Inventory Management Systems (IMS)

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***Abstract*—This study aims to develop an Inventory Management Systems (IMS) that can provide better control and handling of product stock, customer order, customer service and order delivery that relates to company inventory information. The target user is the owner and employee in Small and Medium Enterprise (SME) retail store that stills manages inventory manually in Malaysia. IMS helps retail store to track down the next arrival of product stocks and record customer order for reservation for the product in the store inventory. In this study, the developer used PHP for backend system development and HTML, CSS, JavaScript for frontend system development. This study also applies Rapid Application Development (RAD) software methodology that emphasize on iterative development process. Even though the inventory management system has been fully developed by the developer, there are still limitations found and future enhancement that can be made towards the system.**

Keywords—CSS, HTML, Inventory Management Systems (IMS), JavaScript, PHP, Rapid Application Development (RAD), Small and Medium Enterprise (SME).

Inventory management is one of the crucial supply chain components in retail store. Every day or by weekly, the store needs to update the stock that is coming in or out. Most of the retail store must at least have a warehouse to store their products. To remain customer satisfaction whenever the shop does not have the product, retail company provide delivery service through customer order for product that comes from warehouse inventory. Having inventory management system within an organization is important because the business can monitor and control their product stock and business revenue that is going on within the organization. At the same time, it is also to determine the suitable product quantity to restock according to customer and market demand which will reduce business loss of overstocking (Plinere & Borisov, 2016). Without having good inventory management system within organization, it can cause many businesses risk especially for retail store such as out of stock and product that is not sold due to market demand which will bring a dissatisfaction to customer and business lost (Patil & Divekar, 2014). Moreover, inventory management in an organization are done manually such as updating and checking inventory stocks in an excel and or logbook in some company nowadays and in the old days.

Nowadays, there are many webs application on inventory management system for businesses that deals with managing product and stock. Even if there are inventory management system in the market, there are many companies that still managing their stock in the inventory manually. This is due to company owner finds the inventory management system is costly, unattractive, inflexible, or unsuitable for their business. Therefore, this study is to develop a web application of inventory management system that is less costly and suitable for small to medium business.

I. LITERATURE REVIEW

A. Overview of Inventory Managenent System

Most of the current Inventory Management System that is provided in the market rely on employee to record and track the product in the inventory using web application of inventory management system. These web applications are developed due to several researcher faces similar problems with their client when their inventory is managed manually and contribute to time consuming and inefficient work.

An Inventory Management System for a company in Indonesia has been developed to manage warehouse inventory that is produced with the goals of reducing error on recording product stock into the warehouse inventory and make process of product in and out of the warehouse inventory more effective. To achieve that, simple functionality has included in the system by the researcher which the overall functionality is view of inventory information data including product detailed report within time range and form template for managing the inventory product information. As from the research conclusion, the author work of web-based inventory management application is efficient and effective which will lessen some job on inventory management (S Pasaribu, 2021).

However, most company owner or manager would like to see various kind of report approach and information that can view their inventory and product situation quickly for better planning. A similar development research study that was conducted by technology school student to develop an inventory management system for AIKTC Server Centre. Similarly, the inventory management system is developed due to AIKTC company of manual tracking and recording of product stock problems which the server inventory management is done once a few days or weeks. Though, there is minor difference of situation and usage compared to previous research study, there is various kind of report information and statistical data that is needed and generated by AIKTC such as inventory transaction, purchase, issue, and maintenance report which is part of the author system requirement (Aamir Khan, Aasif Ansari, MD Ghalib, 2019). The research study can be concluded that the inventory

management system the author developed will avoid the employee from performing inventory management manually where data is more secured and various report is auto-generated easily (Aamir Khan, Aasif Ansari, MD Ghalib, 2019).

B. Overview on Tools and Programming Langugae for Inventory Management Systems

A research study has come out with database maintenance of inventory management system for desktop application. The authors have stated they the used python with Tkinter library and SQLite as implementation can be simple and reliable due to its usage popularity. The research study resulted in simple and effective implementation of desktop inventory management system application that can save time, reduce time, secured of storing and retrieving data with the open of future enhancement towards internet of things (IoT) (Yuvaraj et al., 2020).

