

UNIVERSITY OF ECONOMICS AND LAW
FACULTY OF INFORMATION SYSTEM



MID-TERM PROJECT REPORT

**SUBJECT: ANALYSIS AND DESIGN OF INFORMATION
SYSTEMS**

**PAYMENT APPLICATION FOR
SUPERMARKET**

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Ho Chi Minh, December 13rd 2022

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Contents

I. Overview Project	5
1. Description	5
2. Objectives	5
II. Overview analysis	6
1. Business requirements	6
2. Overall flow	6
III. Detail Analysis	8
1. BPMN	8
1.1. Register	8
1.2. Login	10
1.3. Payment	11
1.3.1. Online payment (E-wallet and Internet Banking)	12
1.3.2. Cash machine	13
1.4. App.....	15
1.5. Camera system	16
1.6. Sensor system	18
1.7. Return Area	19
1.8. FaceID	20
2. DFD.....	20
2.1. Context Diagram	21
2.1.1. Diagram	21
2.1.2. Description	21
2.2. DFD Level 0	23
2.2.1. Login/Register	23
2.2.2. FaceID	23
2.2.3. Create Order	24
2.2.4 Payment	24
2.2.5 Security.....	24
2.3. DFD Level 1	25
3. Use Case & Sequence.....	27
3.1. Use Case.....	27
3.2. Sequence	29

3.2.1. Register	29
3.2.3. Login	29
3.2.4. Scan Product System & Create Order	31
3.2.5. Payment	33
3.2.5.1. E-Wallet	34
3.2.6. Security	38
4. Mockup	38

I. Overview Project

1. Description

In Vietnam, the retail industry has grown significantly in our economy, which plays an important role in building the country's gross domestic product. Supermarket chains have become a major segment of the retail industry and the industry is showing signs of continued strong growth.

A supermarket can be simply described as “a large self-service retail market that sells food and household goods”. In the modern world, people have a very tight schedule in their daily life, hence they look for very quick and easy ways to fulfill their shopping requirements. Since the supermarket industry is a customer-centric industry, customer satisfaction is one of the most important and crucial factors that determine profitability and competitiveness compared to supermarkets.

Realizing the urgency, our team has implemented a project on the topic "Mobile application for retail supermarkets, allowing customers to automatically generate invoices and pay directly on their phones, without going to the counter. cashier". This project involved identifying common problems that customers face when they deal with the supermarket industry with the aim of enhancing customer satisfaction with the use of innovative technologies for the chain. grocery supermarket.

2. Objectives

This project is built with the purpose of applying the learned knowledge and self-research of the team to create a mobile application running IOS and Android operating systems for customers' purchase and payment. At retail supermarkets or convenience stores, making the transaction process quick, convenient and optimal for customers.

This application will be installed based on user-friendly interfaces. Simple registration procedure, intuitive shopping cart increases the feeling of experience for customers. Customers just need to pick up the product, the application will automatically add the product to the cart on the application. Diversity of payment methods, depending on the customer's choice. At the last step after each payment successfully, the system will automatically check in to comparing the product in real and in virtual cart (on app), then open the door for customers to pass through. This is to not inconvenience customers when walking through the gate as well as to prevent product theft or fraud.

This application allows users to use the necessary functions: login / registration

account, view information about selected products, pay for multi-modal transactions, save information, print e-invoices or send invoices to the app.

This application will be installed based on user-friendly interfaces. Simple registration procedure, intuitive shopping cart increases the feeling of experience for customers. Customers just need to pick up the product, the application will automatically add the product to the cart on the application. Diversity of payment methods, depending on the customer's choice. At the last step after each payment, the system will automatically check in to demagnetize the product, and open the door for customers to pass through. This is to not inconvenience customers when walking through the gate as well as to prevent product theft or fraud.

II. Overview analysis

1. Business requirements

In order for the system to operate smoothly, achieve the set goals and minimize system failures, the following requirements must be met:

- System components need to be closely linked and optimized to ensure the software works well, saving processing time and labor.
- When saving data, it is necessary to ensure that the data is properly arranged, the storage memory of the data warehouse must be large enough to contain information, to avoid information interference and information overload.
- The interface is simple, easy to get used to and used to help users make transactions quickly and conveniently without the need for a cashier.

