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# A Development of RFID Based Sales and Inventory System for Hup Seng Aluminium

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**Abstract**: Hup Seng Aluminium & Glass is a company that using the aluminium's raw material that ordered from the supplier to build aluminium product such as door, cupboard, wardrobe, cabinet and window for sales. The problem faced by the companyarethe administrator uses manual system to record their business operation, difficult to track the inventory of aluminium's raw materials and products, the manual calculation of sales may occur human's mistake and the administrator unable to make replenishment of raw materials and products on time. The objectives are to design a Sales and Inventory System for managing the business record using structure approach, to develop the system using waterfall model and to test the system using functional testing. The system acts as a medium to manage inventory of raw materials and products, purchase order, sales order, user and supplier account and sales calculation. The system stores all the information of raw materials and products. The system stores the detail of sales order when customer purchasing and purchase order when ordering raw materials from supplier. Besides, the owner of the company shall receive sales report within given time of period. The administrator able to view the low stock item in dashboard in order to make replenishment immediately to maintain the stock in adequate level. The stock of raw materials will be deducted automatically when a product is added. The stock of raw materials will be added automatically when the purchase order is received while the stock of products will be deducted automatically when the sales order is delivered. Meanwhile, the user able to generate invoice in pdf format, download it and email it. The development of the system helps the company to reduce the problem occur in the business process and manage all business data in an easy way.

**Keywords**: Inventory System, Sales Management, Stock Management

## 1. Introduction

An inventory system is compulsory been established to record all transaction of inventory, including in stock and out stock, sales and purchase. Inventory of item normally need to be updated day to day. Hup Seng Aluminium & Glass is the referral company for this project which located in Johor Bahru and the name of the owner is Chong Yun Keong.The staff of the company use the aluminium's raw material to build aluminium product for sales. The company needs to order the raw material from

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the supplier and sell the products to the customers. The aluminium products built such as door, cupboard, wardrobe, cabinet and window for sales. The administrator needs to get know about the inventory of the aluminium products that are ready to sell and record all the selling details such as the price, amount sold and quantity sold. Besides, the administrator needs to make sure that the stock of aluminium's raw material is enough and replenish it before running out. Therefore, a systematic information system is vital for a company to manage their business operation and data [1].

The existing system, the administrator records all data manually, which is using paper to record raw materials and products details such as name, quantity and price. All of the business record on paper and the amount of paperwork generated is huge. The administrator needs to spend more time to track back and check the needed information such as the inventory of aluminium's raw material and products. With the sales and inventory system, the owner and administrator may simply handle all the records. Last but not least, this system will help the owner and administrator handle the inventory records and no longer has to worry about lost or misplaced records. It is necessary to build a system that meet the requirement of company by using appropriate case tool and method [2]. The objective of the project are to design a Sales and Inventory System for managing the business record using structure approach, to develop a Sales and Inventory System using waterfall model and to test the Sales and Inventory System using functional testing. Next chapter discuss about the case study of company Hup Seng Aluminium, comparison with the existing system and the developed system.

## 2. Related Work

### 2.1 Case study of Hup Seng Aluminium Glass

Hup Seng Aluminium & Glass is a producer of Aluminium Home products. The company will order the aluminium's raw materials from supplier and produce some aluminium products for sale [3].

This company used a manual system in their business. The administrator needs to record the information of raw materials and products. The details of the raw materials and products such as the available stock, name of items, quantity and price are recorded in paper. Purchase order such as supplier name, raw materials ordered and total amount are also recorded in paper. Meanwhile, sales order to customers such as customer name, customer contact number, product details and total amount were recorded in paper. In short, all business data is recorded in paper manually.

The administrator records the data on paper when receiving the ordered raw materials from the supplier. Thus, data redundancy may occur. When the administrator fails to find the recorded paper, data duplication may happen as the administrator will record again the data. Therefore, the same data was recorded many times by the administrator. The administrator may get the wrong data as their handwriting is not clear and the record is not neat. Besides, normally all these papers will be filled to form a set of statements and hold all records. Manual system, a book keeping system is a very simple management system to small company as they have less transaction or data to be recorded. Manual system offers a low budget to set up and it is easy to establish [4].

