



UNIVERSITY OF ECONOMICS AND LAW



Faculty of Information Systems



Report

ROSOR SYSTEM FOR PRODUCT AND SHELF MANAGEMENT AT SUPERMARKET

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CHAPTER 1: PROJECT OVERVIEW

1.1. Introduction

Vietnam, with its young population and high urban population, is an attractive supermarket market. It can be said that the supermarket market in Vietnam has witnessed a remarkable change in recent years. Therefore, competition in the market is becoming more and more intense. And in recent years, this market is gradually changing towards industrialization and modernization with more convenient trends. New technologies can save us time, effort and cost, ...

Using robots combined with sensor systems, or "Rosor System" for supermarket management, is an optimal solution for an outing of stock and a wrong shelf product. This system will help staff costs in arranging wrong goods, missing goods, improve product display supervision, improve efficiency, ... Customers will be very satisfied with the Goods are always filled and in the right position when experiencing shopping at the supermarket.

Because of the previous reasons above, our group conducts a Rosor system by using a combined robot and sensor to transport products on the right shelf. Besides, the system allows employees to manage all shelves in the supermarket. Besides, we integrate product, warehouse and system to create order by the handling of employees although they sit in one place. This system is easy to use and we hope it can give a lot of benefit to the supermarket.

1.2. Detail objectives

1.2.1. Target

- With smart design, the shelves help businesses control the number of goods in warehouses more effectively. Goods will be reasonably and scientifically classified. Since then, management is more rigorous and more accurate.
- Limit time for employees to check products on each shelf and limit items on incorrect shelves.
- The system helps to manage inventory and inventory accurately.

- Control product quantity, profit, avoid loss, ensure transparency and clarity of all processes.
- Control the number of invoices/receipts generated and sent to suppliers as well as product migration and storage.
- Improve the quick repair process when the system crashes.
- Helping employees and robots to put products on the right shelf easily and quickly.
- Effective resource management.
- A safe and smart solution to protect and store goods in that warehouse is to use the storage shelf. With the use of a shelf system, it will help goods avoid harmful agents from the outside environment.
- Save the storage space of this product. With the design stacking along with the ceiling, the goods will be arranged in an orderly and neat way.

1.2.2. Users

This application allows employees and robots to perform operations during warehouse management, shelf management and product management. Staff will use the system to manage and track the robot's task performance. The system will notify both the staff and the robot performing the task, the stock status when the stock is out of stock and which products are wrong.

1.2.3. Execute

The Rosor system offers the following functions:

- User control, with decentralization between employees and management. The manager will have the function of adding, modifying, deleting and managing staff, managing robots. The staff member will have the functionality to add, edit, delete and manage the robot.
- The system can handle complex jobs at the same time: out of stock, out of stock, and out of stock at the same time. Besides, it can create a default Purchase order if out of stock.

- The system will notify management, staff, and robots of all problems occurring during the operation as well as update new notices on the robot's warehouse and shelves. The robot is capable of reporting on the shelves to the staff.
- Allows the user to change the status of the robot and product.
- The sensor provides a database (name, price, quantity, image) product for the system.
- The search bar allows several search functions by brand, factory, type, ... to discover quickly, conveniently and save time.

1.3. Users, roles, permissions

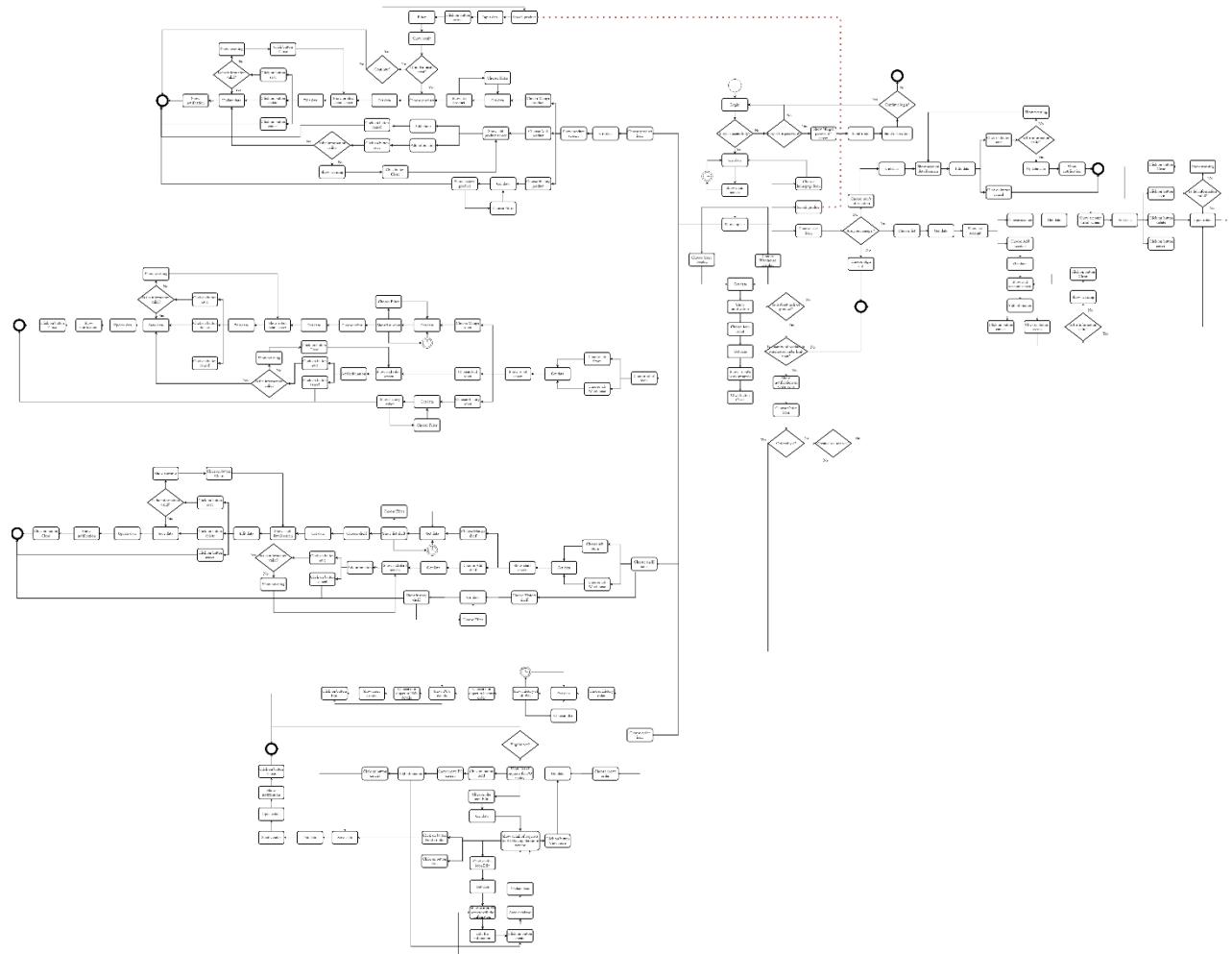
| Roles | Pemission | Functios |
|---------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manager | Manage all activities happening in the system | <ul style="list-style-type: none"> - Log in to the system - Account management (edit information, change password) on the system - Add, delete, and edit accounts on the system - Search product - Add, delete and edit products - View product status on the shelf and in stock - Add, delete, and repair shelves - Manage receipts/invoices and create Purchase orders - Add, delete, and repair robots - View the operation status of the robot |
| Staff | Manage all activities that occur in the system under the employee category | <ul style="list-style-type: none"> - Search product - Add, delete and edit products - View product status on the shelf and in stock - Add, delete, and repair shelves - Manage receipts/invoices and create P.O - Add, delete, and repair robots - View the operation status of the robot |

CHAPTER 2: FUNCTIONAL REQUIREMENT

2.1. Overview of flow

2.1.1. BPMN for user

This is the link of overall BPMN, please touch the link to see more: <https://bit.ly/2KTXtZx>



2.1.1.1. Login

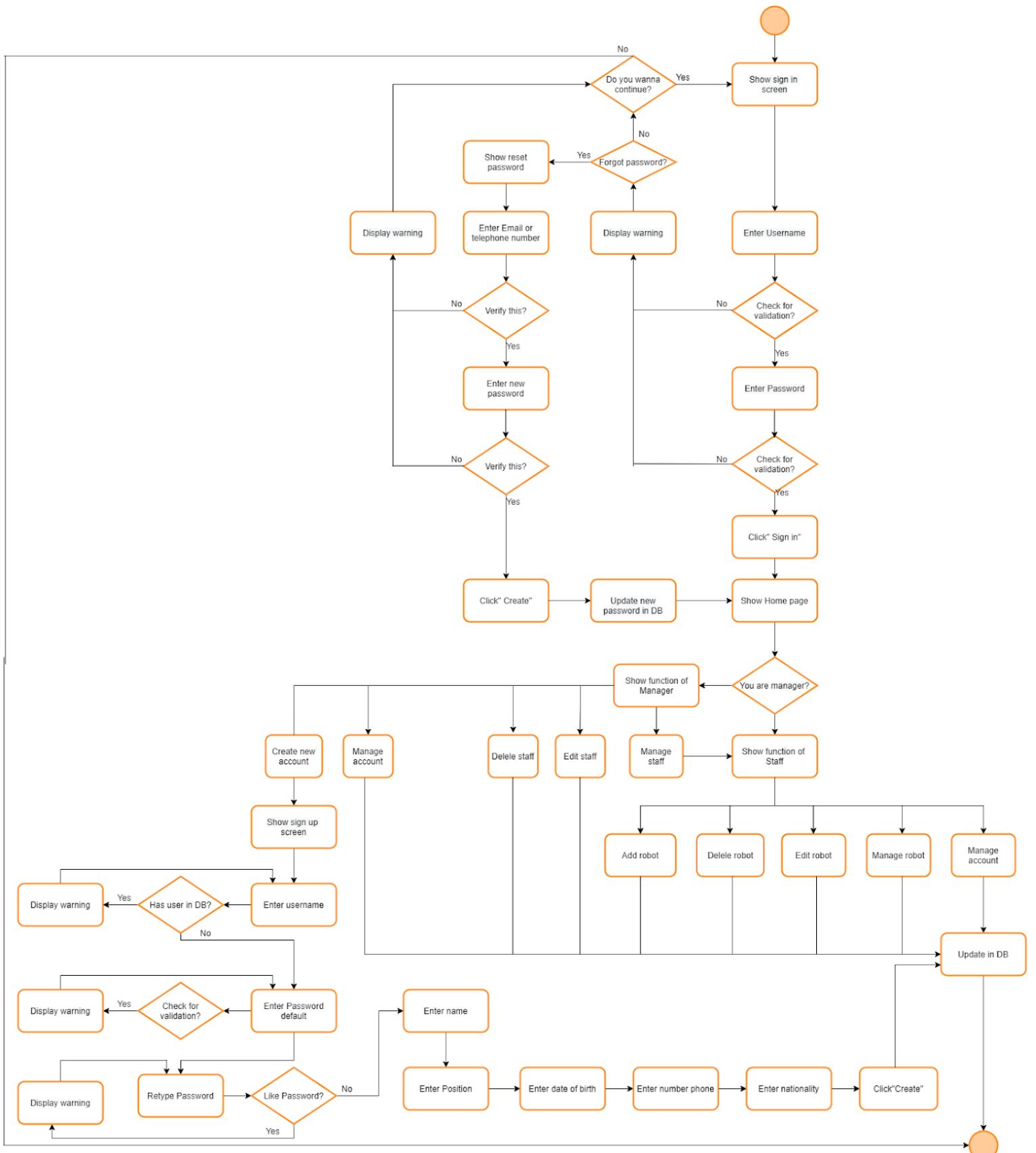
To access the system “Product and shelf management”, users need to provide username and password. This system will check username and password in the database to reply to the results “Successful” or “Unsuccessful”.