2. Overall flow

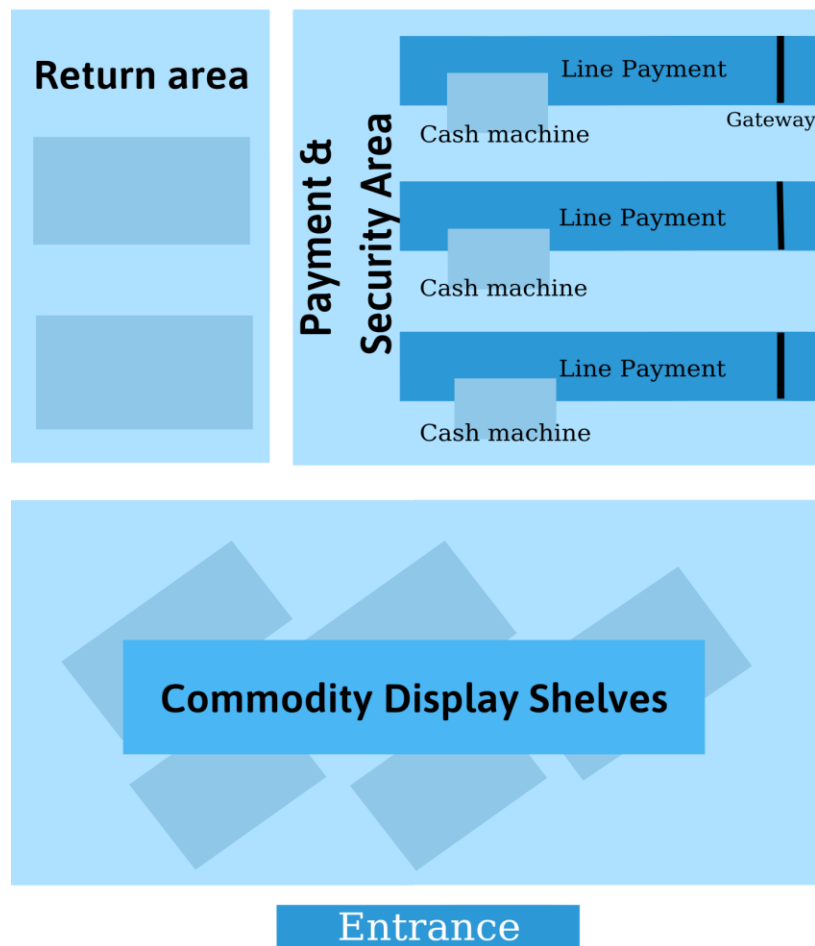
BPMN includes: Register, Login, Camera system, Sensor system, Cash machine, E-wallet, FaceID, Payment, App.

Application includes the following functionality:

- Provide QR code for confirmation upon entry.
- Manage virtual shopping carts, display the products that customers are choosing.
- Error message: Displays an error when something goes wrong with the system.
- The camera system includes the following functions:
 - Tracking customer actions.
 - Scan and identify automatically the product by the camera system selected by the customer.
- The sensor system includes the following functions:

- Product sensor on the shelf to weigh the goods cyclically on the day.
 - Support identifies the product which customers took by weight on the shelf.
- Method payment includes:
 - Cash machine includes functions: Support cash payment and overpayment for customers.
 - E-wallet: Support payment via e-wallet for customers.
 - Internet Banking: Paid customer bills directly from their connected card.
- Security includes:
 - Recognition system: Check all products that customer took in real with all products in virtual cart to detect missing product.
 - Gateway: closing and opening the door depending on the status of payment.
- For visualization, we have illustrated the shop map as shown below:

