testing phase will be started upon the completion of the implementation phase. At this phase, the system will be tested strategically to ensure that the program functions as intended. Two important types of testing will be performed at this phase which are the functionalities testing and the acceptance testing. The system will also be tested for any errors and bugs that might cause the system to crash. A system testing documentation will be produced at the end of the phase that will contain the activities perform during the phase and the outcome of the testing. The system functionalities will also be determined if the system manages to achieved the requirements of the project.

4.   Analysis and Design

System requirement analysis is a process in determining the outcome of the system by the end of its development. During the development of the system, the requirements are formed to determine the user's expectation of the system and also how the system should be developed. The requirements of a system can be better understood through the visualization of it in the form of use case diagrams, sequence diagrams, activity diagrams and class diagrams.

4.1   Use case diagrams

Use case diagrams is a type of Unified Modelling Language (UML) that are mainly use to gather the requirements of a system including the internal and external influences [5]. Use cases specify the expected behaviour and the exact method of making it happen. A typical use case diagrams will contain

actors that represents the users of the system, use cases that represents the system functions and the communication links that shows the relationship between them. For this system development, there are two actors that is the admin and staff of the system. Based on Figure 1 below, there are seven use cases of the system which are registration, login, create report, view report, edit report, delete report and generate overview report. Each use cases in the diagram plays a significant role in the system.[7]
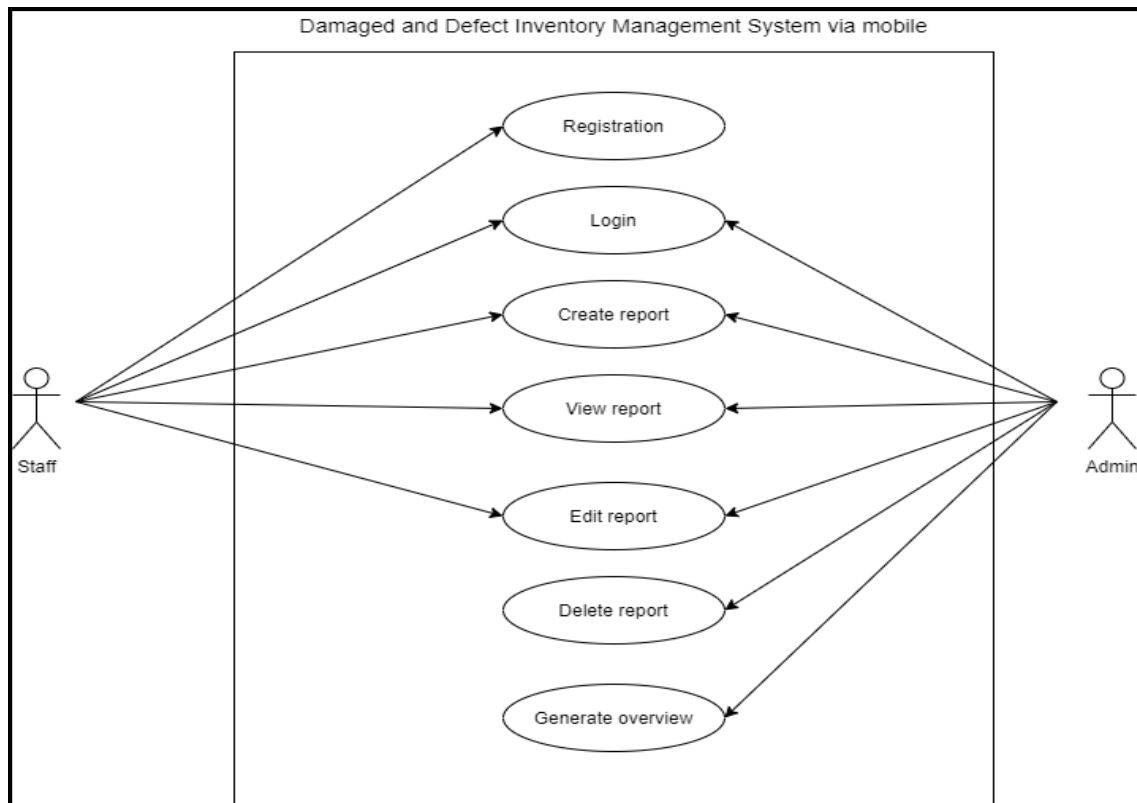