There are some weaknesses of a manual system such as data entry by the manual system will take more time consuming. Since the data entry is done manually, there will have high risk to occur some error or human mistake such as data redundancy and data duplication. It is hard to manage and search particular records, especially the administrator of the company may neglect the low stock level item. Besides, the owner and administrator faced time consuming problems and sometimes recorded data are untraceable. Thus, maintaining data and documents are very arduous if the owner is still using the manual system. Appendix A shows the existing process of the company through As-Is Model.

### 2.2 Comparison with the Existing Systems

Three existing systems had been investigated which are Inventory Management System for Perfex CRM [5], My Retail Solution Suite [6] and Easy Inventory System [7]. There are nine features chosen to compared. The result is shown in Table 1.

**Table 1: Comparison between three similar existing systems and developed system**

| Features/System | Inventory Management System for Perfex CRM | My Retail Solution Suite | Easy Inventory System | Hup Seng Alunimiun Inventory System Using RFID |
|---|---|---|---|---|
| User Login | Email and password | User id and password | Username and password | Username and password or scan RFID card to login directly |
| Show important notification | Yes | None | Yes | Yes |
| Raw Material Management | None | None | None | Yes |
| Product Management | Yes | Yes | Yes | Yes |
| Manage user account | None | None | Yes | Yes |
| Purchase Order Management | Yes | None | Yes | Yes |
| Sales Order Management | Yes | None | None | Yes |
| Barcode Scanning | None | Yes | None | Using RFID |
| Generate Report | Yes | None | Yes | Yes |

All compared systems use user id, email and username to log in the system via correct password. The particular feature in the developed system is that the administrator and owner can use RFID card scan to log in the system. Only MyRetail Solution Suite System do not show important notification. Since the Hup Seng Aluminium & Glass will order raw materials from supplier to produce products, therefore only the developed system ha raw materials management feature. Other three system have only product management feature as there only sell the products. In developed system, the user can use RFID tag to scan for comprehend the details of specific item.

### 2.3 Developed System: Hup Seng Alunimiun Sales and Inventory System Using RFID

The developed system has some similar function with the existing system above. However, the developed system is custom made for the company based on their requirements and needs. In short, the developed system able to improve the data management, data reliability, reduce data redundancy and data duplicated, provide accurate sales figure, save the time consuming as well as increase productivity, enable the administrator to replenish stock on time as the notification fromthe system of the low stock item, improve satisfaction of the customer since all inventory level is easy to know by the administrator so that the customer will no having no stock problem after order. Appendix B shows the improved process of the company with the developed system through the To-Be model.

## 3. Methodology/Framework

This section explains the methodology to be used for the developed system (Sales and Inventory System) for Hup Seng Aluminium & Glass. Waterfall methodology would be used to develop the system[8]. Before starting programming, system requirements have been defined and information on system development is collected to reduce the possibility of waste of money and time because unlike other prototyping models, the waterfall model will only proceed to the next step until the current phase has been fully completed. This model can rise the performance and decrease the number of changes made.

### 3.1 System Development Workflow

Specifications and properties of materials, equipment, and other resources used in the current study should be described in this section. Table 2 shows the outcome of activities during the development of the system at each level. By input and output, each step will be separated.Table 2 indicates the outcome of the activities in four phases: planning, analysis, design and implementation.

**Table 2: System development workflow**

| Phase | Input | Output |
|---|---|---|
| Planning | • Determine problem statement, objective, and scope of the project<br>• Gather data and information Prepare a Gantt chart | • Proposal produced<br>• Problem statement, objective, and scope identified<br>• Gantt chart produced |
| Analysis | • Review other online system<br>• Identify software and hardware needed<br>• Determine user and system requirement<br>• Design process model and data model | • Function of system reviewed<br>• Software and hardware listed out<br>• User and system requirement identified<br>• Context diagram, entity relationship diagram and flow chart produced |
| Design | • Design interface page<br>• Design input and output<br>• Design data organization | • Interface page designed<br>• Input and output designed<br>• Data organization designed<br>• Develop source code of the system |
| Implementation | • Coding and debugging<br>• Evaluation system | • User tested<br>• Feedback from user<br>• Developed system done |

## 4. Analysis and Design

This section discusses the study of system requirements and designs. System analysis deals with the data and data gathered through interview and observation to construct a system that satisfies the requirements of users. Flowchart diagrams, Context Diagram (CD), Data Flow Diagram (DFD) and Entity Relationship Diagram (ERD) will be drawn to provide a clearer impression of the system. Next, the design process involving system interfaces and database design.