Directions Map



III. Detail Analysis

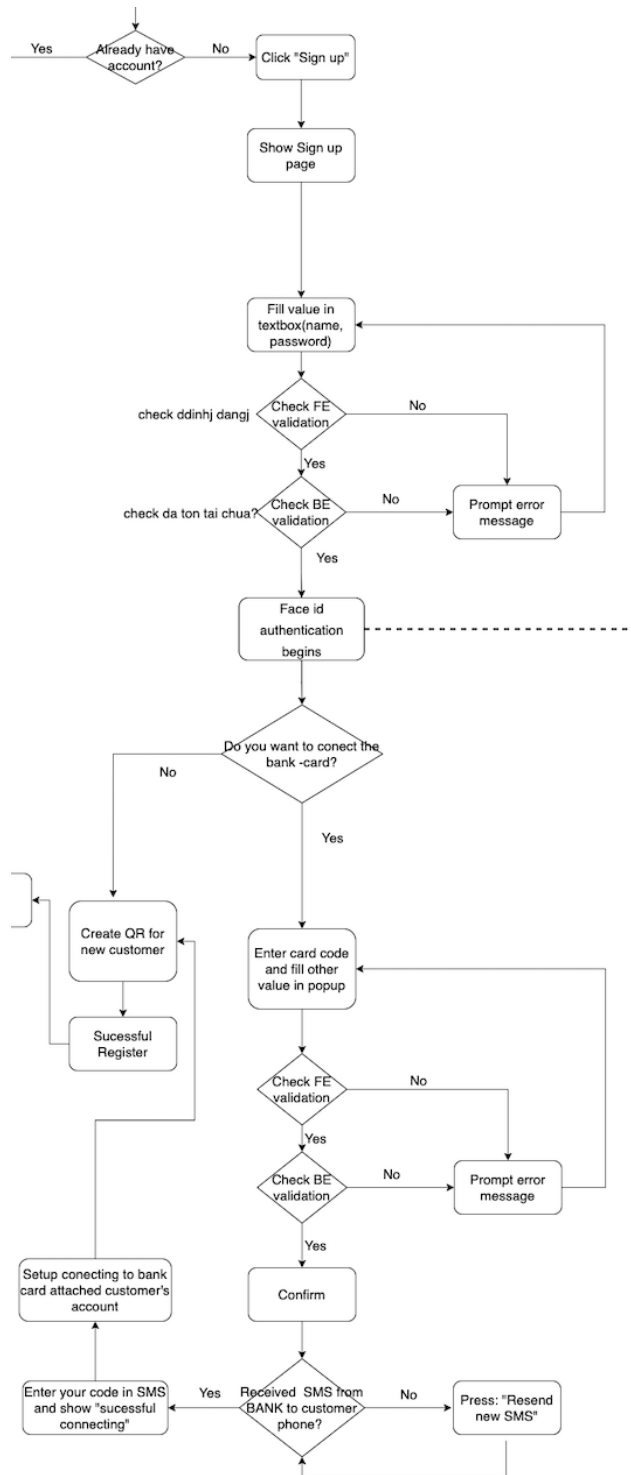
1. BPMN

1.1. Register

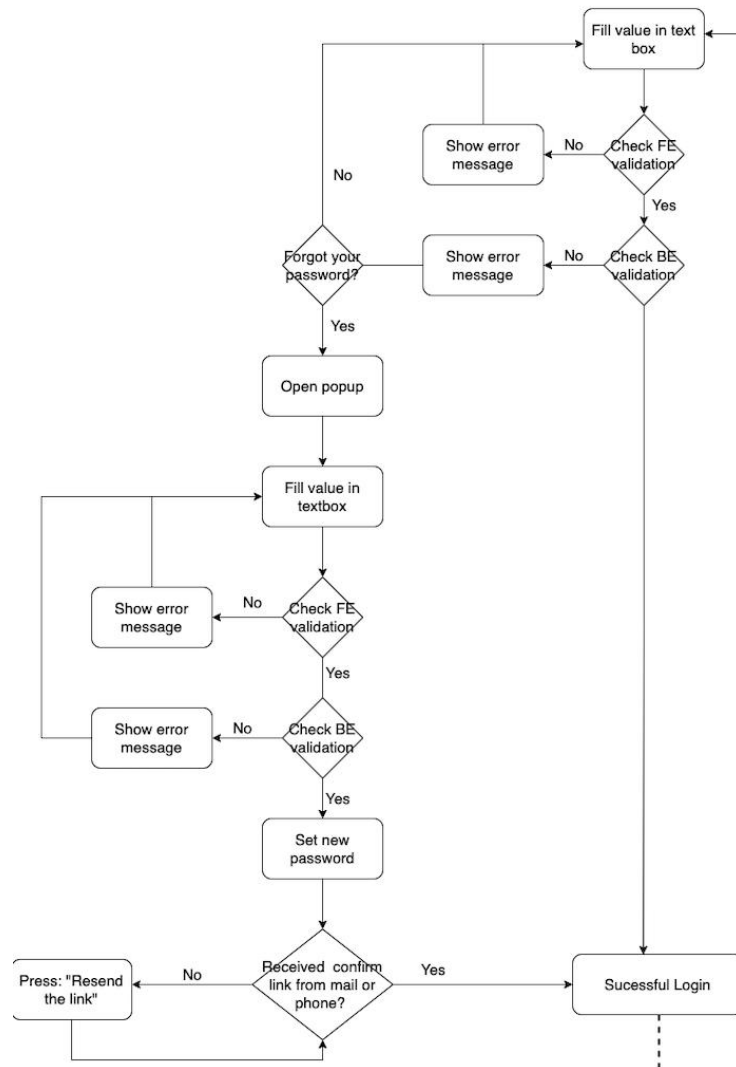
If the customer does not have an account on our system, they need to finish this registration step. Customers must fill in information in all fields on the registration page that appears immediately when they click on the “Register” button: personal information, contact method, account name, password,... During this process, the system will check the format of input parameters. For example, the phone number must be the correct length followed by the country; date time data needs to be compiled to the specified date format; Username and password need to be in the correct format specified by the system. If this check step detects an error, the system will notify the customer. System allows customers to re-enter error information. After that, the system will check whether the account user and password exist or not. If it exists, the customer needs to re-enter.