Case “Unsuccessful”: This system will show error messages. If users have forgotten the password, the system will show the “Reset Password screen for users to proceed reset password. All changes will be saved in the database and the “Home Page” screen will be shown.

Case “Successful”: the “Home Page” screen will be shown.

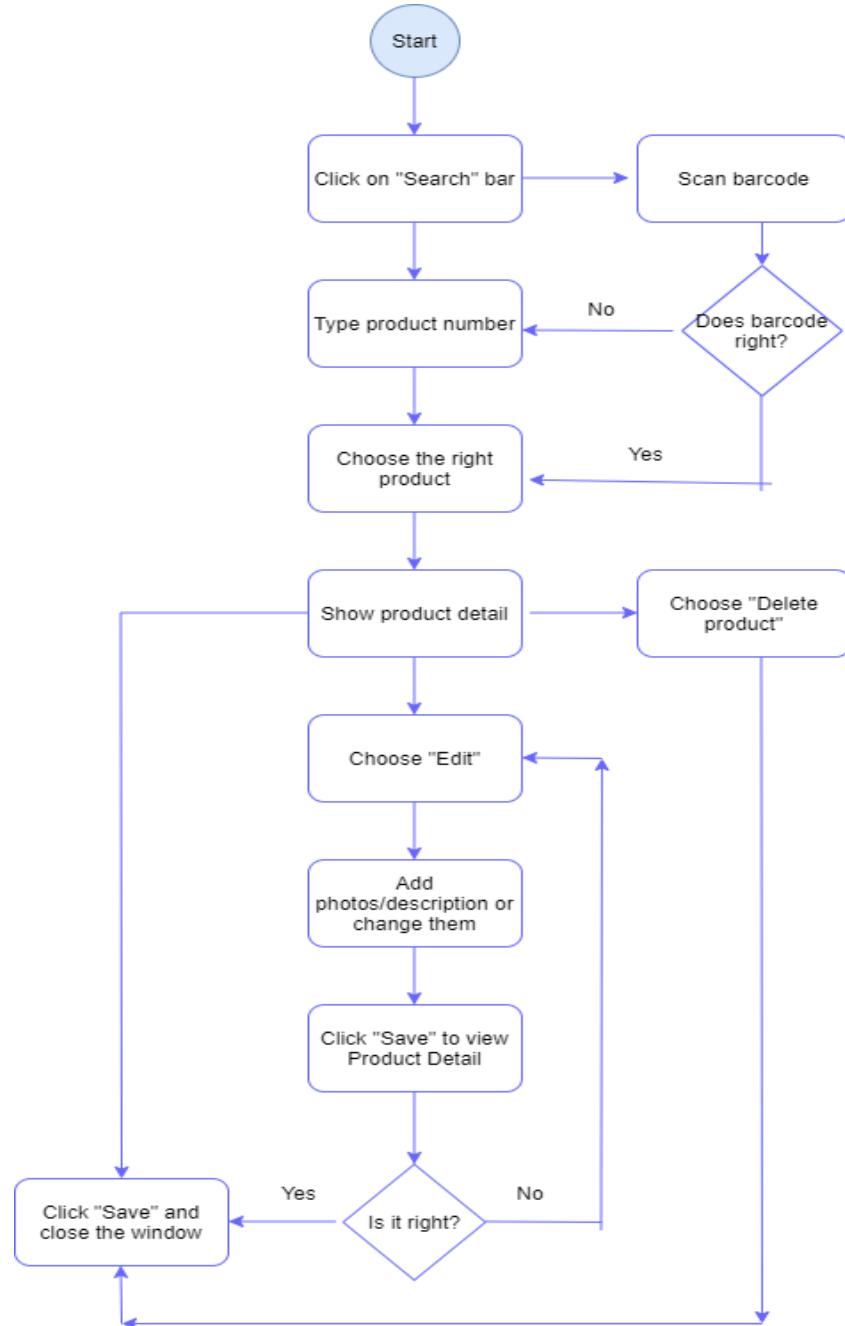
On the “Homepage” will be displayed by “Manage account”, “Edit staff”, “Delete staff”, “Create new staff” and “Manage staff” if the user's position is “Manager”. When “Create new staff”, the user must type a new username and new password. The system will check validation, if the result is reasonable the user needs to fulfil all fields: name, date of birth, position, number phone, nationality and so on. After that, the system will save a new account in the database.

If the user's administration is “Staff”, the user can “Add robot”, “Delete robot”, “Edit robot”, “Manage robot”, “Manage account”. All changes will be updated automatically in the database.



2.1.1.2. Search

When the user selects the “Search” function, the users can scan its barcode or type the product number manually, then all information about that product will be sent from Back End to UI. In other way, userS can delete that product from database by touching “Delete”. Moreover, users also can change information of that product by touching “Edit”. All updates will send to Back End after user touches “Save” button.



2.1.1.3. View notifications

With this function, there are two options for users to choose: “Store” and “Warehouse”. Users can view all notifications in store (about the wrong product on the shelf, lack of products on the shelf) or notifications in the warehouse (about input warehouse or recurring task of robots in the warehouse). Notifications in the store are shown by color for users to easily follow. If a notification is too long to be processed, it will notice for users to check. Besides that, by touching the icon robot next to the notification, users also track the robot’s work progress in real-time because the system always updates notifications and status not only of robots but also of shelves.

2.1.1.4. View, add, edit and delete products

In “Product” icon, users can choose “Manage”, “Add” or “History” which are suitable for each function.

When the user selects the “Add ” button, add product screen will display on the screen. Next, user must fill in all required fields about the new product such as Number, Photo, Quantity, Description,... Then touch “Save”, all information will be saved in Back End. After that, new product will display on the screen. However, users can also edit that product if they don’t feel satisfied by touching “Edit” and change anything they want until it is right. One more time, users touch “Save” to send those new information to Back End.

When the user selects “Manage” button, there are many categories of products that they can choose. After choosing the condition they want (see products by shelf at store or in warehouse), that requirement will be sent to Back End. Then, Back End send a list of products which are in the category that user chose before and display them on the screen. Or user can see all products if they dismiss choosing condition.

When the user selects “History” button, the history screen will exist on the screen. All activities, time, user accounts that relate to those activities and products will be displayed to help manager easily track and manage what staff have done.

2.1.1.5. View, add, edit and delete shelves

When user choose “SHELF” from menu on home screen, user can manage shelf at store and warehouse with add new, edit, delete shelf and view history of shelf function. There are two options for user choose: view self and history.

With view history, user just see all activities related on shelf at store and warehouse. To easier for manage, user can filter those activities by date,....

User choose View, shelf map at store or at warehouse is showed on the screen depend on selection of user. At here, when clicking on any shelf on the screen, shelf detail screen appear. It show information about shelf: location, product_id, product name, status, robot_id,..... User can change basic shelf's information by edit button, or delete it if necessary. At shelf map screen, user can do add new shelf function directly by button “Add” at bottom right of the screen. Note for user in this activity, adding new shelf has just successfully when user input enough information like regulation. All activities impact on shelf: edit, delete, add new will be saved and update in database.

2.1.1.6. View, add, edit and delete robots

The user is either an employee or an administrator. In robot management, the user can view the list of robots, select the robot that users want to see details. After viewing details, if there is an error, the user can correct the error directly on it. In addition, users can add new robots or delete robots.

2.1.1.7. Manage orders

Users can manage PO by viewing purchase order history and list of requests for ordering on the day. When the user chooses the “Order” icon, there are 2 different options: View “History” and “Create Order”.

With the option “History”, users can view the history of all purchase orders. To find the PO faster and easier, users can filter by vendor or by creation date. If users want to know more details of the PO, they choose that PO, and a screen about these will appear. They also view detail about one of the products in that PO.

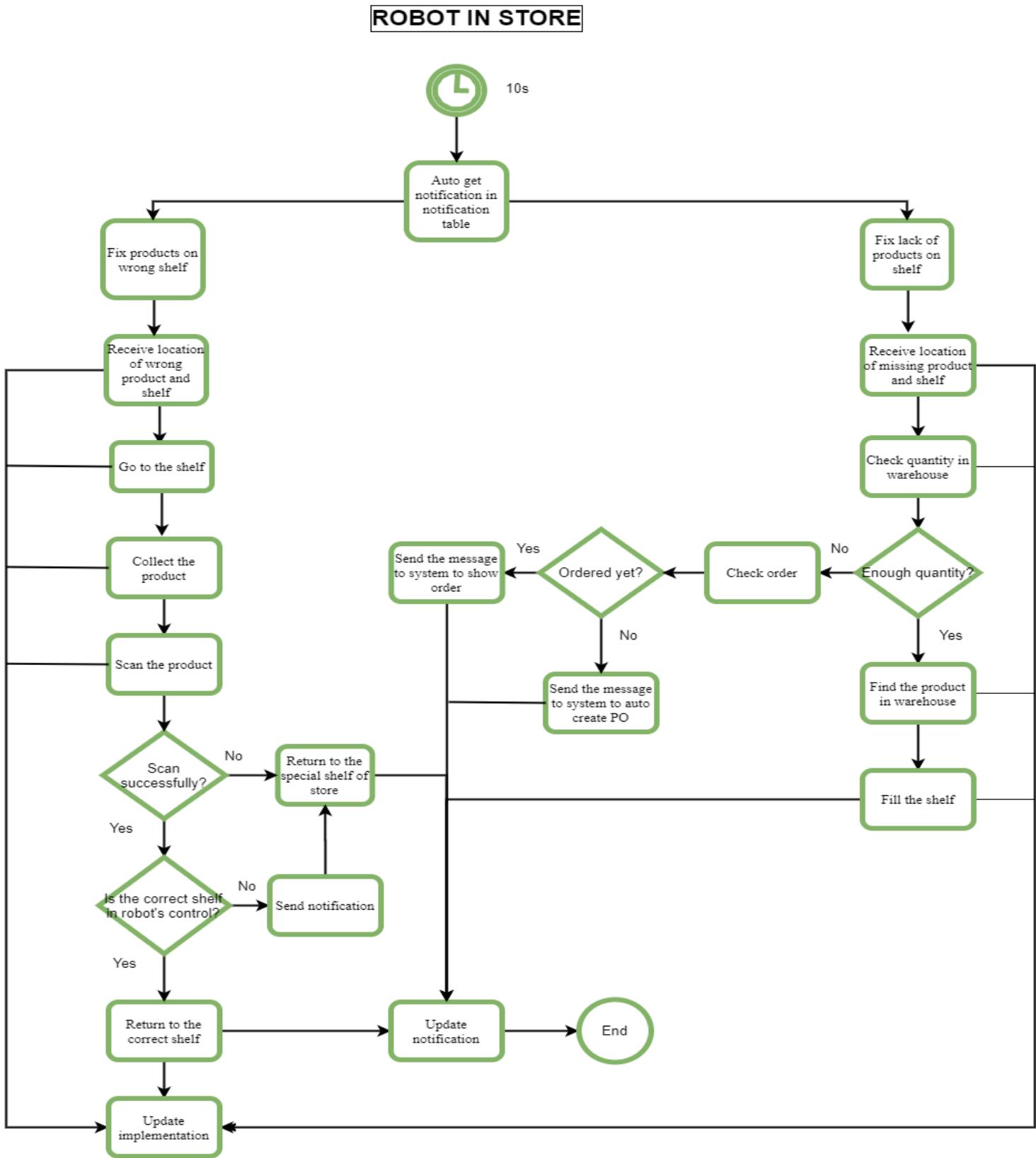
If the user selects the “Create Order” button, they will see a screen with a list of requests on the day. They can use the function filter by the vendor to find easily. When users choose the button “Create” on that screen, the system will move to the screen to create a request for Purchase Order. Users must add information about the product which they want to order. After filling all fields, they choose the button “Create” to confirm the request and send all information to the database or choose “Cancel” to delete that request. After that a screen of all requests for orders that have the same vendor appears and these requests will be collected and sent to the vendor at the end of the day or when there are too many requests for ordering for that vendor. But if the users want to send this list of requests to the vendor immediately, they can touch “Send” on that screen and those will be sent to that vendor. Users can view all requests for ordering on the day by touching “View more” and also edit them (quantity or choose other delivery date) if they want by touching the icon edit next to them.