### 4.1 Functional Requirement Analysis

The functional requirements analysis for the Hup Seng Aluminium Sales and Inventory System is illustrated in Table 3.

**Table 3: Functional Requirement**

| Functional Requirement | Descriptions |
|---|---|
| Login function | The system should allow users to log into the system and access it. |
| User Authentication function | System should determine the login action made by user is success or fail. |
| Create new user function | The system should allow only the admin can add new user that able to access the system. |
| Create function | The system should allow the administrator add new raw materials, product, purchase order, sales order and supplier. |
| View function | The system should enable the user to view all details of raw materials, products, purchase order, sales order, user account and supplier. |
| Update Information function | The system should allow the user to update information of products and raw materials such as price and quantity. |
| Delete function | The system should allow user to delete raw materials, products, purchase order, sales order, user account and supplier. |
| SearchItems function | The system should allow the user to use the item code or RFID card to search for specific items. |
| Update Inventory Function | The system should carry out deduction of product automatically when the sales order is made while top up the stock of raw materials when received the purchase order. Besides, when a new product is added, the quantity of raw of materials used to build the product will be deducted automatically. |
| Generate Statement | The system should allow the user to generate purchase order statement and invoice statement as well as download in pdf file. |
| Email Statement | The system should able to send the purchase order statement to supplier and invoice to customer via email. |
| View Sales Report | The system should display the sales figure and graph according the range of date selected. |

## 4.2 Non-Functional Requirement Analysis

The non-functional requirement study for the Hup Seng Aluminium Sales and Inventory System is shown in Table 4.

**Table 4: Non-Functional Requirement**

| Non-Functional Requirement | Descriptions |
|---|---|
| Performance Requirement | User interface screens should take no longer than two seconds to load, log information should be verified within three seconds, and the results should be returned within three seconds for queries. |
| Availability Requirement | The system to be used within 24/7 hours is available. |
| Security Requirement | All the information will be protected and only authorized user can access the system. |

| | |
|---|---|
| Maintainability Requirement | The system should be simple to manage and easy for the user to handle. |

**Table 4: (Cont.)**

| | |
|---|---|
| Standards Compliance | In developing graphical user interfaces, the system should be consistent. |

### 4.3 User Requirement Analysis

The administrators and the owner are the target users of this developed system. The details of user requirements in the developed sales and inventory system are stated as below:

a) User shall be able to login by scanning RFID card and logout from the system.

b) The administrator should able to conduct sales transactions, such as adding, reading, updating and removing inventory data.

c) The administrator should able to use RFID reader and card to record inventories.

d) The administrator would be able to manage information of all user

e) The administrator should able to manage the sales order.

f) The administrator should able to manage the purchase order with suppliers.

g) The owner should able to view the sales figure by selecting the range of date.

h) The administrator should receive notification from the system when the stock of specific item become low for replenishment.

### 4.4 System Analysis

In development of the system, data and information will be moved to the data flow diagram, which illustrates the flow in and out of the data. The context diagram, data flow diagram and entity relationship diagram are included in this system analysis.

#### 4.4.1 Context Diagram

The context diagram demonstrated the relationship of the developed system between external entities and the data flow from the system.

A context diagram that is drawn for a Hup Seng Aluminium Sales and Inventory System is shown in Figure 1. It involves a system-to-model process, which is a"Hup Seng Aluminium Sales and Inventory System". Based on Figure 1, two entities are involved in the developed system, which is the owner and administrator. Besides, data flow (connectors) are also present, suggesting the presence of an exchange of information between entities and the system. The main different between administrator and owner which is the sales report only allow the owner to view while all the business information including inventory of raw materials, products, sales order, purchase order, admin management and supplier management will be managed by the administrator.