In another research, the researchers confront a problem with specific E-Commerce store where data are missing and lost from database due to improper inventory control. This may be caused by improper database type being used by E-Commerce store. In this research, the author has done a deep investigation and comparison on programming language and tools used especially on database technology for implementing the inventory management system. This is to ensure the researchers can find a faster rate of development and to ensure database are store as structured data where user will be able to view and find the data easily in organize row format unlike unstructured data. Based on the research conclusion, the researchers label their developed inventory management system as hybrid system as it utilise both Java and MongoDB where it is efficient and reliable in processing query with clean user interface that is designed using NetBeans (Srivastava et al., 2020).

As for portability and real-time system there is also web application inventory management system which consist of their own programming language. In research done by educational students, the researcher decides tools that is free to use for developing the web-based inventory management system due to cost problem. At the same time, the researcher also considered on what is suitable for them as their project timeline is short. The thought of system architecture for client server has been taken into consideration by the researchers. Therefore, the result of this research is to use Java JSP and MySQL for implementing the web-based inventory management system as it is free to use which solve the research cost limitation problem (Arina Ramlee, David Henry, 2019)

Lastly, S Pasaribu (2021) has developed an inventory management system based on web application which utilises on HTML, CSS, JavaScript, for frontend, PHP, MySQL, and Apache for backend of the system. The programming languages chosen by this researcher are very common and most used for developing a web application on any project in the market nowadays. Based on the researcher stated tools and programming languages used, the researcher uses a legacy PHP to develop this system which can be quite inefficient compared to using a programming language framework.

Based on the past studies, it can be concluded that choosing a suitable programming language according to type of project application will not only affect development time and cost but also software quality. Nonetheless, supportability and public usage of selected programming language should also be considered to ensure it is not outdated.

C. Comparison of Similar Systems

The proposed system might have some positive and negative impact compared to other similar inventory management system that is provided in the market. As most of the similar mention above such as Zoho and Delivrd, they required user to pay monthly subscription where more features and resources usage will be provided while the proposed system feature will provide for free and resource usage is depends on the hosting device. The proposed system also has combination of each similar system of general inventory management feature which the researcher has added a few businesses module to such as Customer Feedback and User Management Module. At the same time, the proposed system also implements both table and various visualise graph report which each of the similar system is lacking each other. Also, the proposed system also has low on stock reminder on dashboard and email which other comparison of similar system does not have. While the negative impact of the proposed system in this project compared to other similar system is that there is no future implementation of internet of things such as barcode or QR code scanning. Moreover, the proposed system has medium difficulty usability compared to other similar system as the proposed system have a lot of validation for data to be retrieve and recorded.

II. PROBLEM STATEMENT

An Inventory Management System allows employee or manager to track, record, and overview product stocks that is coming in and out from the company inventory to ensure there is no unexpected low on stock or overstock occur. Some small companies just manually used the inventory management as thought that investing inventory management system is not necessary. This is because most inventory management system software that can be found on the Internet require user to pay for monthly subscription. Moreover, this paid software is mostly unsuitable for most businesses as there is limitation usage, expensive to maintain, and confusing to use (Jallow, 2018). Thus, the proposed software in this study provide the user with general inventory management feature to ensure it is suitable for small company usage and less cost needed for the software development.

In addition, research related to AIKTC Server Centre has also experienced side effects on managing their inventory manually as there is more client order received for their product. This is because employee must track and record product and equipment that is coming in from supplier and going out for customer order from the company inventory manually. In a long-term process, it is inefficient on employee productivity for inventory management due to data are recorded manually in paper which is time consuming, and possibility of inaccurate data carry out (Aamir Khan, Aasif Ansari, MD Ghalib, 2019). To increase efficiency for employee on manage inventory, the proposed system provides a template for recording and search product stock in the inventory easily.

Lastly, creating product stock and sales report manually can be ineffective and inaccurate as there are chances of human error. Therefore, manager and employee sometimes forecast how much stock to be bought depending on the

customer demand will sometimes causes overstock or out of stock in the inventory (Patil & Divekar, 2014). At the same time, there is lacking summary on report where some company manager is unable to overview information on how their business done monthly. The proposed system provides a summary report that represents in graph format which allow user to view their company business sales and product inventory condition easily.

III. AIMS AND OBJECTIVE

Aim of this study is to develop an inventory management system that can provide better control and handling of product stock, customer order, customer service, and order delivery that relates to company inventory information.