Especially, the system can make automatic requests for ordering when it receives messages from robots in store. It will show an icon “!” on the “Order” icon

to notice users. These messages will be created when the robots check the stock and realise that the quantity of the product is under the limit race. If the product is in ordering, the system will show the PO of its own. If not, it will show the screen to create a request with all information about that product by reference to the PO before. Users only edit the quantity or delivery date if they want and touch the button “Create”.

2.1.2. BPMN for robot

- Robot in store:

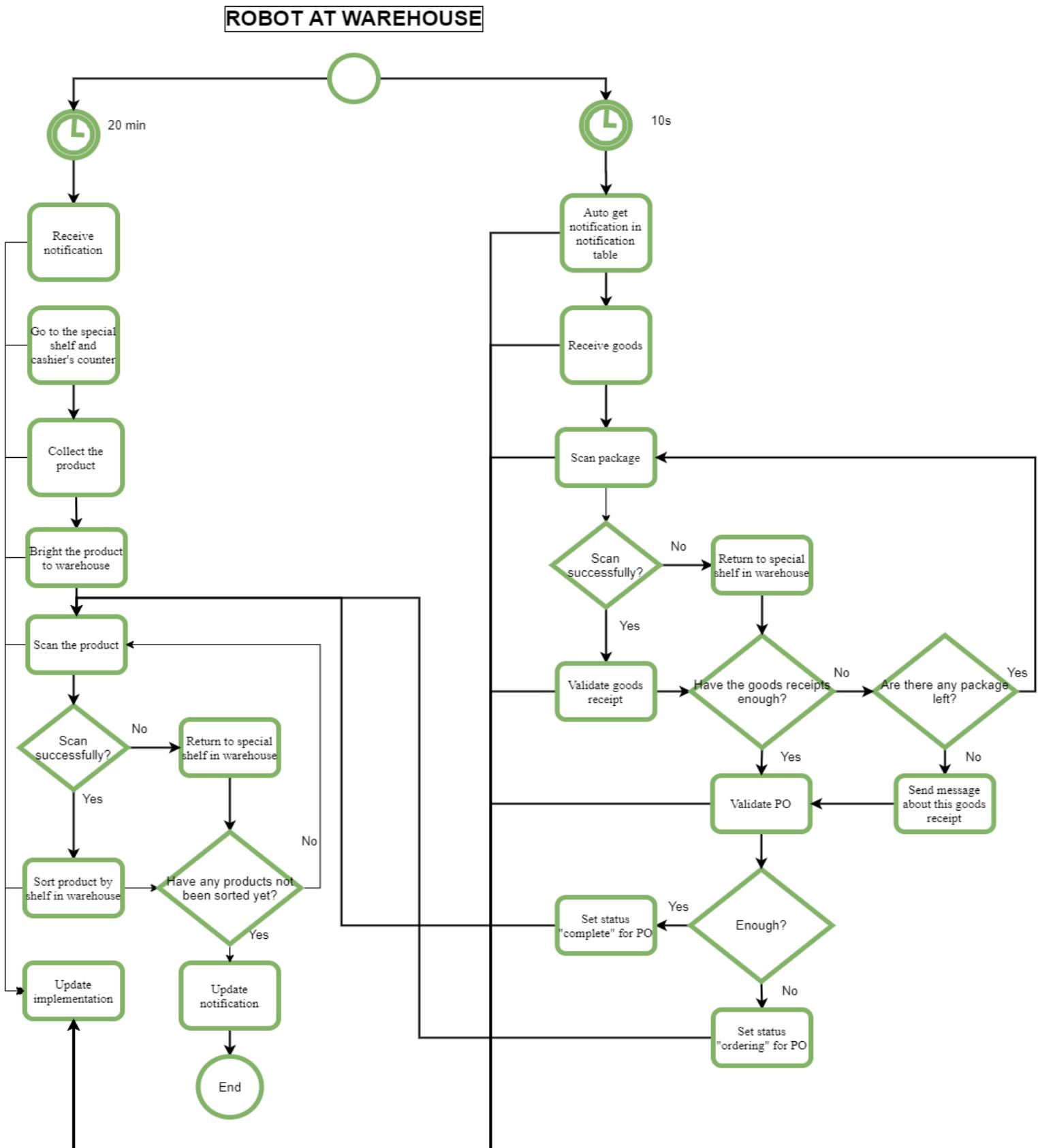


After 10 seconds the robots in the store will reset the notification table to automatically get new notifications. There are two kinds of notifications for robots at store: notifications about wrong shelves and notifications about lack of products on shelves.

With notifications about wrong shelves, robots will receive information about shelves that have the wrong products so robots can define the location of shelves. Then robots go to and collect the wrong products on those shelves. After that, the wrong products will be scanned to define the correct shelves to which they belong. If the correct shelf is in control of the robot which fixes this notification, the robot will return products to that shelf. If it is not, the robot will send a notification to the system. If scanning is not successful, wrong products will be returned to a special shelf in the store. Every step in processing will be updated to the system in order to user following. Once done, the notification will be updated (will be setted status “complete” and deleted in the notification table).

With notification about lack of products on shelves, robots will receive information about the products and the shelves (including shelves in store and in warehouse). Then robots can check the stock of those products. If those items have enough quantity, robots will go to the shelves to which the products belong in the warehouse and bring them to the correct shelves in the store. If the quantity is not enough, the robot will check the order. If the products are ordering, it will send the message to the system in order to show the order to the user. If the products are not ordered, it will send the message to the system in order to create automatically PO. Like the flow of the wrong shelf, every step in processing will be updated to the system in order for the user to follow and when the task is done, the notification will be updated (will be setted status “complete” and deleted in the notification table).

- Robot in warehouse:



Robots in the warehouse have two tasks: collecting the products in the special shelves in the store and the products are left at the cashier's counter and inputting the warehouse.

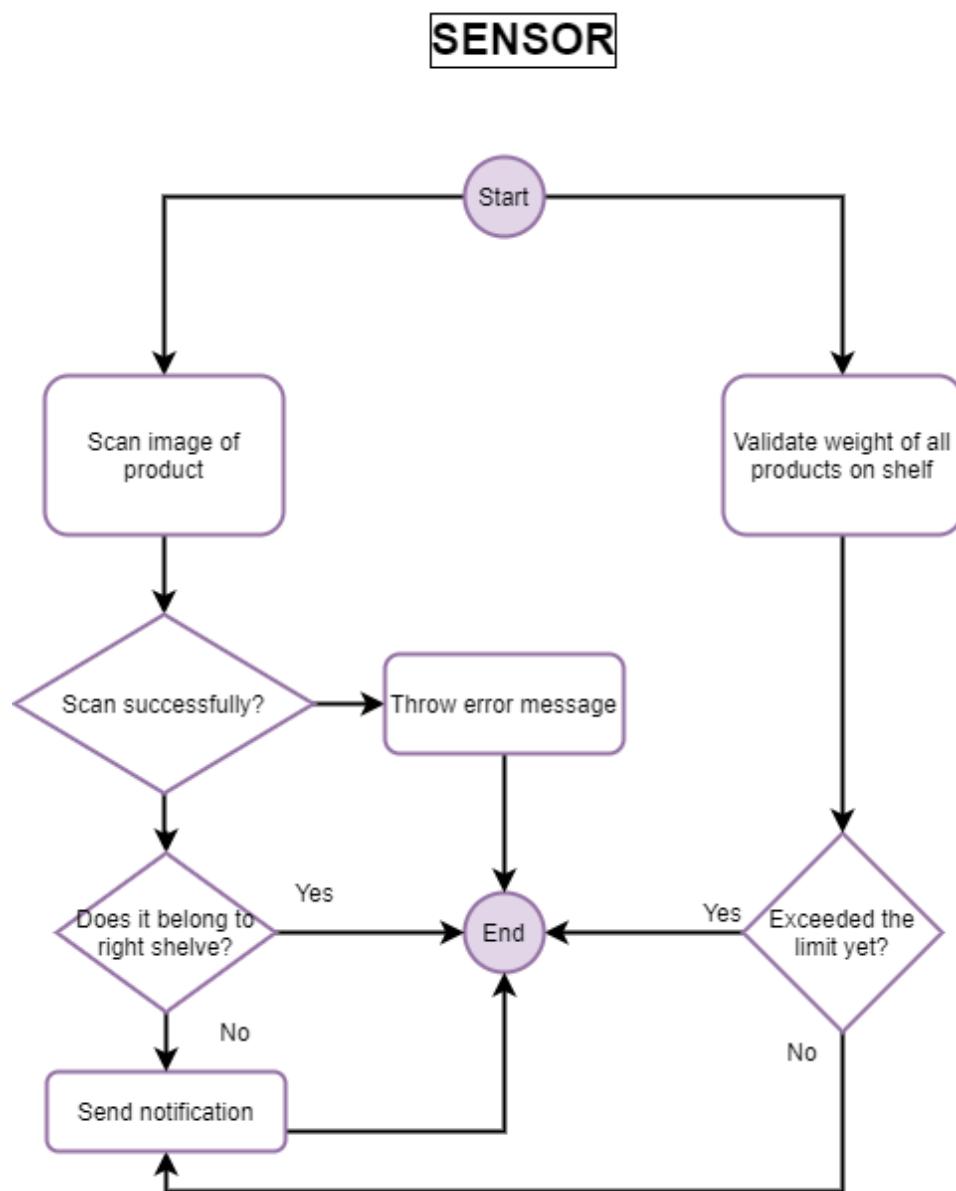
About the task of collecting the products in the special shelves in the store and the products are left at the cashier's counter, a notification about this task will be created automatically every 20 minutes. Robots will receive that notification then they collect and bring all the products in the special shelves in the store and the products are left at the cashier's counter to warehouse. In the warehouse, robots continue the process of sorting the products. Robots scan those products to define the shelves to which they belong in the warehouse. Then they will be returned to the correct shelves in the warehouse. If scanning is not successful, wrong products will be returned to a special shelf in the warehouse (staff will fix those products at the end of the day). After finishing the task, the notification will be updated and all steps will be updated for users to easily follow.