Figure 1: Use Case Diagram

i. Registration

The staff of the application will require an account before accessing the services of the application. New staff that hasn't created an account will be able to do so at the registration page. For the registration, the staff will require to enter their email address, username, staff id and password. After registration is successful, the staff can proceed to login to access the application services. For admins, only an admin of the application can add a new admin directly through the database. This is done to ensure that admin privileges are only given to certain individuals only.

ii. Login

Upon registering an account, the user can login through the login page. At here, the user will require to enter a valid username and password to login into the system. If an error occurs, the user will receive a notification stating the login failure and will require the user to login in again.

iii. Create Report

One of the main functions of the application. At the create report page, the user will be displayed an empty report form with the required information field needed to create a new

report. At here, the user can fill in the required information needed to create a report form before submitting the form into the database.

iv. View Report
The view report functions will display all of the report stored in the database. At here, the user can view the complete list of the report created by all the user of the application. A simple filter search feature will also be available here to enable the user to easily narrow the search of a specific report.

v. Edit Report
The edit report functions can be access by the user to edit an existing report stored in the database. This feature will enable the user to make changes to a report created in the past and upon making the necessary changes, the user can submit the form with the new changes which will replace the original file in the database.

vi. Delete Report
The delete report function can only be access by the admin to delete a form entry in the database. Upon completing the deletion process, the report record will be removed from the database.

vii. Generate Overview
At this function, only the admin will be able to generate a general overview details of the reports stored in the application database. An example of the overview is the number of reports created in each month. With the help of this function, the admin can have a better understanding on the reports status presented in the database.

4.2 Sequence Diagram

Sequence diagrams help to identify a set of cooperative objects involved in the use case scenario [7]. These sequence diagrams are used to illustrate the interactions involved between the actors and the order or arrangement of each event, such as how reports are created and stored in the database.

i. Registration and Login Sequence Diagram
Figure 2 shows the sequence diagram for the staff registration and login process. When opening the application, the staff will firstly be displayed the main menu. Before proceeding to access the other function of the application, the staff will be required to login. At the login page, the staff will require a valid username and password to login. If the staff is a new user, the staff can then proceed to the registration page to create a new user account. At the registration page, the staff will require to enter their email, username and password. Upon successfully registering a new account, the staff can then proceed to login their account.
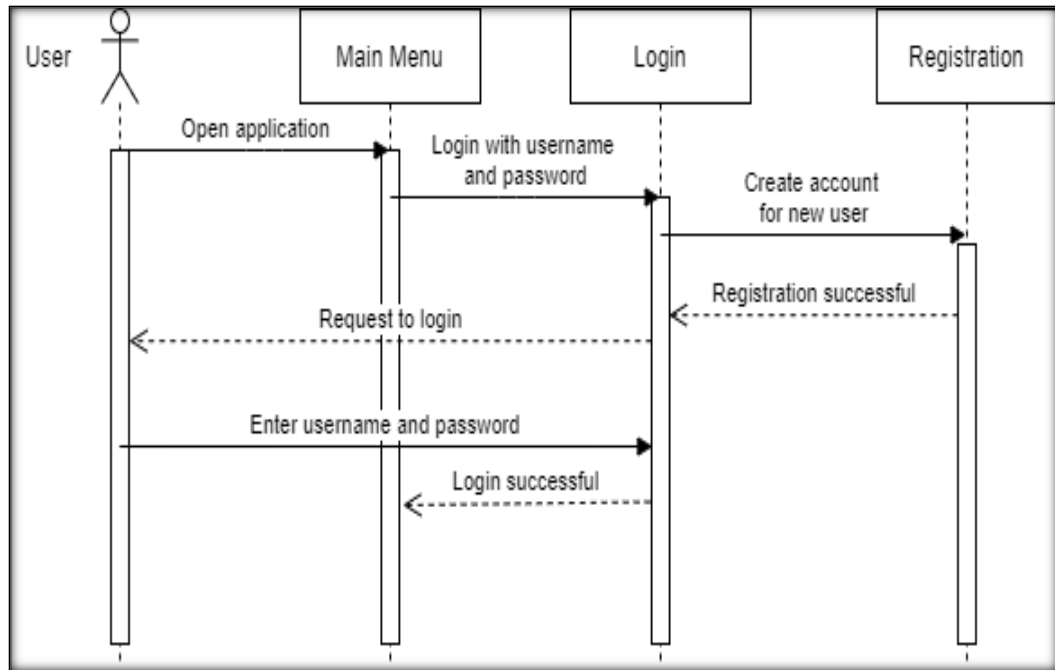
Figure 2: Registration and Login Sequence Diagram