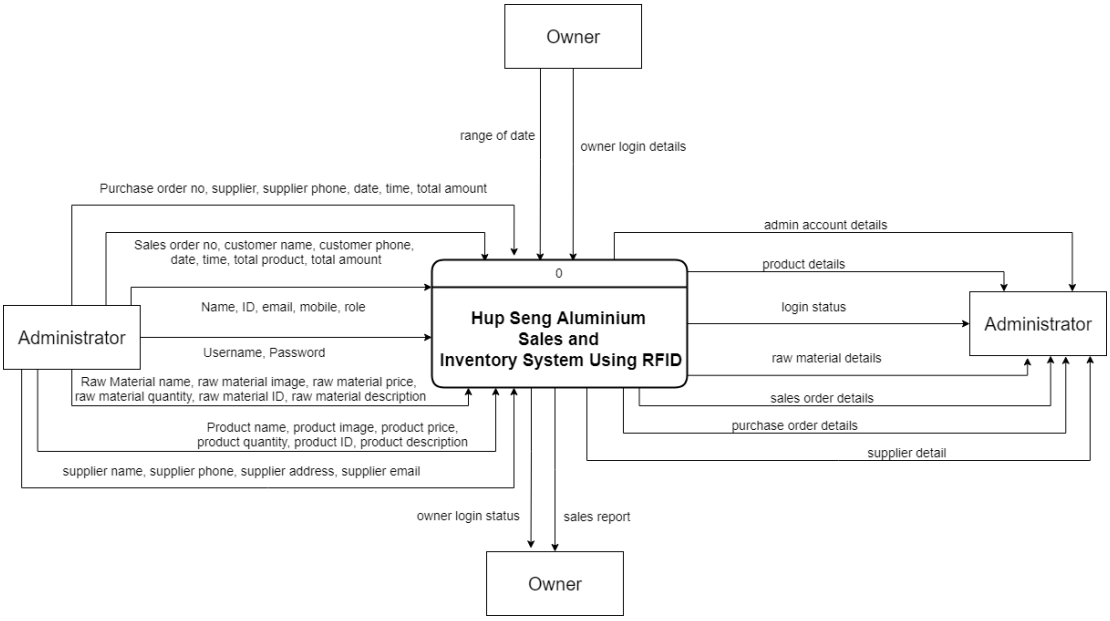


**Figure 1: Context Diagram**

4.4.2 Data Flow Diagram

Appendix C illustrates that how the two entities interact with the developed system. The Data Flow Diagram (DFD) Level 0 of the Hup Seng Aluminium Sales and Inventory System containing eight processes, two external entities and eight data stores. For each management process will be illustrated in DFD level 1.

From DFD level 0, the administrator and the owner enter their username and password into the Login process and then which stored in User data store. At the same time, the users receive login status from the process.

In process Raw Material Management process, administrator send raw material name, raw material image, raw material price, raw material quantity, raw material ID and raw material description to the process which stored in Raw Material data store and receive raw material list.

Besides, administrator send product name, product image, product price, product quantity, product ID and product description into the Product Management process which stored in Product data store and receive product list. The product here means the products that made by the raw materials. Therefore, the Product Management process send quantity used of raw materials to Raw Material data store as the automatically reduction of raw materials for build products.

In process Purchase Order Management process, administrator send purchase order no, supplier, supplier phone, date, time and total amount to the process which stored in Purchase Order data store and receive purchase order list. In contrast, administrator send sales order no, customer name, customer phone, date, time, total product and total amount to the Sales Order process which stored in Sales Order data store and receive sales order list.

In addition, administrator send name, ID, email, mobile, role, username and password to admin management process which stored in User data store. This process is same going to process 8.

The owner can receive sales report from report process. Report process get the required sales information from Sales Order data store.

4.4.3 Entity Relationship Diagram

There are eight entities contribute in the database of thedeveloped system based on Figure 2.