About the task of inputting the warehouse, after 10s the robots in the warehouse will reset the notification table to automatically get new notifications. The notification about the inputting warehouse will be created when the system receives a goods receipt from the vendor. The robots receive goods and scan the package of goods to check the goods receipt. If scanning is not successful, wrong products will be returned to a special shelf in the warehouse (staff will fix those products at the end of the day). If they scan all the packages which they receive but the goods receipt is not enough, they will send a message to the system about this goods receipt. After validating the goods receipt, robots continue validating PO. A PO will be setted status “complete” if all the products in that PO are received. If not, that PO will be setted status “ordering”. Finally, the robots finish this task by processing sort and return the products to the correct shelves in the warehouse, like that of the task about collecting the products in the special shelves in the store and the products are left at the cashier's counter. Every step in processing will be updated to the system in order to user

following. Once done, the notification will be updated (will be setted status “complete” and deleted in the notification table).

2.1.3. BPMN for sensor

Every shelf in the store has sensors to identify and manage all products of the shelf. The sensor can define the product by scanning images of its own in order to control the problem about the product on the wrong shelf. In addition, sensors also validate the weight of all products on shelf to check the quantity of products on shelf exceeded the limit or not. If the quantity of product is under the limit race or the product is on the wrong shelf, sensors will send the notification to the system.



2.2 Business requirements

2.2.1 Context Diagram

2.2.1.1. User system

Users send login information (username and password) to the system, then the system will send them a successful login notification or error message if username or password is not valid. Users must type both username and password again and make sure they are right, if they cannot remember their password correctly, they should touch the “Forgot Password” button and change their password by typing a new password.

In case users do not have an account, they must touch the “Register” button to create a new account by sending all required information such as name, username, password, email address, phone number,... After they send those information to the system, it will send them a successful register notification and now they can use that account to login into the user system.

Account user management manages all information about the user accounts. It will show a warning message for users if the username or password is incorrect. Moreover, information about username and password in the session which has just login will be sent to Account user management, too.

The system will send information about the product to Product detail, such as product number, shelf, quantity, photos, description. And Product detail also can send again information about the product to the system, such as product number, shelf, quantity, photos, description.

The system will send a Purchase Order, which has just created the user to the vendor they chose.

The system updates information about the product to the Warehouse by sending product status such as quantity, shelf,...

Sensor is an integration device that will send a “Wrong shelf” notice to the system if it realizes a product locating the wrong shelf. It also sends a “Fulfillment”

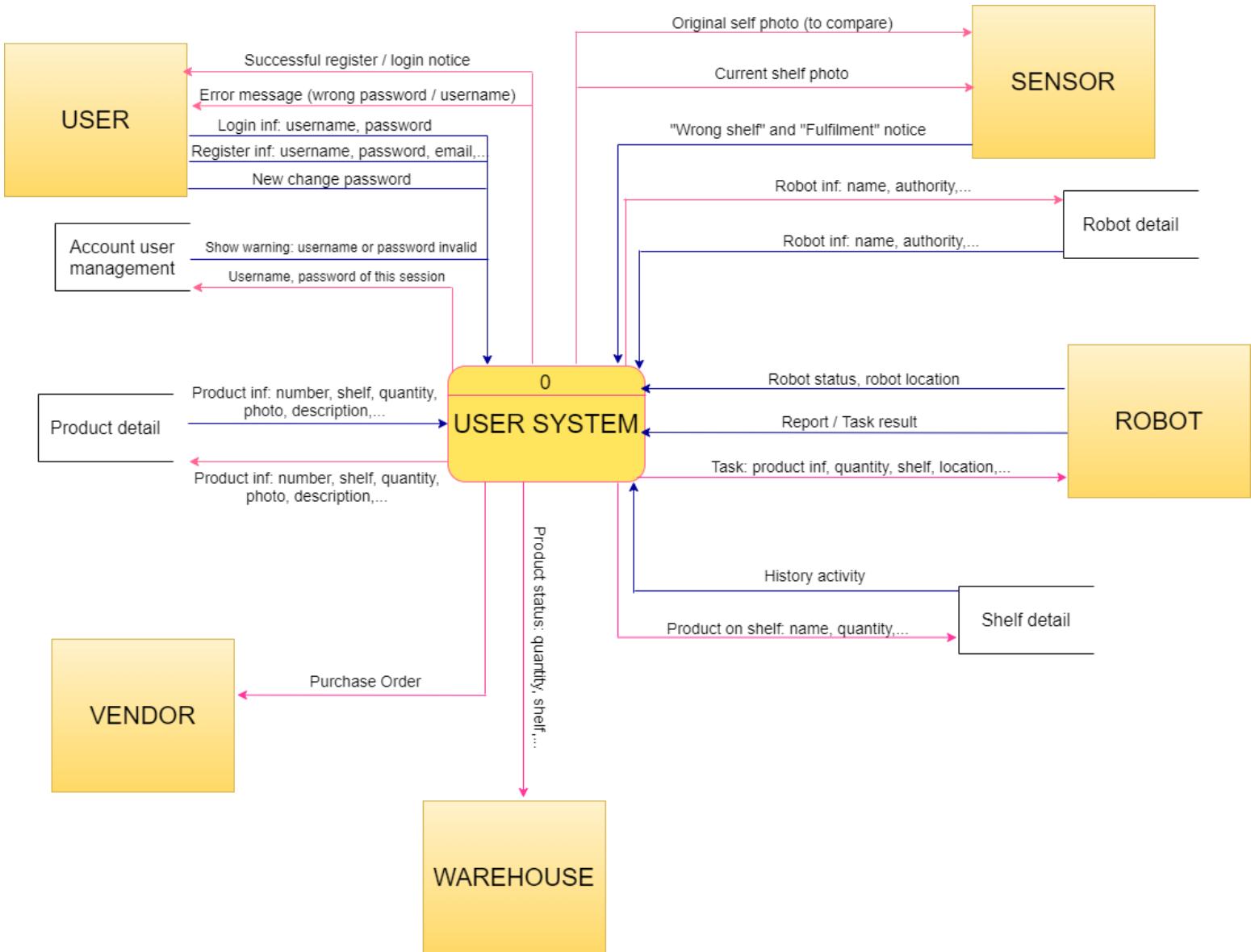
notice if it realizes the products on shelf are under limitation and they need filling immediately. When the system receives those notifications, it will send back information about the product such as quantity, name, shelf,... to the robot to proceed. Moreover, to identify the wrong location, the system will send the sensor original photos of that shelf and current photos to compare easily.

Robot will send its status (available or unavailable), its location,.. to the system to manage. The system will send the robot their task (fulfill the shelf or collect the wrong location product), after finishing the task, the robot will send the report, result to the system.

Robot detail will send all information about the robot such as robot name, or its authority,... to the system and vice versa.

Shelf detail will send the history activity to the system, then users can see what robots did with each shelf in the past. And the system can send information about all kinds of products on that shelf to shelf detail such as product name, quantity,...

Context diagram of user



2.2.1.2. Robot application

Sensor is a device detecting the wrong product on shelf at a store and lacking product status, ensuring that any product is always put on the correct shelf as well as providing enough product timely at the store. It will provide information about:

- Warning wrong location product, lack of product.
- Shelf information: name, location, image product, weight.

and also receive responses from robots to know the product is on the right shelf or not and the product is full or not.

Warehouse provides product information about shelf at warehouse: name, quantity, location, type, date and updates quantity of product in warehouse to inform purchasing.

User system will inform the warning message that the robot must handle and track processing of robots.

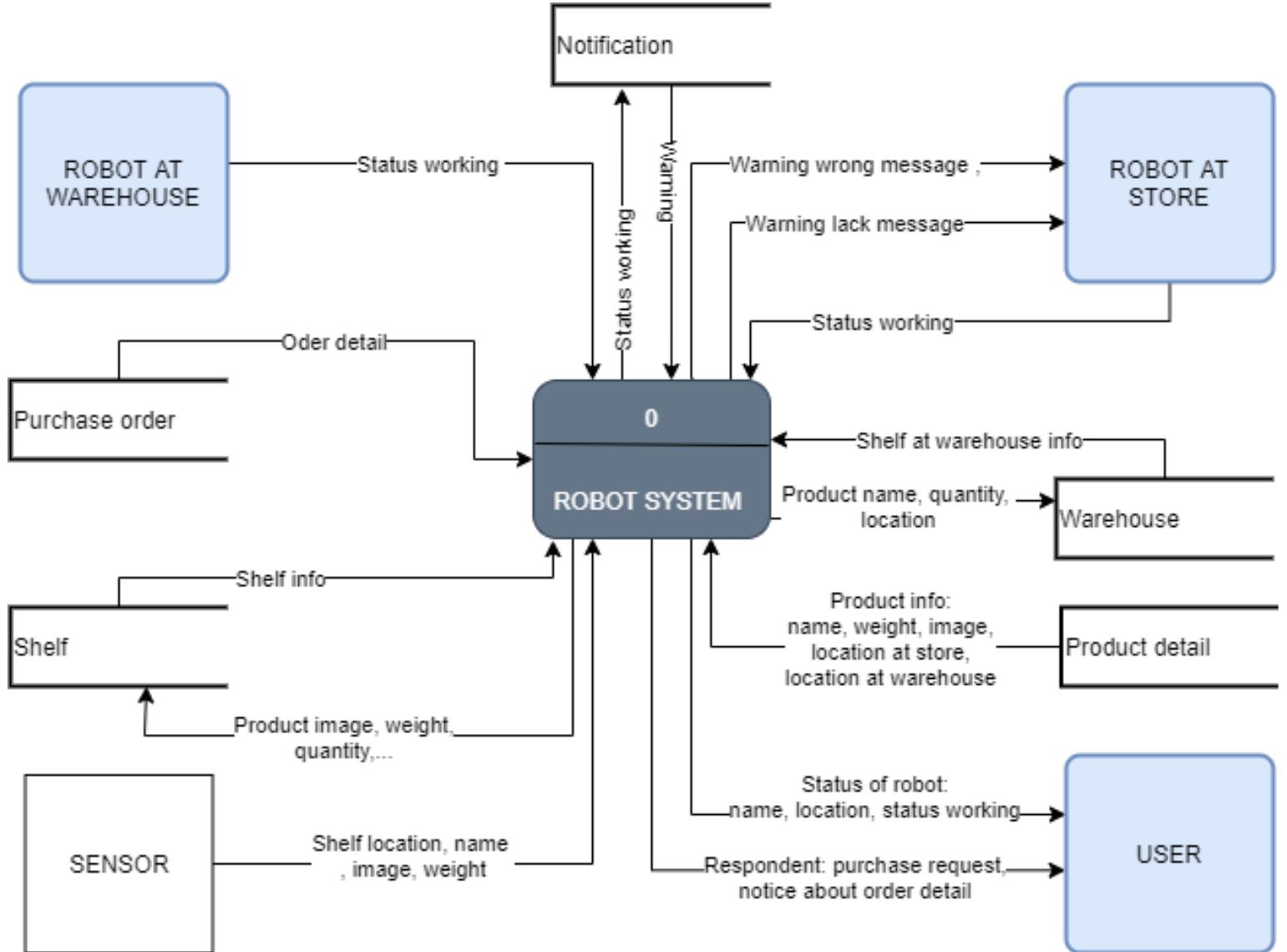
Shelf provides information about shelf at store to sensor.