ii. Create report sequence diagram

Figure 3 shows the sequence diagram to create a report process. From the main menu, the user can select the create a report function to add a new report into the application's database. At the create a report page, the user will be displayed a report template with the required details field needed to be enter by the user to successfully create a new report. After filling in the required details, the newly created report can then be submitted. The application will firstly verify that all the required fields are not empty before proceeding to store the report into the database. The user will be notified of the report status before being redirected to the application main menu.
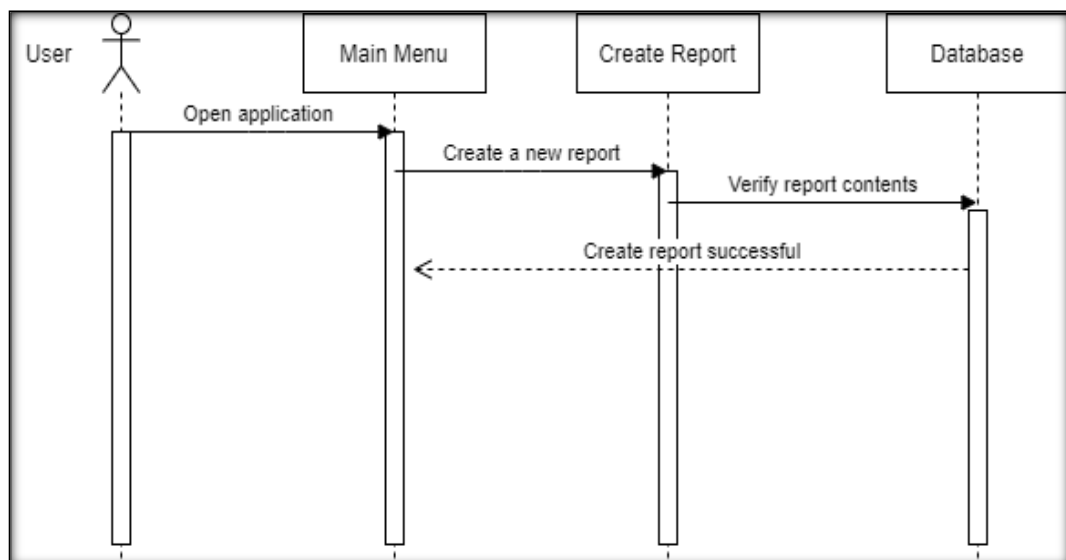

Figure 3: Create Report Sequence Diagram

iii. View, Edit and Delete report sequence diagram

Figure 4 shows the sequence diagram to view, edit and delete a report process. From the main menu, the user can select the view report function to view all the reports stored in the

application's database. At the view report page, the user will be displayed a list of all the reports stored in the database. The user can then select a desired report form the list which the database will then retrieve the targeted report and displays its content to the user. While viewing the content of the report, the staff will be only be given the option to edit the report while admins can edit or delete the report. Any changes made by the user during the process will be performed before redirecting the user to the view report page where the updated list of reports will be displayed.
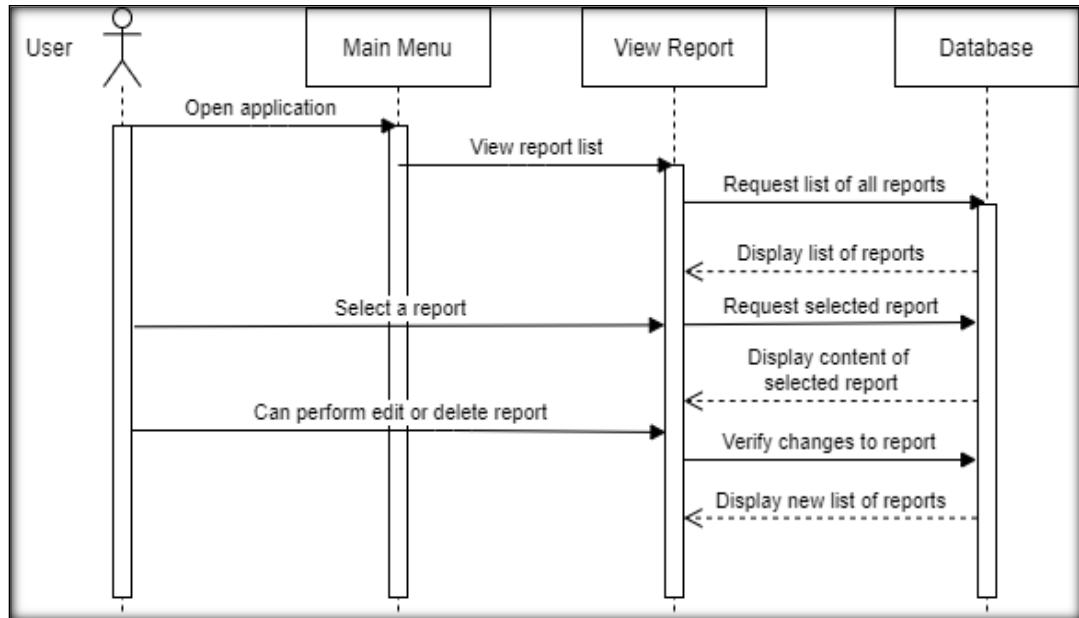