After all the information is correct, the customer will continue to the Face ID step, and the face ID registration process will be initiated. After that, the system will ask customers whether they want to link the card or not. If yes, the customer will fill all the fields on the card table and just pop up. The system will also check the format of the information the customer has just entered and check whether the card exists in the system's datastore or not. If there are any errors, the system will notify the customer and allow the customer to re-enter the information. On the contrary, if it is correct, the customer needs to enter the correct code that the system has sent to the customer's phone number. If you do not receive the code, you can press the "resend" button on the screen.

Thus, when the registration step is completed, the system will create a private QR code for the customer and notify: “Success registration”.



1.2. Login



If the customer already has an account, the customer needs to enter the username and password. During the input, the system will check the format of the input parameters: account, password and notify customers if they enter the wrong format. If wrong, the customer must re-enter them in the correct format. Then the system will check whether the information account has already existed or not. Then, the system will check the database and let the customer login successfully if no error happens.

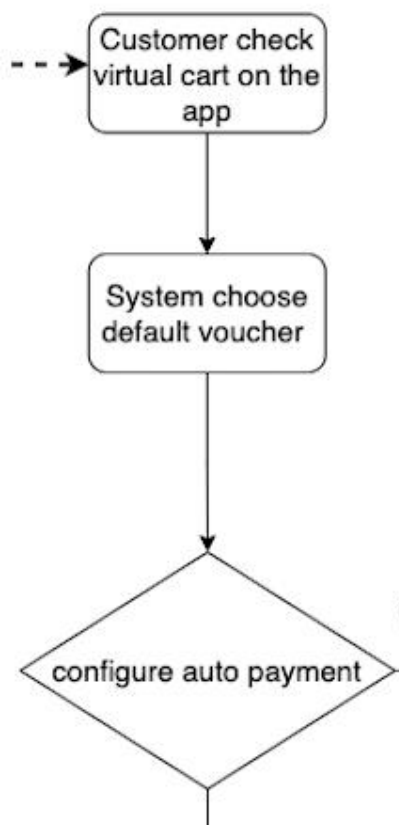
If login fails, the system will prompt an error message and the customer must re-enter account and password until they are all matched with the user database. Or they can press “Forgot your password” to get the new password.