Product information is a data store providing info and update it, include: Name, image, weight, supplier, barcode, date, location outside, location in warehouse.

Notification is a place to store all messages about warnings, those are all tasks robots need to complete. It's include following information:

- Type of warning (wrong message, lacking message, error message,...).
- Description (location).
- Confirmation (True, False).
- Detail (quantity).
- Status (Complete, not completed).

Context diagram of robot



2.2.2 DFD level 0

2.2.2.1. User system

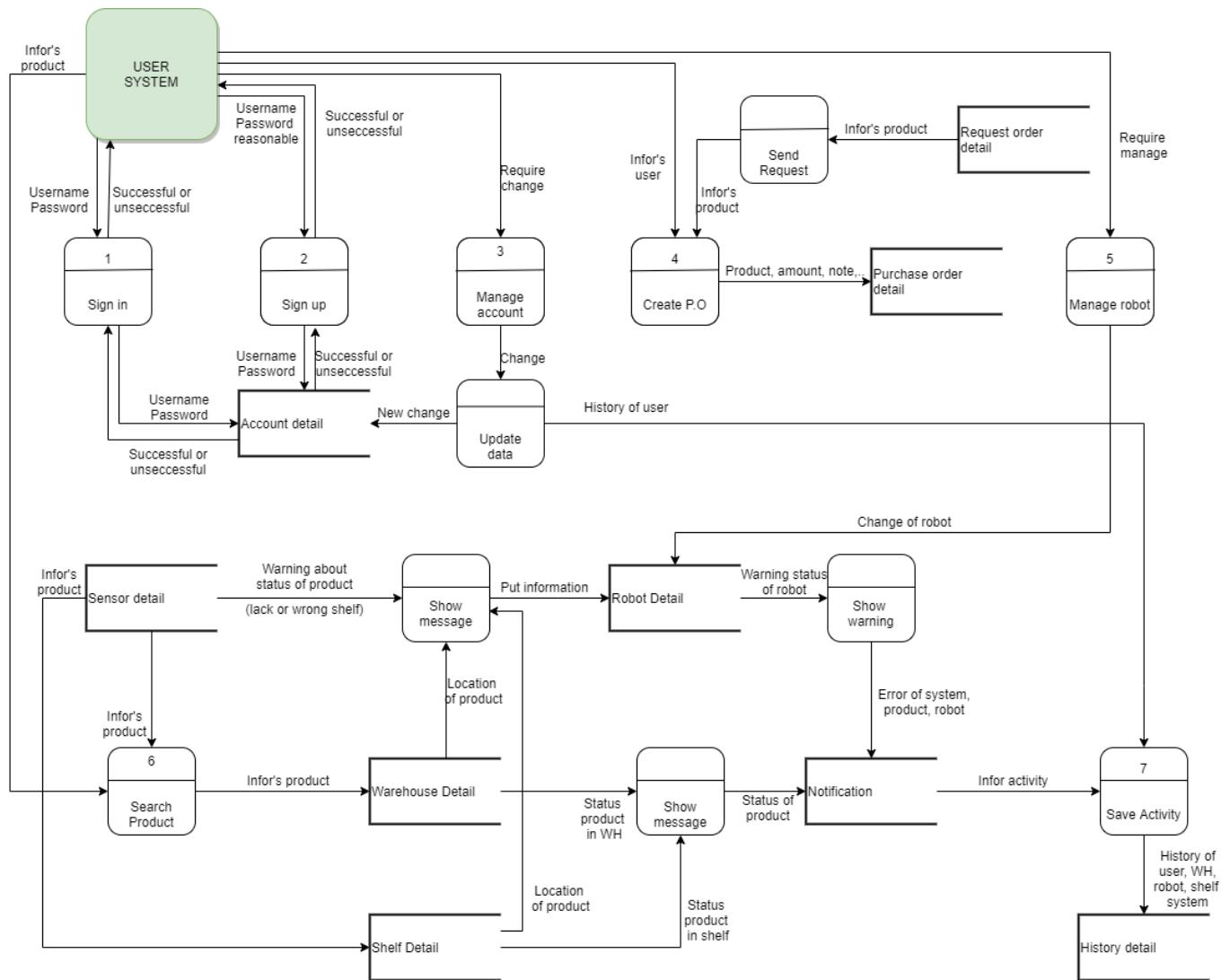
In the login screen, user provides a username and password and then they will receive a successful or unsuccessful login message. In case they do not have any account, they need to sign up by giving a reasonable username and password to create new account, then they also receive a successful or unsuccessful register message. User should provide required information to change their password or others. Besides, when user uses their account to create PO, all information about them will be recorded in PO detail to easily manage later. And user can also manage robots by changing information or just viewing all robots.

Moreover, to search any product, user can use info's product to search, then all information about that product such as quantity, status in warehouse, status at store will be shown on the screen.

Whenever detecting any wrong shelf products or lack of products, sensor detail will send that warning message to robot detail to show notification to the robot. Simultaneously, sensor give info's product which need to be corrected or status of product on shelf to shelf detail and a shelf location will also be sent to robot.

Especially, all activities that users, sensors and robots do will be recorded to history detail. So, when they need to view history they can access to history to manage.

Diagram level 0 of user



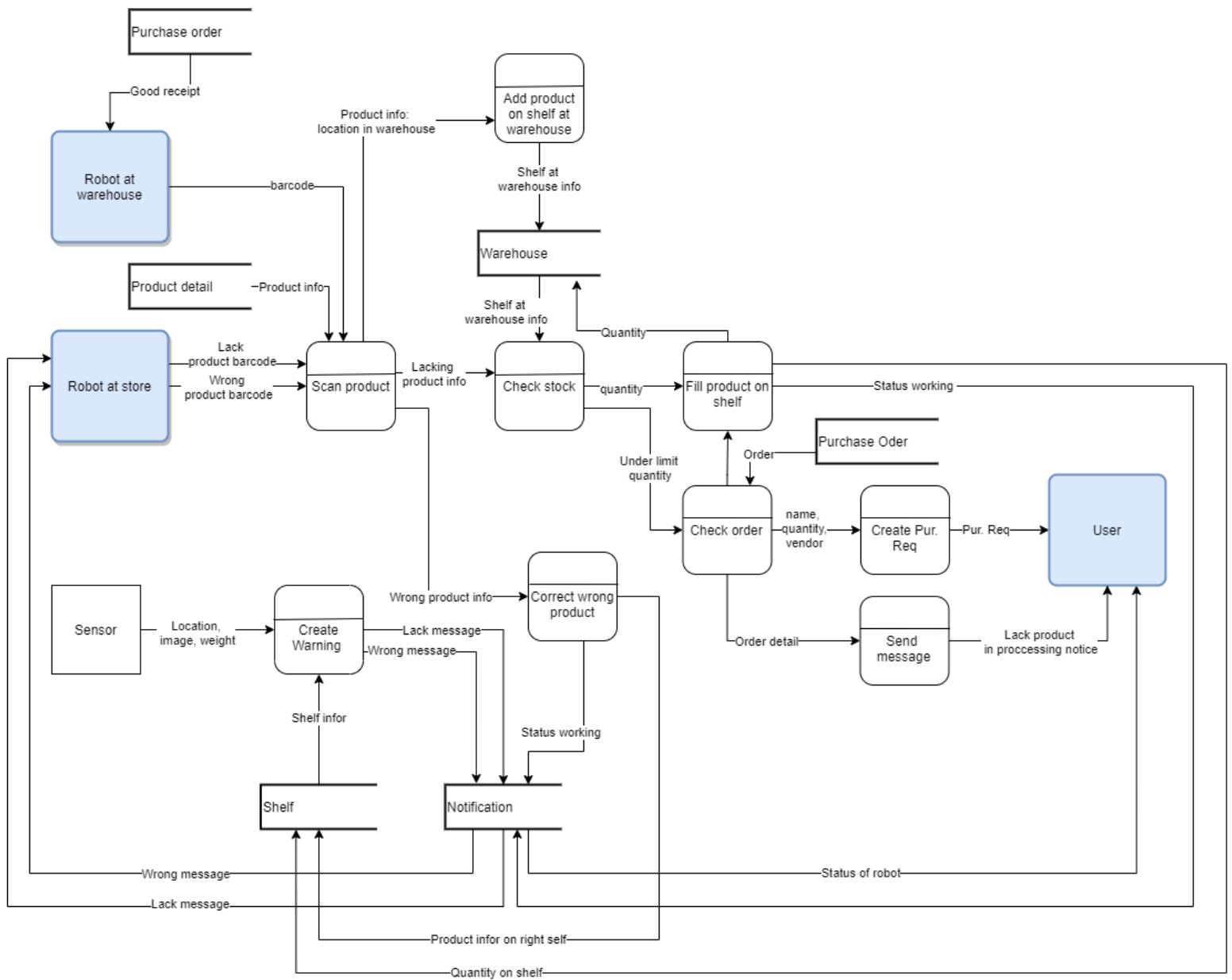
2.2.2.2. Robot application

There are two types of robot active in system: Robot at store and robot at warehouse:

- Robot at store will check notification from notification table to get task must be done. When receive lacking message, robot will arrive to lacking shelf and scan barcode of product to confirm product need to fill. Then check stock at warehouse. After confirming quantity product in stock specifically, robot at store begin to go to the warehouse take product and fill in shelf at store. If that product under limit of stock, robot still confirm remain amount to get into shelf at store. At the same time, robot check product in order processing or not thank to purchase order table, create purchase requisition in next step or send message about order detail to user. Forward to warning wrong product on shelf, robot at store also arrive to wrong shelf, scan barcode to check again and return product to right shelf. After robot done task, data: name, quantity, weight, image will be updated on shelf table and warehouse table.
- Robot at warehouse takes responsibility for adding new product on shelf when system create good receipt check stock when has request from robot at store and send result to system, update on notification table. In there, robot at warehouse also collect product in waiter to return line up on shelf at warehouse and error product to inform for staff to handle.

Both robot at store and warehouse often update their status show information about name, location, status working (level of work completion) into notification for user can control and manage robot and status of shelf, ensure robots are active in work.

Diagram level 0 of robot



CHAPTER 3: MOCKUP

3.1 Description

What: The system can help people save time and labor when using this system, which is automatic with robots and sensors to manage shelves at store and warehouse.

Who: The system is deployed at supermarkets or grocery stores so managers and staff at those can use the system.

When: The system is active 24/7.

Where: The system is used at stores to manage all products on shelves. Moreover, the system can also be used to manage products in the warehouse.

3.2. Identify entities

3.2.1. Entities

- User (ID, Name, Password, Role, Nationality, Phone, DOB).
- Product (ID, Name, Price, Brand, Vendor, Size, Weight, Type, Barcode, Location ID, Shelf ID).
- Shelf (Shelf ID, Location ID).
- Location (Location ID, Location Name).
- Order (Order ID, User ID, Sale Date, Total).
- Order Detail (Order ID, Product ID, Quantity, Discount, Total).
- Robot (Robot ID, Robot Name, Shelf ID, Manufacture, Warranty, Vendor, Size, Weight, Battery).