The objectives are:

- To reduce manual tracking and recording of incoming and outgoing stock from company inventory.
- To provide summary of sales and product report for manager to view business situation.
- To provide a better customer service to handle feedback based on their order quality and problem.
- To produce effective computerized system to be used by all parties who involved directly in inventory management.

IV. RESARCH METHOD

A. Target Users

The target users for the proposed system will be owner and employee that is related or working to the retail store that involves in using the inventory management system for track and manage product information store in the warehouse inventory. In the proposed inventory management system, each target user will have their own role and feature based on given user roles of login credential. There are 5 target users with different login credential role which is Super Admin User for system admin and company owner, Admin User for employee that handles inventory information, Delivery Staff, Customer Service Staff, and Human Resource Staff. Since the proposed system will be web application, every target user will be able to use the system through devices web browser including mobile phones that can help some employee to work at home and helps packaging staff efficiently without walking back and forth from the computer to track and update product status.

B. Technical Research

The developer has decided to choose PHP for backend system development of proposed inventory management system in this study. This is because PHP has smoother performance speed of building web pages as it requires less memory consumption. Moreover, PHP is free to use programming language for web development which does not require to pay. At the same time, PHP is well known for developing a full fledge application that can be used in most situation (Mariappan, 2017). Last and foremost it is easy for developer to learn and write code as the syntax can nearly be interpret as English.

Then, the developer has chosen HTML, CSS, JavaScript for frontend system development of proposed inventory management system. Components design of web pages will be using HTML while CSS can make the web pages and the components to be more attractive. After that, the developer utilises JavaScript which is use for making web pages to be interactive where user experience is concern. The finished frontend system without any backend process can also be used as prototype to show project stakeholder to test and finalise the web page design and user interaction with the proposed inventory management system.

C. IDE (Interactive Development Environment) chosen

An Interactive Development Environment (IDE) is a software development application that provides developer various tools such as code editor, debugger and many others depending on which IDE is being used. Throughout the development in this study, the developer will be using between Visual Studio Code version 1.59.0 and PhpStorm version 2021.3.2 due to the developer preferences of code editor in the IDE. At the same time, both IDE supports PHP environment which is suitable for this study.

For PhpStorm, the code editor consists of all basic features that developer needs to be use during development when the IDE is installed. For example, the code editor allows to use auto code completion, highlighted syntax error, quick error fixes, and others that can make developer to write code at ease (PhpStorsm, 2022). At the same time, PhpStorm also provide code searches throughout the project files which will lessen the time for developer on finding specific code in a large project file. After that, there is also PHPUnit test which is part of PhpStorm IDE where it is used for testing business logic code as code coverage (PhpStorm, 2022).

In Visual Studio Code, the IDE also have highlighted syntax error, auto code completion, snippets and many more compared to PhpStorm (Microsoft, 2022). However, developer is necessary to download suitable extension for the stated feature in Visual Studio Code as the IDE supports many other programming languages. At the same time, developer can customise the interface for code editor of Visual Studio Code that can be install from Microsoft Store to suit their comfortability (Microsoft, 2022). Moreover, both Visual Studio Code and PhpStorm have Git or GitHub support that allow developer to manage project development progression easily.

D. Libraries/Tools chosen

Laravel is a PHP framework that have good reputation on developing and delivering web application on both frontend and backend at a rapid speed. This is because Laravel framework is easy to understand as most of the design pattern are following model, view, and controller (MVC) which is commonly well-known in developer community (Tutorialspoint, 2021a). Also, most of the syntax used in Laravel framework are mostly the same as normal PHP language which a developer with less knowledge on PHP will be able to utilise Laravel framework also. In terms of usage, Laravel is free to every user and the documentation of the framework are provided by their own websites. Also, there are certain prerequisite that developer need to install before using Laravel framework which is composer. With the composer, it allows developer to create a project with other framework which is not limited to Laravel where their dependencies of the framework library are stored inside

composer.json file (Tutorialspoint, 2021a). Moreover, the Laravel framework also uses Artisan where it has a set of command for web development such as creating controller class automatically in the project file. There are many features if a web application utilises Laravel framework. One of the few feature that is best to describe for this project are testability, routing, query builder, and authentication where the others feature are commonly used in the market for more complex feature. Laravel framework is still getting updates where the current version is 9 that is released not long ago in February 2022 to follow up the feature of latest PHP version 8 (Otwell, 2022).