If the customer chooses “Forgot your password”, the system will open a popup and the customer can get the new password by inputting the new account and information. Same

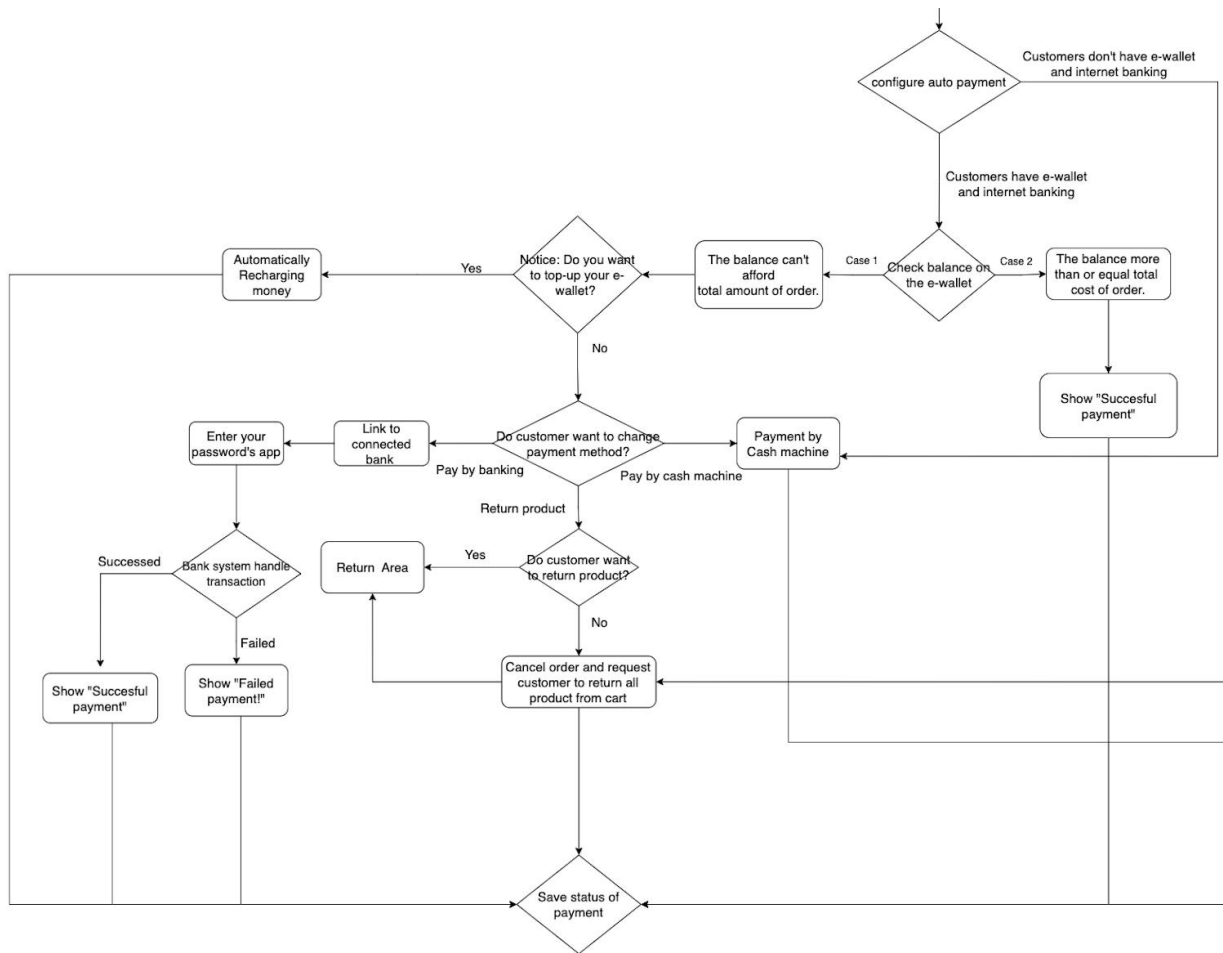
as login, the system will check the format of the input parameters, check under the user database and notify if the check fails. If nothing is wrong, the system will confirm your new password by sending a link to the customer phone number. If a customer doesn't receive the mail, press “Resend mail” and the system will resend this link to your phone number. After receiving and confirming the link, the new information account will be updated in the database and let the customer get the new password successfully.

1.3. Payment

When the customer walks into Line Payment, the process will automatically trigger. On the App will automatically switch to the Create order screen for the customer to check the product they have selected on the Virtual cart. Next, the system will automatically select the voucher for the customer, according to the pre-set settings. The default method is paying by E-wallet.