3.2.2. Detailed entities

3.2.2.1. User

| Attribute | Type | Null | Constraint | Description |
|-----------|------|------|------------|-------------------|
| User ID | Char | | PK | ID of user |
| User Name | Char | | | Name of user |
| Password | Char | | | Password to login |

| | | | | |
|-------------|----------|--|--|---------------------|
| Role | Char | | | User's role |
| Nationality | Char | | | User's nationality |
| Phone | Char | | | User's phone number |
| DOB | Datetime | | | User's birthday |

3.2.2.2. Product

| Attribute | Type | Null | Constraint | Description |
|--------------|-------|------|------------|---------------------------------------------|
| Product ID | Char | | PK | ID of product |
| Product Name | Char | | | Name of product |
| Price | Float | | | Price of product |
| Brand | Char | | | Brand of product |
| Vendor | Char | | | Vendor of product |
| Size | Float | X | | Size of product |
| Weight | Char | X | | Weight of product |
| Type | Char | | | Type of product |
| Detail Type | Char | X | | Detail type of product |
| Barcode | Char | | | Product's barcode |
| Location ID | Char | | | Location of product (Store or Warehouse) |
| Shelf ID | Char | | | Location of shelf of product |

3.2.2.3. Location

| Attribute | Type | Null | Constraint | Description |
|---------------|------|------|------------|------------------------------------------|
| Location ID | Char | | PK | ID of location |
| Location Name | Char | | | Name of location (Store or Warehouse) |

3.2.2.4. Shelf

| Attribute | Type | Null | Constraint | Description |
|-------------|------|------|------------|-------------------------------------------|
| Shelf ID | Char | | PK | ID of shelf |
| Location ID | Char | | | Location of shelf (Store or Warehouse) |

3.2.2.5. Purchase Order

| Attribute | Type | Null | Constraint | Description |
|-------------|------|------|------------|-------------------------------------------|
| Shelf ID | Char | | PK | ID of shelf |
| Location ID | Char | | | Location of shelf (Store or Warehouse) |

3.2.2.6. Detailed Order:

| Attribute | Type | Null | Constraint | Description |
|------------|------|------|------------|----------------------------|
| Order ID | Char | | | ID of order |
| Product ID | Char | | | ID of product in the order |
| Quantity | Int | | | Quantity of each product |

| | | | | |
|--------------|-------|--|--|-----------------------|
| Discount (%) | Int | | | Discount information |
| Total | Float | | | Total of each product |

3.2.2.7. Robot

| Attribute | Type | Null | Constraint | Description |
|-------------|----------|------|------------|-------------------------------------|
| Robot ID | Char | | PK | ID of robot |
| Shelf ID | Char | | | ID of the shelf that robot controls |
| Robot Name | Char | | | Name of robot |
| Vendor | Char | | | Vendor of robot |
| Size | Char | | | Size of robot |
| Weight | Char | | | Weight of robot |
| Manufacture | DateTime | | | Date of manufacture |
| Warranty | DateTime | | | Date of warranty |
| Battery (%) | Int | | | Battery status |

3.3. Interface of system

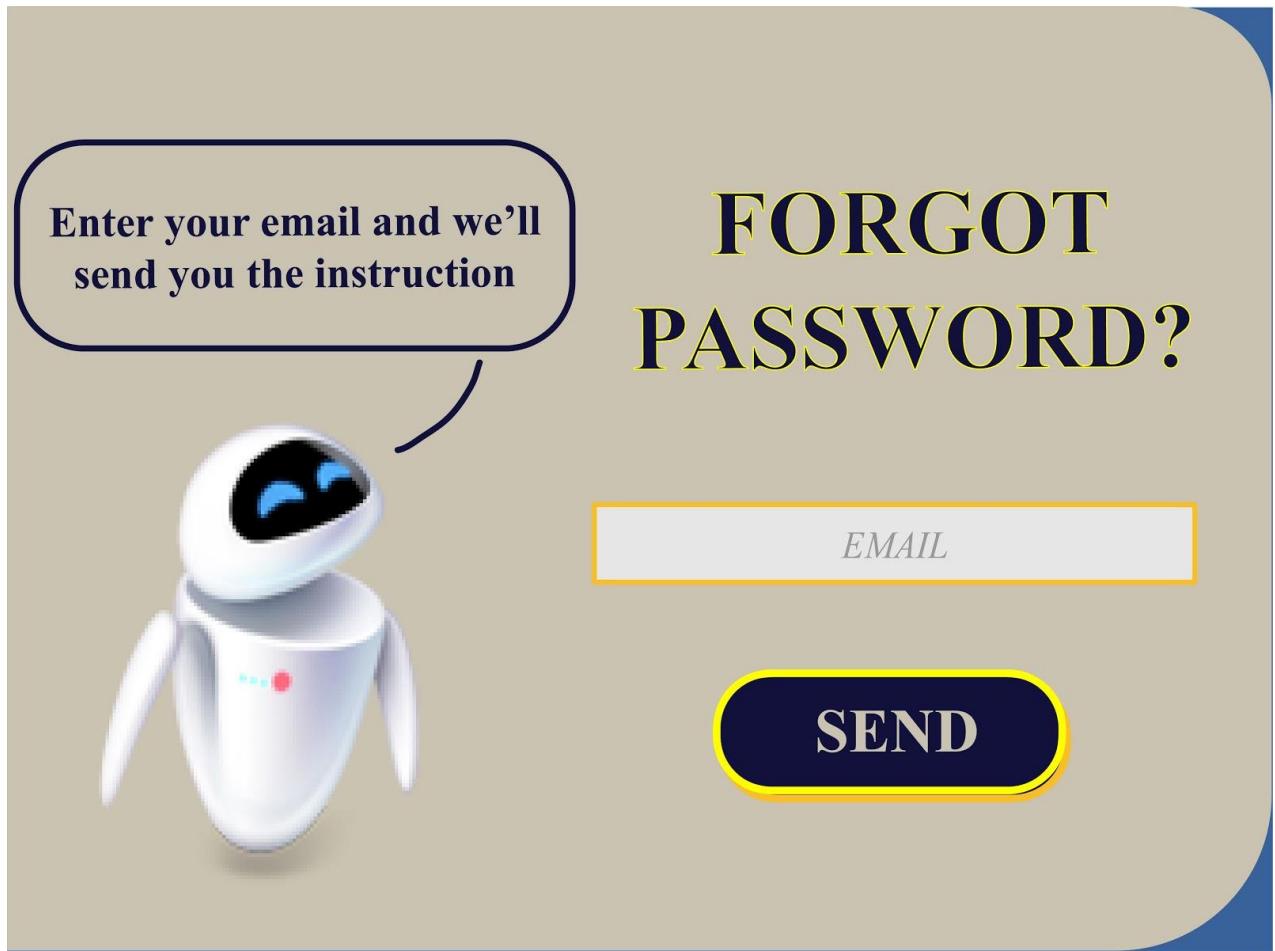
3.3.1. Login screen



The "Login" screen is the first display. Users must enter Username and Password (correct with one of the Username and Password saved under Database) and touch "Sign in". If there is no Username and Password stored under Database, an error will be reported to the user. If both the Username and Password match under Database, it will be moved to the next Home Page.

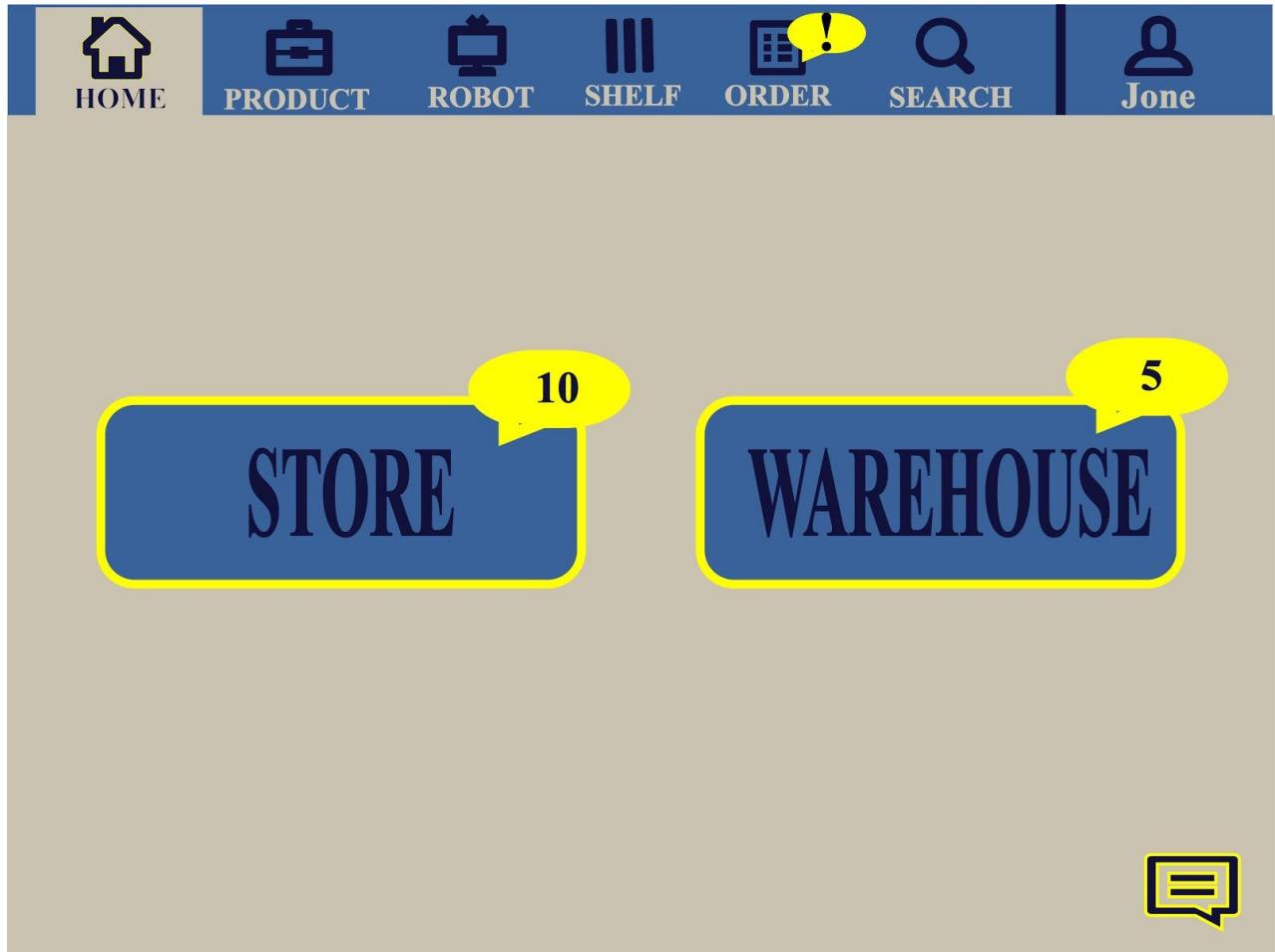
Besides that, there are also the "Forgot Password" and "Remember password" functions:

- "Remember password": helps users not need to re-enter the password with each login.
- "Forgot Password": help users to reset password through authentication via email or phone number. If a user touches "Forgot Password", it will be moved to the below next "Forgot Password" page.