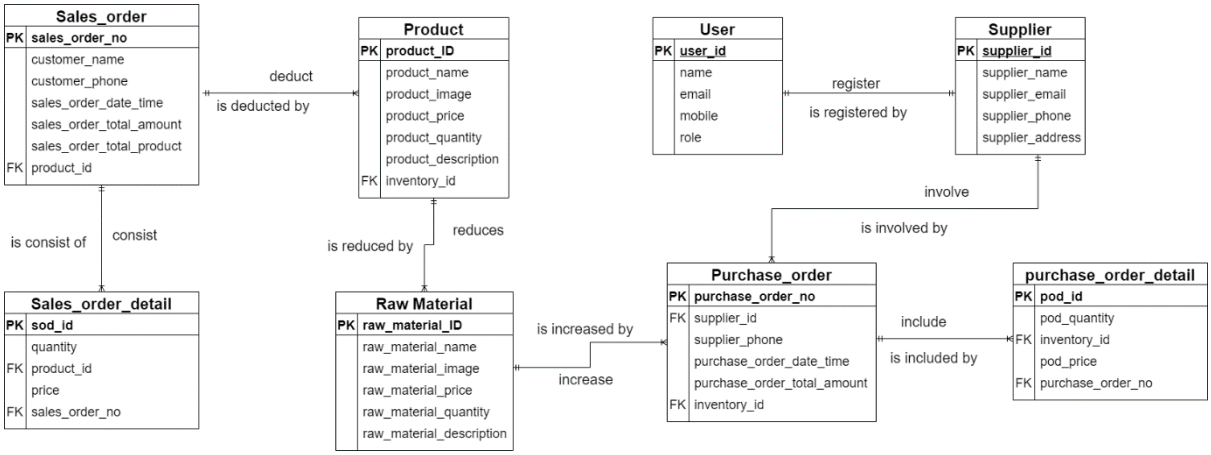


**Figure 2: Entity Relationship Diagram of developed system**

## 4.5 Interface Design

This section indicates the interface design of the developed system. Figure 3 shows the dashboard of the developed system.

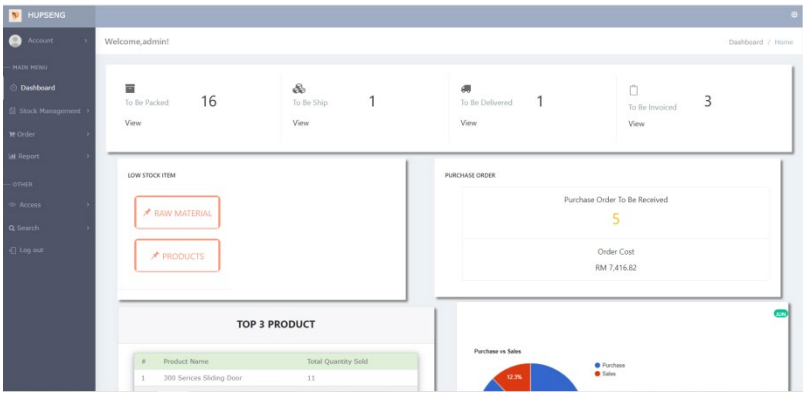


**Figure 3: Dashboard of developed system**

## 5. Implementation and Testing

The development of this management system entails eight modules. There are verify user, manage raw material, manage product, manage purchase order, manage sales order, manage admin, manage supplier and generate report.

## 5.1 Implementation

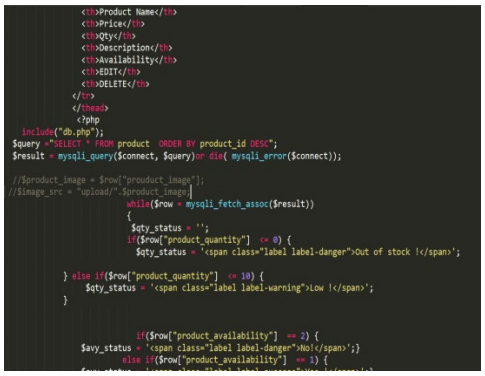

**Figure 4: Code of manage product**

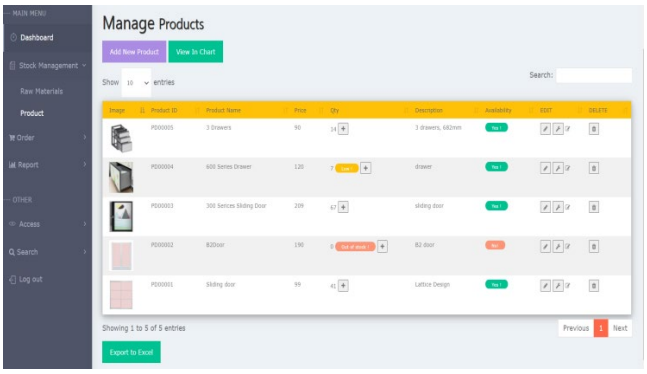


**Figure 5: Product ManagementModule**

Figure 4 shows the program code while Figure 5 shows the interface of product management module.