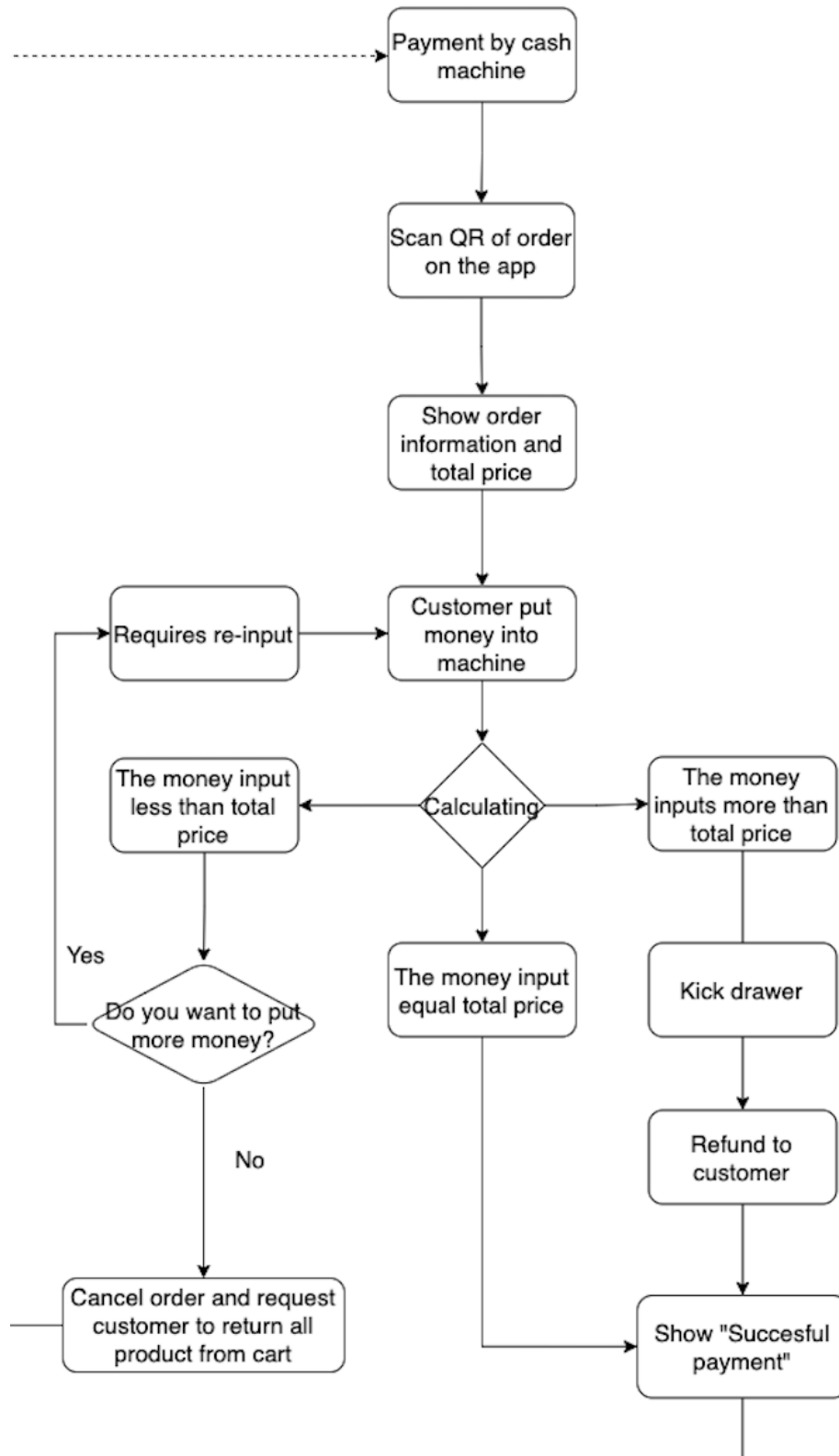
1.3.1. Online payment (E-wallet and Internet Banking)