As for frontend development on CSS, the developer decided to include Bootstrap 4 framework in the project as it is free to used and mostly known for developed interactive and responsive website design (Ayushjoshi, 2022). The developer has chosen Bootstrap framework is because it is widely used in the community and ease to implement compared to normal CSS language. Furthermore, any developer unfamiliar with Bootstrap can learn the usage in short amount of time as developer must know pre-defined class stated on Bootstrap documentation. This is because the design code is already provided by Bootstrap pre-defined class where developer do not need complex code on CSS to design the website. Bootstrap framework is continuing their support on their framework which the newest Bootstrap 5 has just been released in recent months.

At the same time, the use of DataTable library is also included in this project. This library will allow developer to create table for frontend more easily as there is component and function that is stored in their JQuery. By using DataTable library, developer do not have to worry on implementing data pagination or data search by themselves for the table in frontend as the library provide the mention function in their JQuery library. Another benefits is that the data pagination and data search on the table does not require user to refresh the page.

E. Database Management System Chosen

A normal database management system (DBMS) is normally store in a server where it is used for managing data such as accessing, delete, update, and store new data to the database. There are many types of database management system in market nowadays. One of the types of database management system that will be used in this project are relational database management system (RDBMS) which is common in both educational and market purposes. The relational database management system (RDBMS) such as MySQL exists to make better performance on database in terms of speed and flexibility compared to normal database management system (Xiaojie, 2011). This is because MySQL database store data in relational way by separating tables which consist of their relationship between tables and data field which is suitable for the proposed inventory management system. By doing separation of table and relationship, it can help most application to avoid any inconsistence outdated, or duplicate data (Oracle, 2022). Moreover, MySQL has released its license as open source which is free for every developer for personal use since the year 1995 (Xiaojie, 2011).

The first advantage of using MySQL in this project is that it provides good compatibility with most application or platform that can be found in the market nowadays (Alexandrea, 2022). This is because, MySQL is maintained and supported by Oracle where various updates of MySQL version and documents are provided over the years. After that, MySQL is also good for web application as data can be store or fetch according to business logic or use cases. Lastly, the data store in MySQL is secure and fast in processing rate due to data masking and flexible data column (Alexandrea, 2022).

There are few disadvantages of using MySQL in this project is that it is not suitable for having large-sized data (Alexandrea, 2022). This is because MySQL will process the whole database for a process such as searching a specific data or viewing data which causes performance to be slow. After that, MySQL also tend to have data corruption if some of the specific use cases is being used due to MySQL is Relational Database Management System. Certain actions are restricted to ensure MySQL data is not corrupted such as creating transaction and audit (Munasingha, 2021).

F. Operating System Chosen

The developer is using Windows 10 version 21H1 with 64-bit that is install in laptop. This is because Windows operating system is being used widely and common in the market. Moreover, the developer hardware device does not meet the requirement of receiving Windows 11 update.

G. Web Server Chosen

For this project, the developer decided to use XAMP as it is a free to use web solution tool which includes Apache Web Server for hosting the web application locally. The purpose of XAMPP is to allow developer to test their web application by hosting on local computer or laptop. The project work around XAMP is related to PHP, Perl, MYSQL, and Apache (Tutorialspoint, 2021b). XAMP is a perfect web development for creating frontend and backend of web application as result are shown in web browser after it is host locally. At the same time, it is also a perfect testing environment to ensure there is no issue on the developed web application before deploying to customer main server (Tutorialspoint, 2021b).

H. Web browser Chosen

In the proposed inventory management system, any web browsers will be able to access the web application. However, there will be a web browser that can get the best performance which is Google Chrome where the developer will be focussed on developing. The options stated is easily access and owned by most user in their devices and getting support to increase performance in processing web pages.

V. RAPID APPLICATION DEVELOPMENT METHODOLOGY (RAD)

Rapid Application Development (RAD) is a software methodology that emphasize on iterative development process. The RAD software methodology is introduced by James Martin in the year of 1991 to solve the problems of slow development process in waterfall methodology (Agrawa, 2019). The slowness of using waterfall methodology in software development is due to the documentation activity such as data gathering and analysis in early phases which often

lead to project failure in software development (Unhamzah, n.d.). With RAD methodology, data gathering is done during the project planning phase which it is done in a short time. In RAD methodology, prototype and system design is the most crucial part as it provides client and stakeholder an overview of how the web application going to works. Hence, RAD methodology is a trend in the market due to its fast development that produces results in a project (Creatio, 2022).