Figure 4: View, Edit and Delete Report Sequence Diagram

iv.   Generate overview sequence diagram
Figure 5 shows the sequence diagram to generate the overview process. From the main menu, the admin can select the generate overview function to request the application to generate a general overview status of the reports available in that application database. At the generate overview page, the admin will be displayed visually charts of the reports status in the database.
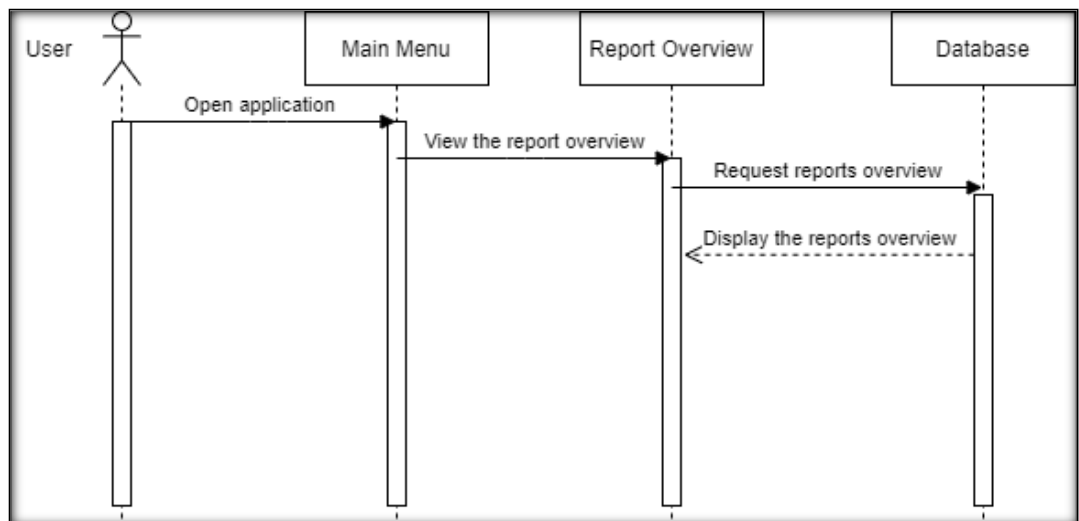