**Figure 6: Code of manage sales order**

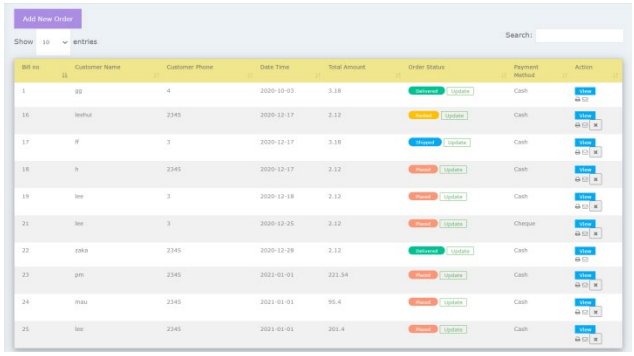

**Figure 7: Sales Order Management Module**

Figure 6 shows the program code while Figure 7 shows the interface of sales order management module.

**Figure 8: Code for monthly sales report**

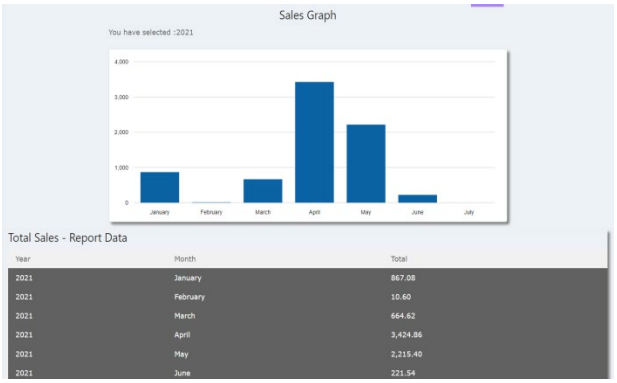


**Figure 9: Sales report Module**

Figure 8 shows the program code while Figure 9 shows the interface of sales report module.

## 5.2 System Functional Testing

Eight modules are tested and the expected as well as the actual results are tabulated. Table 5 shows the testing result of the developed system.

**Table 5: System Functional Testing**

| Testing Module | Testing | Expected Result | Actual Result |
|---|---|---|---|
| Verify User | User insert the correct username and password or scan the RFID card. | Display the dashboard of the system. | Login successfully |
| Manage Raw Material | User can view, add, edit and delete the raw materials | Display the list of raw materials include image, ID, name, price, quantity, detail and availability. | Successfully display the list and able to update the list and delete the raw material. |
| Manage Product | User can view, add, edit and delete the product | Display the list of products include image, ID, name, price, quantity, detail and availability. | Successfully display the list and able to update the list and delete the product. |
| Manage Purchase Order | User can view, add and delete the order. | Display the list of purchase order. | Successfully update the stock of raw materials once received the raw material from supplier. |
| Manage Sales Order | User can view, add and delete the order. | Display the list of sales orders. | Successfully update the stock of product once delivered to the customer. |
| Manage User | User can view, add and delete the account. | Display the list of account | Successfully display the list of account and able to update and delete. |
| Manage Supplier | User can view, add and delete the supplier. | Display the list of suppliers. | Successfully display the list of suppliers and able to update and delete. |
| Generate Report | User can view the day by day report and monthly report in chart. | Display the sales report. | Successfully generated the sales report. |

## 6. Conclusion

The main purpose of the system is to improve the business management of the Hup Seng Aluminium that will help the owner and administrator minimize the problems that arise. The administrator able to manage safely and save all information and records. User able to perform create, view, update and delete function in manage raw material module, manage product module, manage administrator module and manage supplier module. Besides, the user able to perform create, view and delete function in manage purchase order module and manage sales order module. All the record is stored in real time. User can easily keep track the business record as all needed action can be take just by a few clicks. Last but not least, the sales and inventory system is simple to operate. The user will find this system to be simple to learn and operate. There are no sophisticated instructions that could cause a user to become confused or have difficulty using this system. This developed system can assist the user in resolving the present problems.

There are still certain improvements that may be made to improve efficiency of the system. First, the sales and inventory system can be improved on sales report module. The system can add the profit calculation function. Therefore, the user able to know the profit earn by the business every month and year. Besides, the developed system can be improved on purchase order and sales order modules. The system can let the user to edit the purchase order and sales order after created not only cancel.