The characteristic of RAD methodology works around software reusability or software development frameworks with a small to medium team structure which its aim is to achieve project completion according to schedule. At the same time, project that uses RAD methodology must progress each task with caution to avoid any confusion and miscommunication for both project team and client/stakeholders (Unhamzah, n.d.). Lastly, software application develops using RAD are mostly suitable for client usage as constant testing on prototype are conducted.

The advantage of using RAD in this project is developing a quality web application of inventory management system. This is because prototype of the web application that is close to the real implementation system is given as a test for client and stakeholder which will get higher success rate of getting approve in user acceptance testing (Agrawa, 2019). After that, RAD methodology will provide a better management of project risk (Agrawa, 2019). This is because problems and issues are identified and solved efficiently in a short time. At the same time, the project development can be finished according to schedule if the task progress is run smoothly. Lastly, RAD methodology allows a project to have flexibility on requirement changed during prototype and design phase only (Creatio, 2022).

There are also disadvantages of using RAD in this project where it relies individual developer creativity to produce functionality during the project planning phase (Unhamzah, n.d.). This will make developer to have many works on the researched and gathering functionality which in the end some of the functionality will be removed from the list. At the same time, prototype that is completely rejected by client/stakeholder can also be seen as wasted effort and time as developer need to produce a new design and prototype (Creatio, 2022). Moreover, RAD methodology requires a team of developer to be experienced on doing the task they receive (Agrawa, 2019). This is due to the nature of RAD methodology as it requires the product to deliver at a short amount of time which inexperience developer might not contribute much to the project as they require training on the technology used which requires time.

A. RAD Phases and Stages

As shown in Fig 1, the first stage of RAD for this project is Requirement Planning or Defining Project Requirement where this project activity is mainly on the developer to define all general features and requirement after research and explore on all the existed inventory management system. The definition of features and requirement for the proposed system will be based on user role to ensure it is agreed by projects stakeholders or participants. Also, there will be minor customisation apply for this phase which does not follow original RAD activity where the developer will state the expected deadline in each phase of RAD using Gantt Chart to ensure the developer can track of the project progress.

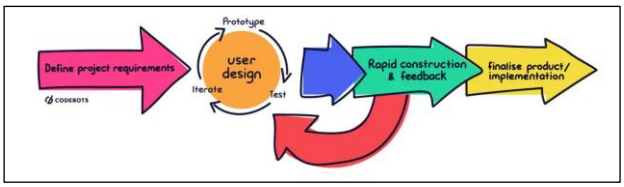

Fig. 1. RAD Phases and Stages (Chien, 2020)

The second stage of RAD is User Design where this project activity is mainly on developer to produce system model such as flowchart, some UML diagram, and prototype of web page design with interaction of the proposed inventory management system. Once the prototype and system design are done, it will be given to the experienced project participant with IT knowledge on validating the user interface and experience of the prototype and system design of the feature process flow are correctly stated and drawn.

The third stage of RAD is Rapid Construction where the developer will be focus on developing backend feature based on the system model. Then, the developer in this stage also will integrate the backend feature with the frontend web page that is done in stage 2. The expected result of this stage will be an inventory management system is fully working and run normally on the developer local device.

The last stage of RAD is Finalise Product where the developer will be conducting User Acceptance Testing with the project stakeholder or participants to ensure the proposed inventory management system is ready to be released and used (Bajjouk, et. al., 2021). There will be 1- or 2-week time for extending project duration for fixing the developed proposed system according to participant comment in UAT result. Once the change and fixes on proposed system is ready, the developer must prepare documentation such as user manual to ensure it can guide any new user.

VI. RESEARCH METHOD

The researcher uses quantitative research method by conducting survey. The questionnaire are distributed to IT and business groups which has some IT knowledge and experienced of inventory management. This is because the project developer lacking knowledge of inventory management and how to design web page that visualise report information that is ease for company manager or manager to do analysis. Therefore, the main objective of conducting the data gathering through questionnaire survey is to get better understanding of inventory management and participant opinion based on their knowledge or working experience as the researcher needs to know whether the proposed system is suitable to solve the manual inventory management process that is still practice daily in some retail store. Furthermore, the researcher also needs to know whether there is suggestion from participants regarding to report data that is useful for observing product sales and inventory condition of the company and the way to represent the report data for better view of analysis.