Figure 5: Generate Overview Sequence Diagram

4.3   Activity Diagram

Activity diagram describes the dynamic aspects of the system. Activity diagram is quite similar to a flow chart that shows the modelling flow from one activity to another activity. The main purpose of designing an activity diagram is to have a better understanding of the system process flow and also suitable for modelling on how the use cases interact with each other to perform various operations. Figure 6 shows the activity diagram for the user. The application firstly starts by displaying the main menu. Before proceeding to access the other functions of the application, the user will require to login valid account. After successfully login, admin can choose to either create a new report, view the reports in the database or generate an overview of the reports. Admins can also edit and delete the reports in the database. On the other hand, staff can choose to either create a new report, view the report or edit the report in the database. Once the user has performed the task needed in the application, the user can then log out of the application before closing it.
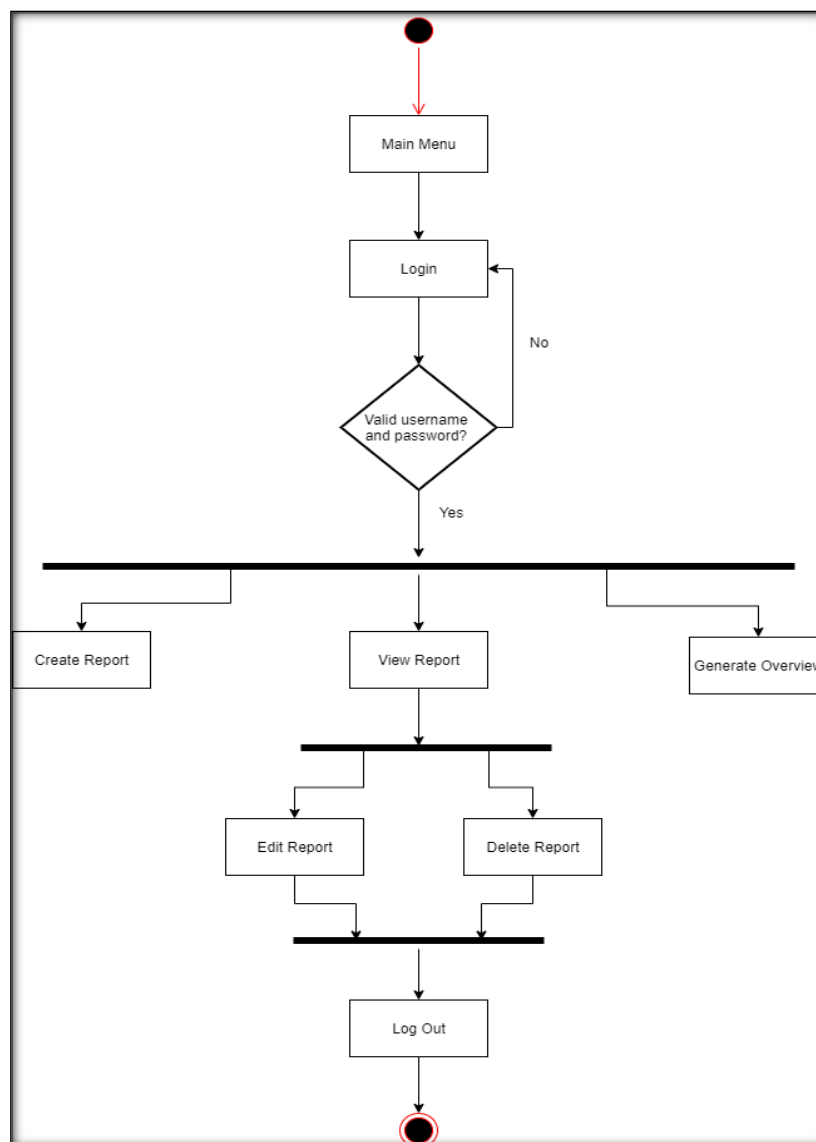