After touching "Forgot password", the user needs to provide an email registered in the system. The system will proceed to check the existence of the email in the database. If it matches, the system will send email to the user's email inside with the active link. The user will touch on the link to activate his account. Changing the password will work on this link. Then, the user returns to the Rosor system and login again.

3.3.2. Home screen



After successfully logging into the system, "Home Page" will appear. There are full functions of Product, Robot, Shelf, Order, Search, and User to serve the needs of User. In addition, in the Home page, users will see notifications in store and in warehouse. Users choose "Store" if they want to see all detail about notifications in store and if they want to know that in the warehouse, they choose "Warehouse".

When they choose "Store", they will see the screen below:



In this screen, there are notifications about wrong shelves and lack of products in the store. It also shows the total notification and how many notifications are in processing. A notification includes: information about shelf and product, the process of robot and color (red represents lacking of products, represents wrong shelf). If the notification is not received by any robot or the robot wastes too much time to finish the task or there are any problems, an icon “!” will appear in that notification for users to know. And the icon “!” at the order icon represents requests for PO waiting users to confirm. That PO is created automatically when the robots in the store fix the problem of lack of product and define that the quantity of product in the warehouse is under the limit race. When users choose one notification, a pop up showing all robot's work progress in store will appear and it will focus on the robot's work progress of notification which users choose. Below screen illustrates it:



When users choose “Warehouse”, it also shows notification about warehouse and robot’s work progress in warehouse like the screen “Store”.

WAREHOUSE

STORE

COLLECT AND SORT THE PRODUCT
9:20:00

INPUT WAREHOUSE

COLLECT AND SORT THE PRODUCT
9:00:00

W02 - 25%

W04 - 25%

W01 - 75%

Processing 100%



3.3.3. Order screen

If users choose “Order” when it has an icon “!”, a screen create PO for the product which quantity is under the limit race will appear:



In this screen, there is all information about the product which references the purchase order before. Users can edit quantity, receive date or vendor for suitable. They confirm the request for PO when they choose the button “Create”. Then a screen about all the requests for PO which have the same vendor with that product with 3 buttons (View more, Send vendor and Exit).



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Order >> Create order

VIEW ORDER

SEND VENDOR

| UPDATE AT | USER ID | PRODUCT | PRODUCT ID | VENDOR | QUANTITY | TOTAL | DATE RECEIVE |
|------------------------|---------|---------|------------|--------|----------|---------|--------------|
| 19/12/2020 14:30:00 | SD01 | | NN1011 | CTY B | 1000 | 1000000 | 20/12/2020 |
| 19/12/2020 10:00:10 | SD01 | | NN1012 | | 1000 | 1000000 | 20/12/2020 |

VIEW MORE

EXIT



If users touch the button “Exit”, they will return to the Home page. At the end of the day or when there are enough requests for PO having the same vendor, PO will be created automatically and a pop up will be shown to notify the users. However, if users want to create PO immediately, they choose “Send vendor” and a pop up showing notification for the users also appears. Users can choose the button “View more” to move to the screen which shows other requests for PO having the same vendor and this screen is also the main screen when users choose “Create order” in the menu of icon order. It has filter by the vendor to help user easily view the vendor whom they want to know.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Order >> Create order

LIST OF ORDER

Vendor

ADD

| UPDATE AT | USER ID | PRODUCT | PRODUCT ID | VENDOR | QUANTITY | TOTAL | DATE RECEIVE |
|------------------------|---------|---------|------------|--------|----------|---------|--------------|
| 19/12/2020 14:30:00 | SD01 | | NN1011 | CTY B | 1000 | 1000000 | 20/12/2020 |
| 19/12/2020 10:00:10 | SD01 | | NN1012 | | 1000 | 1000000 | 20/12/2020 |
| 19/12/2020 11:12:00 | SG01 | | WT1001 | CTY C | 2000 | 1000000 | 20/12/2020 |



If the users want to create a new request for PO, they choose the button “Add” in the screen “Create order” and a screen create PO will appear.

Order >> Create order

CREATE ORDER

Name:

Price:

Brand:

Vendor:

ID Product:

Size: Weight:

Type: Detail type:

Barcode:

Quantity: Date receive:

Location at warehouse:

CREATE **CANCEL**

Users need to input all information about the product to create a request for PO. To be faster, users should input the id of the product for the system to get information automatically and user only need to input information about quantity and receive date. After all, users touch on the button “Create” to create a request for PO or touch on “Cancel” to cancel this action.

The screen below show the menu of order:



When users choose “History”, system will move to the screen like this:



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Order >> History

HISTORY

Date ▼

Vendor ▼

| ORDER ID | ORDER DATE | USER ID | VENDOR | TOTAL | STATUS |
|----------|------------|---------|--------|----------|----------|
| OR0106 | 18/12/2020 | SD01 | CTY E | 8000000 | ORDERING |
| OR0105 | 17/12/2020 | SD02 | CTY B | 10000000 | ORDERING |
| OR0104 | 17/12/2020 | SD03 | CTY C | 30000000 | ORDERING |
| OR0103 | 17/12/2020 | SD04 | CTY D | 20000000 | ORDERING |
| OR0102 | 15/12/2020 | SD05 | CTY B | 10000000 | COMPLETE |
| OR0101 | 15/12/2020 | SD06 | CTY C | 10000000 | COMPLETE |
| OR0100 | 15/12/2020 | SD07 | CTY E | 40000000 | COMPLETE |

All POs will be shown in this screen with their status so the users can track PO more clearly. When users touch on one line, the detail of that PO will be shown.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Order >> History >> Order's detail

ORDER'S DETAIL

Order ID: OR0106

User ID: SD01

Vendor: CTY E

Total: 8000000Đ

Order date: 15/12/2020

Receive date: 18/12/2020

ORDERING

| NUMBER | IMAGE | PRODUCT ID | QUANTITY | TOTAL |
|--------|-------|------------|----------|---------|
| 1 | | SN113 | 1000 | 8000000 |

EXIT



If users want to see more detail about the product of the PO, they touch the icon next to the line of that product. The picture below illustrates that. If not, users can press the button "Exit" to move to the screen before.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Order >> History >> Order's detail

ORDER'S DETAIL



Name: **VINAMILK**
Price: **8000 Đ**
Brand: **VINAMILK**
Vendor: **CTY E**
ID Product: **SN113**
Size: **180 ML**
Type: **MILK** Detail type: **WM**
Barcode: **M17762162**
Quantity: **1000** Date receive: **17/12/2020**
Location at warehouse: **WA4**

ORDERING

EXIT



3.3.4. Product screen



When users hover over the Product icon, user can see 3 options for them to choose: Add new product, Manage product and View History of product. Users can touch one of them to continue.



First, if users touch “Add”, there exists an “Add product” screen above. Then, users need to fill in all information relating to the new product which users want to add more such as product name, price, ID, Location,... and its photo. After finishing all required information, users touch “Save” button to save that new product to database. Or if users do not want to continue, users can touch “Cancel” button to cancel what users are doing.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Product >> Manage product

LIST OF PRODUCT

Shelf at store ▾

Shelf at WH ▾

| IMAGE | NAME | PRICE | ID PRODUCT | QUANTITY | STATUS | SHELF AT STORE | SHELF AT WH |
|-------|--------------|---------|------------|-----------|---------|----------------|-------------|
| | OVALTINE | 70000 ₫ | SN110 | 1000/1000 | ENOUGH | A1 | WA1 |
| | MILO | 70000 ₫ | SN111 | 1000/1000 | ENOUGH | A2 | WA2 |
| | TH TRUE MILK | 90000 ₫ | SN112 | 1500/2000 | ENOUGH | A3 | WA3 |
| | VINAMILK | 80000 ₫ | SN113 | 100/1000 | ODERING | A4 | WA4 |



Second, if user touches “Manage” button, this is the manage product screen. User can view all products here, with the overview information such as name, price, ID, quantity, status, its shelf at store and its shelf at warehouse. Besides, users can see 2 categories here: Shelf at store and Shelf at warehouse. If users want to see products just in store, they need to choose the first category and select which shelf they want to see. The second category: Shelf at WH is similar to the former. At the end of each row, users can see an “Edit” icon. If user wants to edit information of that product, they will touch to that icon. Then, the screen below will exist.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Product >> Manage product >> Edit

EDIT PRODUCT



Name: MILO
Price: 7000 Đ
Brand: MILO
Vendor: CTY A
ID Product: SN111
Size: Weight: 180 ML
Type: MILK Detail type: WM
Barcode: M18519989
Location at store: A2
Location at warehouse: WA2

DELETE

SAVE

CANCEL



User can change any information of that product in this screen or even delete it. After finishing, user need to touch “Save” button to save all information to database or “Cancel” button if they do not want to save any new things.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Product >> History

HISTORY

Date ▼

Activity ▼

| UPDATE AT | PRODUCT | PRODUCT ID | PRICE | ACTIVITY | MADE BY USER ID |
|------------------------|---------|------------|-------|----------|-----------------|
| 08/11/2020 13:00:45 | | BA1002 | 20000 | ADD NEW | SG01 |
| 08/11/2020 13:00:05 | | BA1001 | 25000 | ADD NEW | SG01 |
| 07/11/2020 17:50:06 | | SN111 | 7000 | EDIT | SD01 |



Last, if the user chooses “History” in the pop up of the “Product” icon, they will see this screen. They can easily know all activities relating to that product such as time update, product ID, activity and user ID who did those activities. Moreover, you can see 2 categories: Date and Activity. User can choose the date they want to see all activities in that day or kind of activity and all information relating to that activity will exist in the table below.

3.3.5.Robot screen



On the Robot screen, there are two types of robot to manage are robots at store and robots at warehouse. There is a notification bubble above each type to notify user problems are status of robots.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Robot >> Store

ADD ROBOT

MANAGE ROBOT

HISTORY



When touching on each type of “Robot” above, we can see functions to manage robots like add, edit, manage, status and working history of that robot.



HOME



PRODUCT



ROBOT



SHELF



ORDER



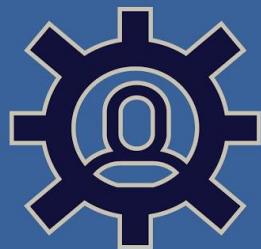
SEARCH



Jone

Robot >> Store >> Add robot

ADD ROBOT



Name:

ID:

Vendor:

Speech:

Battery:

Size: Weight: Productivity: Control shelf: **SAVE****CANCEL**

After touch “Add robot”, the screen will be below, user need to fill in the information of the new robot to add it into the database. Touch “Save” to update it to the database and “Cancel” to quit.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Robot >> Store >> Manage Robot >> Robot's detail >> Edit

EDIT ROBOT



Name:

S1

ID:

S01

Vendor:

ANO Company

Speech:

0.7km/h

Battery:

FULL

Size: 165 x 70

Weight: 3 kg

Productivity:

2030

Control shelf:

A

DELETE

SAVE

CANCEL



To “Edit robot”, user need to fill in new or changed information of the robot to fix it. Touch “Save” to update it to the database, “Delete” to delete that robot from the database, and “Cancel” to quit.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Robot >> Store >> Manage Robot >> Robot's detail

ROBOT'S DETAIL



Name: S1

ID: S01

Vendor: ANO Company

Speech: 0.7km/h

Battery: FULL

Size: 165 x 70 Weight: 3 kg

Productivity: 2030

Control shelf: A

EDIT

CANCEL



“Robot Detail” helps users check the information of a robot. If the user wants to fix the information, touch “Edit” to be led to the EDIT ROBOT page, touch “Cancel” to quit.