VII. REQUIREMENT ANALAYSIS

Based on the analysis conducted by the researcher, there are good and bad outcomes that is gathered from the participants in this questionnaire survey. This research is to get better idea of the data and features that is needed to be included into the proposed management system to ensure the report information will be useful for all retail company usage.

Moreover, the researcher also gets better idea of the problem in managing and tracking inventory manually in a book based on participants respond and answer. Therefore, most of the features for the proposed system that is stated in the deliverable will be remained while there are additional report data to be included such as Product Sales Report, Customer Feedback Report, and Product Quantity in Inventory Report which is highly recommended in the survey result.

VIII. SYSTEM ARCHITECTURE

Fig 2. shows the architectural diagram for the proposed IMS project which follows MVC pattern that is automatically provided by Laravel Framework during the creation of new project. MVC indicates for Model, View, and Controller which is a logical component in the software architecture diagram. In Laravel framework, MVC pattern will help separating business logic and application of the software project into the 3 logical components as stated (Kausar Bagwan & Swati Ghule, 2019). This is to ensure each component will handle their own task on the website (Tutorialspoint, 2022).

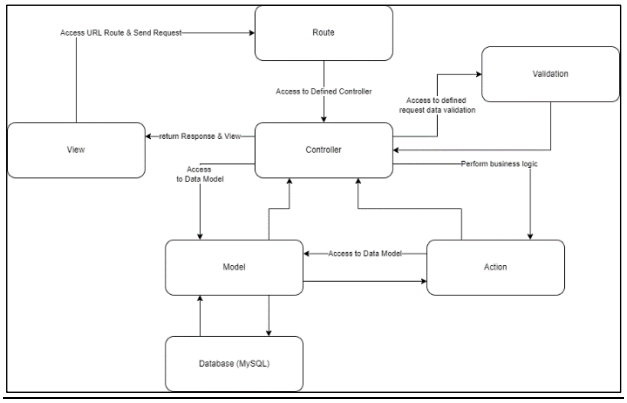

Fig. 2. Architecture diagram for the proposed IMS project

As shown in Fig 2, there is some decouple component being made from normal MVC pattern which is the validation and action component. As normal MVC pattern, the controller is being made into handling both request, response, and business logic. By decouple business logic from controller to action class and validation class, it can help other developer to read the code more easily during the maintenance as each class will only have 1 public method name execute (Collin, 2018). At the same time, it will save any code duplication by calling action class to desirable method in different controller class (Collin, 2018).

In Fig 2, there are 7 different components of the project system which are Route, View, Controller, Validation, Action, Model, and Database. To start, the route component is a file where all URL names are stored which also contains their defined controller class for behaviour and view name. View in the project component is user interface for web pages that stores HTML, CSS, and JavaScript, and others related web user interface library inside blade file. After that, there is controller component where all the controller class are used for handling request that is given from route and return a response or view of web pages (Aakashpawar, 2019). Then, there is validation component where all the validation class are used for validating request data according to stated coded rule function. As for action component, it is classes used for storing business or functional logic that is like an API. At the same time, model component is like an API that allows developer to code for storing, update, and fetch data from database component using Laravel eloquent and query builder feature which it is being utilise in action class or component (Kausar Bagwan & Swati Ghule, 2019).

The flow of Fig 2. starts with user using a specific URL from route component. With the specific route, it will access to the defined controller class with declared method which will normally return result of view or JSON response based on controller class function behaviour. Within the controller class of specific method, it will either perform business logic for backend data through action class then only return response with view or return response and view directly to the user. At the same time, the action class will access to specific model to query data from database like get, add, delete, and update while Controller class only access for getting data. Meanwhile, the validation component will only apply on controller component of specific method when there is request data received from the route.

IX. PROJECT PLAN

Release plan for a software application normally describe what features and changes has been done like adding, remove, or update/improved of existing component. In this study, the researcher will discuss what has been added, remove, or update on each version towards the inventory management system with the stated released date. There are 3 release version that is done on the inventory management system.

A. Inventory Management System (IMS) Version 1

The inventory management system (IMS) version 1 is released on the 10th of June 2022 where basic functionality like add, delete, update, and view for manage information feature that is used by super admin, admin, hr, customer service, and delivery staff user role is done in the application. The most basic authenticate and account feature like login, update profile information is also added. Interface Design

B. Inventory Management System (IMS) Version 2

The inventory management system (IMS) version 2 is released on the 17th of June 2022 where additional features like send daily notification, add restock order information, download restock orrder and update collected payment are added to the system.