Figure 6: User Activity Diagram

4.4   Class Diagram

Class diagram is a form of static structure diagram that describes the overall structure of the system by visualizing the system classes, attributes, operations and also the relationship among the objects in the system. Figure 7 shows the class diagram for the Damaged and Defect Inventory Management System using Mobile Application.
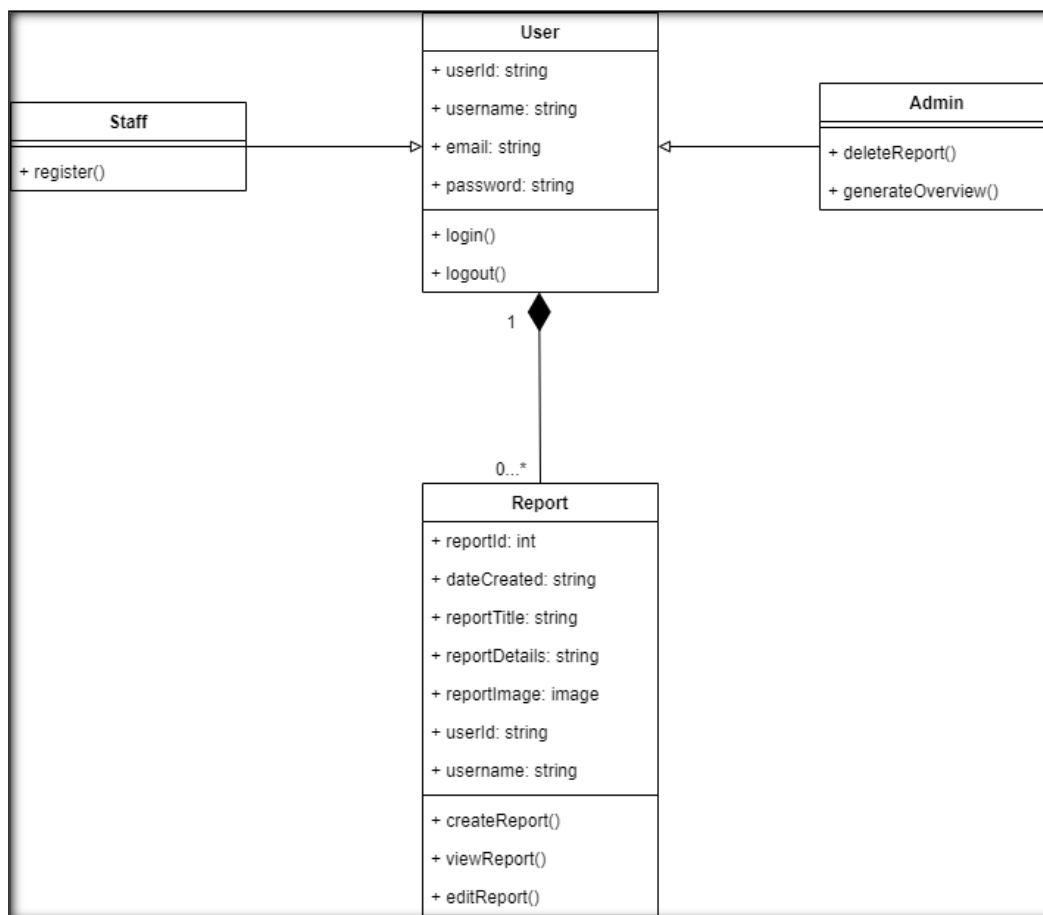

Figure 7: Class Diagram

4.5   Database Design

The design of the database illustrates the type of data contained in the database with its respective attribute and functions. For the development of this application database, Google Firebase was chosen as the primary choice for the database. There are a total of 2 tables in the application database which are the user's database and the reports database.

   i.   Users Database
          The user's database will store all the details of users. Table 1 shows the attributes of the user's table. In the users table, the userId is set as the primary key.

Table 1: Users Table

Attributes	Data Type	Size	Key	Descriptions
userId	string	30	Primary	Admin user ID
username	string	30	None	Admin username
email	string	30	None	Admin full email address
adminStatus	Boolean	10	None	Admin privileges
password	string	30	None	Admin password

ii. Report Database
The report database will store all the details of the reports. Table 2 shows the attributes of the report table. In the report table, the reportId is set as the primary key.

Table 2: Reports Table

Attributes	Data Type	Size	Key	Descriptions
reportId	int	30	Primary	Report ID
dateCreated	string	30	None	Date the report was created
reportTitle	string	30	None	Report Title
reportDetails	string	50	None	Contents of the report
reportImage	image	100	None	Image file type of the report
userId	string	30	Foreign	User ID of the report creator
username	string	30	Foreign	Username of the report creator

4.6   Testing

The testing process is conducted thoroughly to ensure that the system functions as intended and that the system will not have sudden crash or issues throughout its usage. The testing process is mainly done through the usage of test cases. A test case is a set of steps performed in order to established or test a feature or function of the system. Each test case will consist of the test case id, test description, test steps, test data, expected results, actual results and pass or fail status. Table 3 in Appendix shows the test cases table.

5.   Conclusion

To conclude this project study, the overall objective and requirements for this project have been successfully achieved. The full documentation of the study has also been completed for future references that may possible be use by others. At the end of this project development process, the application develop consists of some advantages and disadvantage to it. Some advantages of the application are such as having a user-friendly interface and also the application being cost and time efficient in comparison to the old method. As for the disadvantages are such as the application restriction to being only able to operate in the Android environment. The application also requires constant network access to operate seamlessly and also only having a single online storage without any data redundancy. Finally, some future improvements and recommendation that can be implemented for this project are to develop an iOS version of the system and also to configure and integrate another remote database to avoid any data loss.