## Acknowledgement

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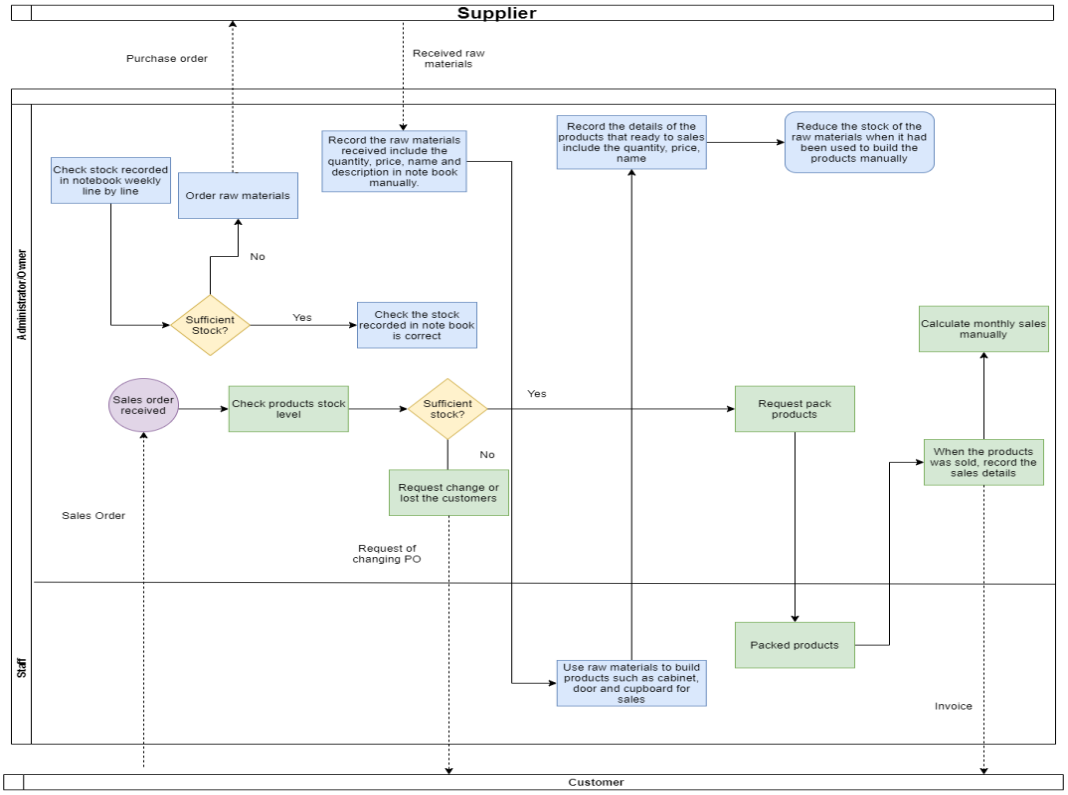
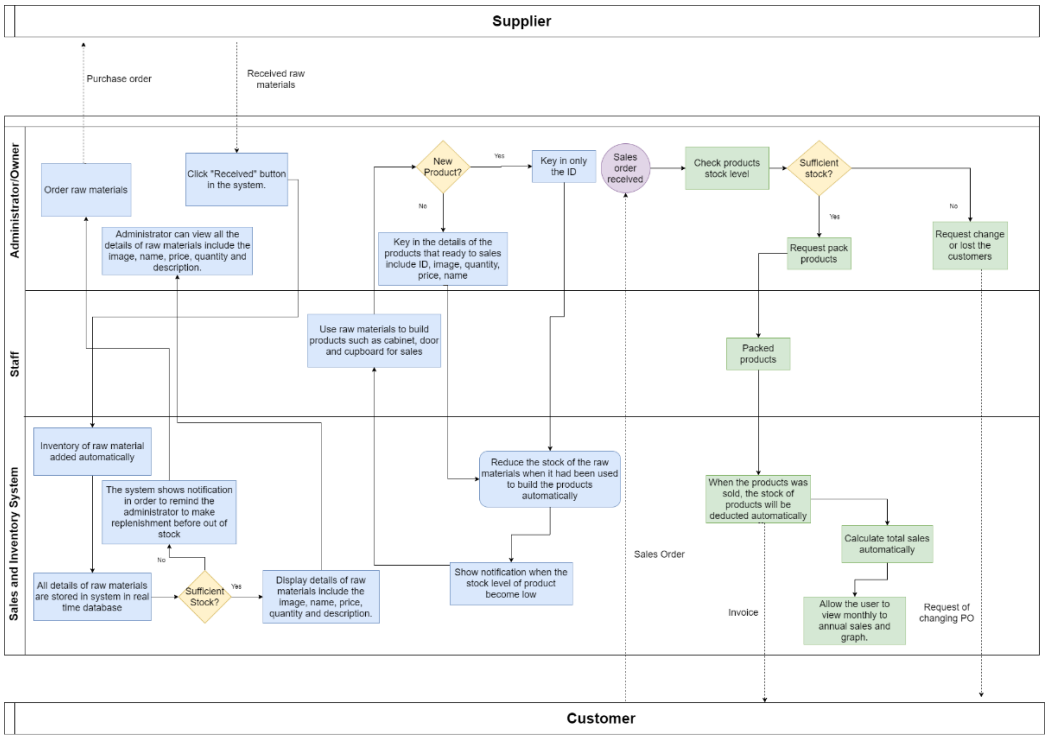