C. Inventory Management System (IMS) Version 3

The inventory management system (IMS) version 3 is released on the 24h of June 2022 where minor changes on password data for update user information is done.

X. SYSTEM VALIDATION

Starting with the conclusion of unit test, the developer has confidence that the developed inventory management system will not cause any system error from the backend. This is because the unit test is done for every important feature of the system like create, delete, and update. Even though the unit test scenario is based on frontend, however the result conducted on the test is based on backend. However, view feature is not added in unit test as most of the backend only get data from database that relies on Laravel query builder API which most of the times does not cause error. As the

developer conducting the unit test on the inventory management system along the way, the developer has fixed some small error and add some minor validation for some features.

As for user acceptance test (UAT), the 3 selected tester has performed all and every user role feature in the inventory management system. By conducting testing in this approach, the result of ensuring that the system is free from any business logic bugs and error is higher. Moreover, the developer can get honest suggestion that can be made on the system as an improvement.

The first tester concluded that the inventory management system is good for managing product in the company inventory. This is because there is email notification on total for low stock and out of stock product provided daily by the system which is useful when they do not want to visit the system. In addition, the tester provides a suggestion on having the system records all the return product as it might have default or broken during the delivery. Also, the tester found a minor business logic error on the feedback where specific order can add more than 1 feedback information. The second tester can be concluded that the inventory management system is useful in her store. However, the tester finds the system to be difficult to used especially for creating customer order where finding product to add items on the order is time consuming as she need to scroll the dropdown box. Lastly, the third tester finds the system to be acceptable in overall as their store does not have any automated way to manage their product and stocks. The only problem that 3rd tester have is that he finds the system interface is dull as there is no image to represent the product.

Due to the project time constraint, the suggestion that is given by the 3 testers will be taken into future implementation and improvement on the system. The business logic error that is found by 1st tester has been solved by the developer on the inventory management system. The developer also found a solution for finding product in dropdown add customer order form by using Select2 library however further studies is needed for adjusting the web page design.

XI. CONCLUSION

The proposed and developed inventory management system aims to provide a free software that can be used by small to medium retail store that stills manages inventory manually in Malaysia. Moreover, it also helps a retail store to track down the next arrival of product stocks and record customer order for reservation for the product in the store inventory. In overall, the inventory management system achieved the general of inventory management activities but there are more additional features like recording feedbacks and assigning staff for order delivery and many more that can be used by the user if needed. Even though the inventory management system has been fully developed by the developer, there are still limitations found and future enhancement that can be made towards the system.

XII. LIMITATION

The first limitation of inventory management system is that the system only stores inventory, product, and sales information of the retail store based on only one inventory location. This is because most huge retail store businesses will have multiple inventory location to store their assets and products. However, small retail store will have only one inventory location as their businesses is small while medium size business retail stores that have more than one inventory location for storing their assets and product will face the limitation of using the proposed inventory management system. As the project timeline is very short, the developer did not aim to store inventory information from multiple locations.

Secondly, the customer order payment collectible only manually updates and records how much amount that is collected by the customer into the system. This is a system limitation as record or process payment transaction of credit card, debit card, or online banking is not useable on personal websites.

Lastly, the inventory management system is also not open to IOT features like scanning barcode on the arrival product. Features like barcode scanning can help to staff identify and search the product faster in the inventory without opening the product package itself which is useful for inventory management. This is because website application development for Laravel currently does not have a way to implement for scanning product barcode even if the website is developed dynamically for mobile phone browser to use.

XIII. FUTURE DIRECTION

Meanwhile there is also future enhancement that can be made on the system that is based on the feedback given by the tester in UAT test and the researcher ideas due to time constraint of the project.

The first future enhancement that can be made is to provide a search feature inside dropdown value especially for searching products in report or add customer order form. This will provide better user experience where user can design the desirable product in the dropdown component more easily.

Secondly, an additional data of product picture needs to be added to the system as requested by the tester. This is because the picture helps staff to identify variety and description the product. For example, there are varieties of milo flavours such as original, caramel, vanilla and cocoa.

Lastly, the system also needs an additional module for recording return product data that is based on customer order after valid feedback were given. Sometimes, product will be delivered at faulty condition due to unexpected circumstances. Thus company need to record the defect product return by the customer to view how much loss affected to the company.

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