Acknowledgement

Appendix

Table 3: Test Cases Table

Test Cases	Test Description	Test Steps	Test Data	Expected Results	Actual Result	Pass/Fail
TC 001	User attempts to login into the apps without an account	1. User launches the apps 2. Enter email address 3. Apps detected new email 4. User enter details for new account registration	Any new email	The registration form will be displayed	Similar as expected result	Pass
TC 002	User attempts to login into the apps with an invalid account	1. User launches the apps 2. Enter email address 3. Enter password	Any invalid email and password	User cannot login. An error message will be shown	Similar as expected result	Pass
TC 003	User attempts to login into the apps with a valid account	1. User launches the apps 2. Enter email address 3. Enter password	Email: user1@email.com Password: asdfasdf	User can login into the apps	Similar as expected result	Pass
TC 004	User attempts to create a report without completing the required details	1. User select the "Create Report" tab from the main menu 2. User attempts to click the "Create Report" button	No data is entered into the all the report fields	User cannot click the "Create Report" button	Similar as expected result	Pass
TC 005	User attempts to create a report with completing the required details	1. User select the "Create Report" tab from the main menu 2. User attempts to click the "Create Report" button	Relevant data is entered into the all the report fields	1. User can click the "Create Report" button. 2. A confirmation message box will be displayed 3. If user select "Yes" a new report is created and added to the database. The user will	Similar as expected result	Pass

			be redirected to the view report interface. 4. If user select "No" the confirmation message box will close		
TC 006	User attempts to view the list of all reports in the database	User select the "View Report" tab from the main menu	-	List of all the reports in the database will be displayed	Similar as expected result	Pass
TC 007	Users attempts to view in full details of a report from the database	User select the "View Report" tab from the main menu User selects a desired report from the list of reports	-	Full details of the selected report will be displayed	Similar as expected result	Pass
TC 008	Users attempts to edit a report created by another user	1. User select the "View Report" tab from the main menu 2. User selects a report created by a different user from the list of reports.	-	User won't be able to edit the report as the report is created by a different user	Similar as expected result	Pass
TC 009	Users attempts to edit a report created by the same user	1. User select the "View Report" tab from the main menu 2. User selects a report the current user created from the list of reports. 3. User click the "Edit Report" button to edit the report.	-	1. User can view and click the "Edit Report" button. 2. After clicking the button, the reports fields can be edited. 3. User can complete the edit process by clicking on the "Edit Button" again. 4. A confirmation message box will be displayed. 5. If user select "Yes" the report changes will be	Similar as expected result	Pass

				edited and store in the database. 6. If user select "No" the confirmation message box will close	
TC 010	Users attempts to delete a report without admin privileges	1. User select the "View Report" tab from the main menu. 2. User selects a report from the list of reports.	Account without admin privileges	User won't be able to delete the report as this can only be done by user with admin privileges.	Similar as expected result	Pass
TC 011	Users attempts to delete a report with admin privileges	1. User select the "View Report" tab from the main menu. 2. User selects a report from the list of reports. 3. User click the "Delete Report" button to delete the report.	Account with admin privileges	1. User can view and click the "Delete Report" button. 2. After clicking the button, a confirmation message box will be displayed. 3. If user select "Yes" the report will be deleted from the database. 4. If user select "Cancel" the confirmation message box will close.	Similar as expected result	Pass
TC 012	Users attempts to sort the list of reports by alphabetical	1. User select the "View Report" tab from the main menu. 2. User clicks the sort button on the top right of the interface. 3. User selects the "Alphabetical" option.	-	The list of reports will be sorted alphabetically based on the report title.	Similar as expected result	Pass
TC 013	Users attempts to sort the list of reports by most recent	1. User select the "View Report" tab from the main menu.	-	The list of reports will be sorted by most recently created based on the report date.	Similar as expected result	Pass

		2. User clicks the sort button on the top right of the interface. 3. User selects the "Most Recent" option.				
TC 014	Users without admin privileges cannot view the "Generate Report" tab from the main menu	User open the app.	Account without admin privileges	The user won't be able to view the "Generate Report" tab from the main menu	Similar as expected result	Pass
TC 015	Users with admin privileges can view and access the "Generate Report" tab from the main menu	1. User open the app. 2. User can view and select the "Generate Report" tab from the main menu.	Account with admin privileges	1. The user can view and access the "Generate Report" tab from the main menu. 2. A line chart will be generated based on the data obtained from the database. 3. The chart x-axis represents the year the reports was created while the y-axis represents the number of reports available in each year from the database.	Similar as expected result	Pass

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