The screenshot shows a mobile application interface with a blue header bar containing icons for Home, Product, Robot, Shelf, Order, Search, and a user profile labeled "Jone". Below the header, the text "Robot >> Store >> Manage robot" is displayed. The main content area has a yellow rounded rectangle border and contains the title "LIST OF ROBOT" in large, bold, dark blue letters. Below the title are two filter buttons: "Shelf" and "Status", each with a dropdown arrow icon. The main list area displays six entries, each consisting of a gear icon with a robot head inside, followed by a green button with the identifier and a shelf label (e.g., S1 - A). To the right of the list is a vertical bar with three colored segments (light blue, dark blue, and black) and a small speech bubble icon at the bottom.

| Index | Shelf | Status |
|-------|-------|--------|
| S1 | A | Green |
| S2 | B | Orange |
| S3 | C | Red |
| S4 | D | Green |
| S5 | E | Green |
| S6 | F | Green |

When the user touches on the “Manage” button in the “Robot Management” page, he or she can see the list of robots working in the store (S) or warehouse (W) and the shelf they are working at, also the working status of them.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Robot >> Store >> History

HISTORY

Date ▼

Activity ▼

| UPDATE AT | ROBOTID | CONTROL SHELF | VENDOR | ACTIVITY | MADE BY USER ID |
|------------------------|---------|---------------|--------|----------|-----------------|
| 08/11/2020 13:00:45 | S02 | B | ANO | EDIT | SG01 |
| 08/11/2020 13:00:05 | S03 | C | ANO | EDIT | SD01 |
| 07/11/2020 17:50:06 | S06 | F | MAS | ADD NEW | SD01 |

“Robot History” can help users check the work the robot had done in times and what is that, at what shelf.

3.3.6. Shelf screen



From menu, if user choose “SHELF”, there are two function for user: View and History with two option location: Store and Warehouse.



When user click SHELF from main menu --> choose View function --> Store, system will show shelf map at store: Each row is numbered in alphabetical order a. b. c and in each row, shelves are numbered that correspond to each different product.

User can focus on specific area by filtering shelf and product status: yellow color: Wrong product on shelf, red color: Lack product on shelf.

User can also add product for new self at store by button “Add”_Add self screen.



HOME



PRODUCT



ROBOT



SHELF



ORDER



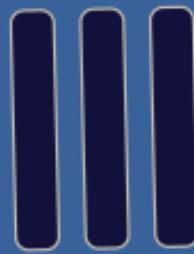
SEARCH



Jone

Shelf >> View >> Store >> Shelf's detail

SHELF'S DETAIL



Shelf: A Number: 1

ID Product: SN110

Image:



Status: Has wrong product

ID Robot control: S1

EDIT

CANCEL



When user want to know shelf's detail, she or he just need to click on shelf, following screen show information about location, belong to what robot management. Here, user can edit basic shelf's information or view and exit.



HOME



PRODUCT



ROBOT



SHELF



ORDER



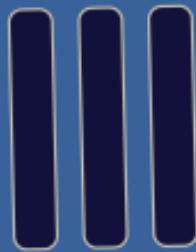
SEARCH



Jone

Shelf >> View >> Store >> Shelf's detail

SHELF'S DETAIL



Shelf: A Number: 1

ID Product: SN110

Image:



Status: Has wrong product

ID Robot control: S1

EDIT

CANCEL



User can edit shelf with following information even delete it.



HOME



PRODUCT



ROBOT



SHELF



ORDER



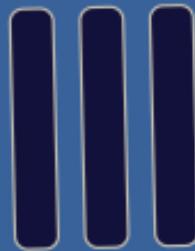
SEARCH



Jone

Shelf >> View >> Store >> Add shelf

ADD SHELF



Shelf:

Number:

ID Product:

ID Robot control:

SAVE**CANCEL**

User need to fill enough following information to add new self.



Similar the way to arrange at store, shelf map in warehouse also has the same function.



HOME



PRODUCT



ROBOT



SHELF



ORDER



SEARCH



Jone

Shelf >> History

HISTORY

Shelf

Activity

Date

| UPDATE AT | SHELF ID | PRODUCT'S NAME | PRODUCT ID | ROBOT ID | ACTIVITY | MADE BY USER ID |
|------------------------|----------|----------------|------------|----------|--------------|-----------------|
| 17/12/2020 14:00:45 | E6 | HENIKEN | B0115 | S05 | EDIT PRODUCT | SD01 |
| 17/12/2020 14:00:05 | E5 | TIGER | B0116 | S05 | EDIT PRODUCT | SD01 |
| 02/12/2020 08:00:05 | A2 | MILO | SN111 | S01 | EDIT ROBOT | SG01 |



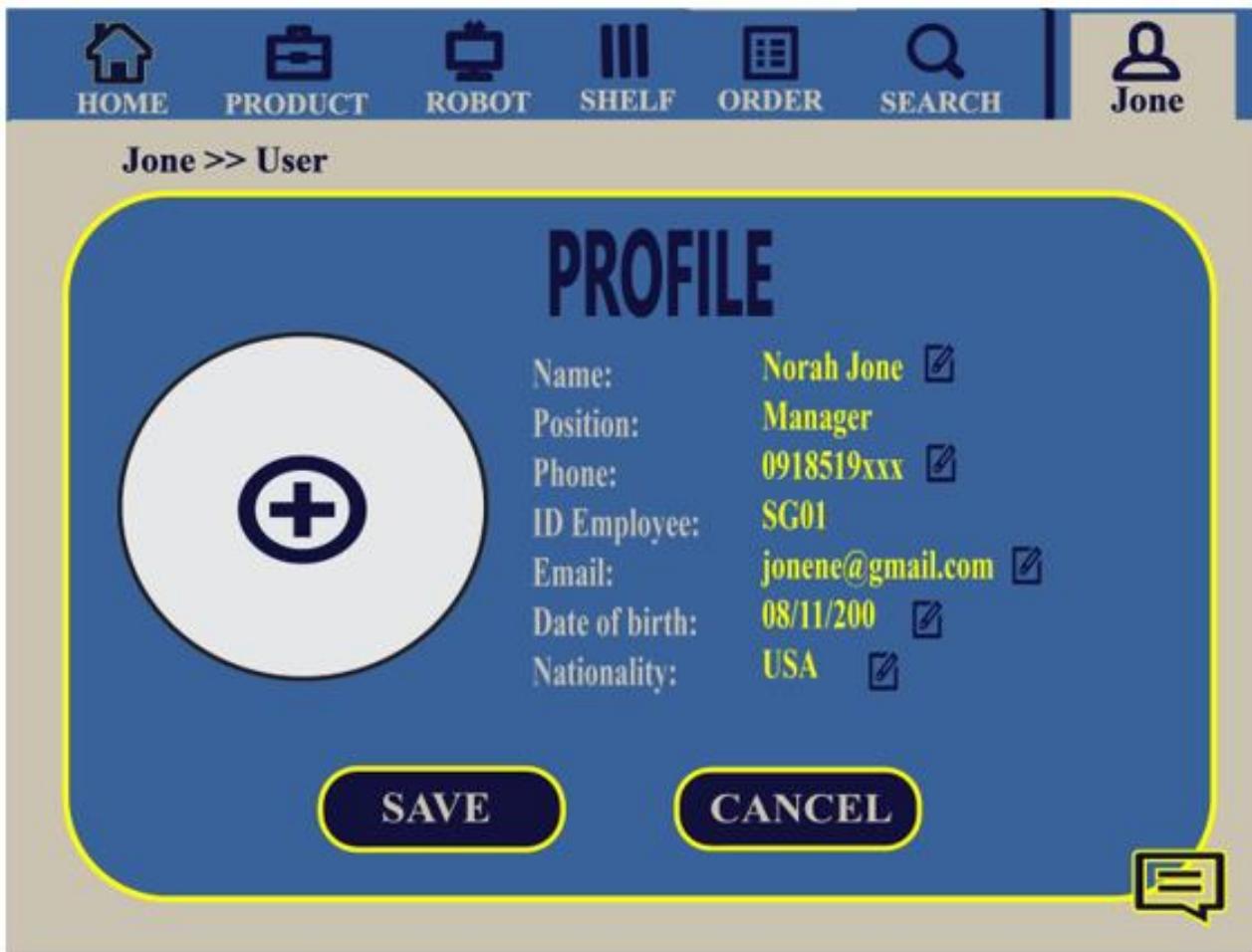
This function allow user manage shelf better. Its record all activities on shelf in real-time. User can sort by shelf, activity and date, which has impact on shelf.

3.3.7. User screen



In the User section, the name of the user will be displayed. When clicking on the User's Name (eg Jone with the manager position as shown in the picture) the user will see "User", "List User" for the manager position and "Sign out". For users as recipients, "List User" will be grayed out.

The "User" functions that help users manage their profile such as name, date of birth, position, email, phone number, nationality, image The screen when clicking User is as follows:



Then click "Save" to save all changes to Database. If the user does not want to change, click "Cancel" to return to the "Home Page" screen.

The screenshot shows a software interface with a blue header bar containing icons for Home, Product, Robot, Shelf, Order, Search, and a user profile for 'Jone'. Below the header, the text 'Jone >> List of user' is displayed. A large blue rounded rectangle contains the title 'LIST OF USER' and an 'ADD +' button. Inside this area is a table with four columns: 'NUMBER', 'ID', 'NAME', and 'POSITION'. Two rows of data are shown:

| NUMBER | ID | NAME | POSITION |
|--------|------|------------|----------|
| 1 | SG01 | Norah Jone | Manager |
| 2 | SD01 | QuoHo | Staff |

On the right side of the table, there are three circular icons: a play button, an edit button (pencil), and a message icon.

The "List of user" function is only visible to administrative users. Here, the administrator can view the complete list of users in the Rosor system. The administrator can edit their information by clicking on that line.



When users touch edit, "Edit User" will appear as follows. Here the manager can change the position as well as delete the selected person. All changes will be saved to the Database if the user clicks "Save", otherwise "Cancel".

The screenshot shows a software application window titled "Jone >> List user >> Add use". At the top, there is a navigation bar with icons for Home, Product, Robot, Shelf, Order, Search, and a profile icon for "Jone". The main area is a blue-bordered form titled "ADD USER". It contains several input fields and a selection button. The fields are arranged in two columns: "NAME", "ID EMPLOYEE", "NATIONALITY", "PHONE", "EMAL", "USER NAME", "DATE OF BRITH", "PASSWORD", and "CONFIRM PASSWORD". Below these fields is a selection button with two options: "Manager" (highlighted in yellow) and "Staff". At the bottom of the form are two buttons: "SAVE" and "CANCEL". A small speech bubble icon is located in the bottom right corner of the form area.

Besides, the manager can add new employees by clicking "Add" on the "List User" screen. The "Add user" screen is as below. At here, manager need to fill profile of new employee such as: name, date of birth, position, email, phone number, nationality, image.... All changes will be saved to the Database if the user clicks "Save", otherwise "Cancel".

REFERENCES

1. Systems Analysis and Design-Cengage, Scott Tilley, 2020.
2. The lecture slide is provided by the instructor.