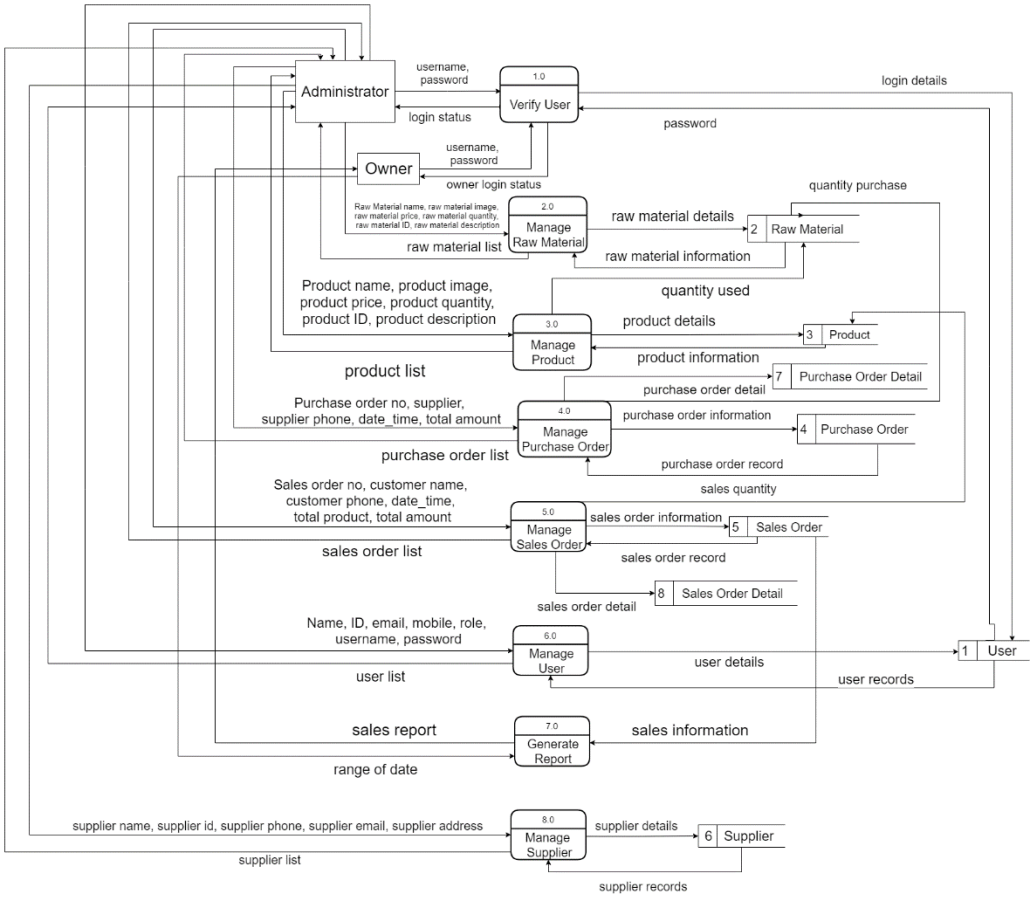
## Appendix A




## Appendix B



## Appendix C

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