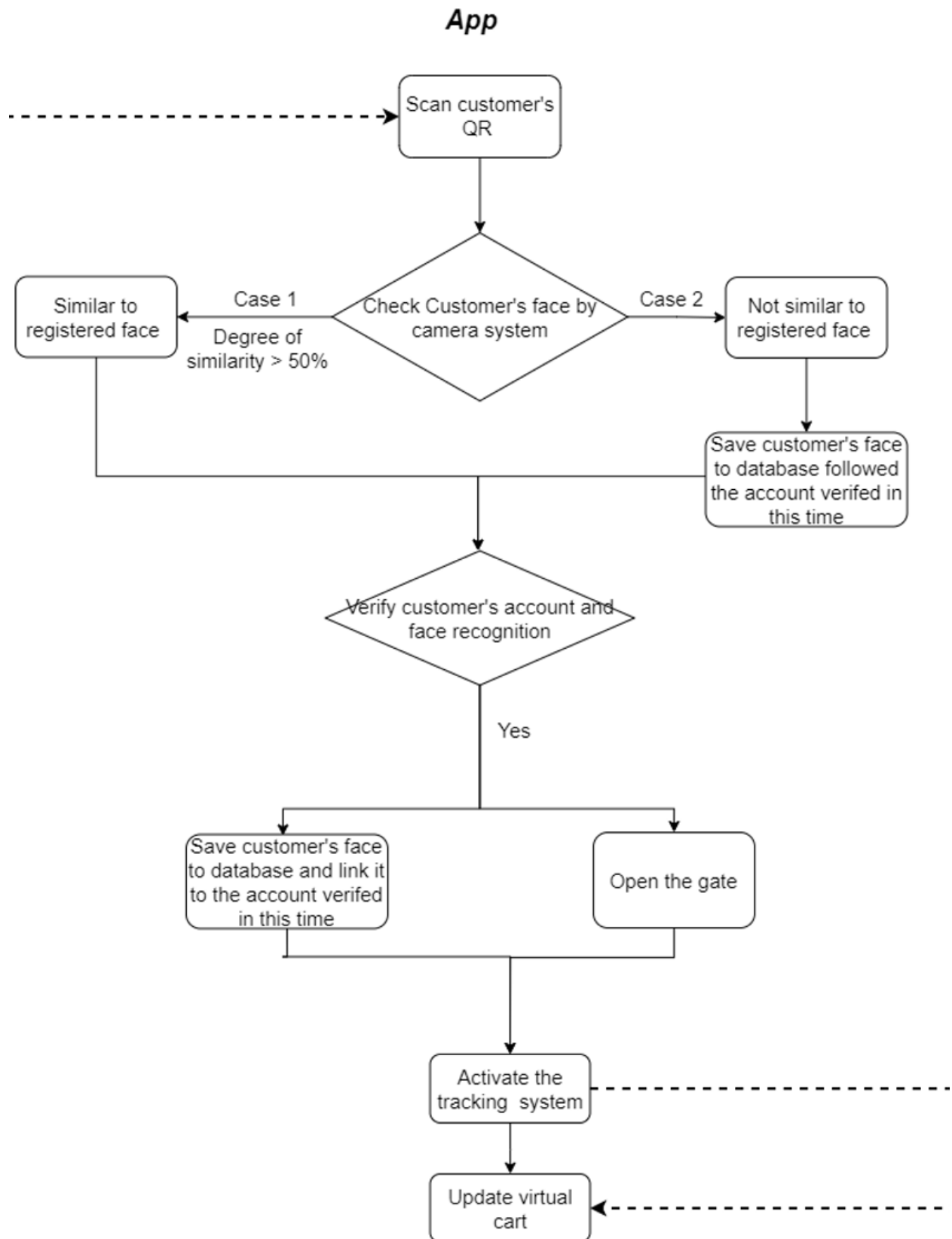
First, the system will check if the customer has the ability to pay online. Because there are customers who choose to skip the step of linking with a bank card when registering a card. The application will prioritize payment by e-wallet. Then the system will check your e-wallet to see if there is enough money to pay the bill. If there is enough payment, the system will display “Successful payment” and complete the payment process. If there is not enough money to pay, the system will ask if you want to top up the e-wallet, if yes, the system will automatically convert money and complete the payment. Otherwise, the System will continue to ask if you want to switch to another payment method. Here, the system will provide 3 methods: Pay by banking, Pay by cash machine, Return product. If the customer chooses Pay by banking, the system will switch screen to connected bank ask the customer to enter the password. Then the banking system will process that transaction, and return the result as Successful payment or failed payment.

1.3.2. Cash machine

With Cash Machine, customers need to scan the QR code of their order to transmit order and payment information to the machine. Customers can review order details and total price on the screen machine. If the inputted money is less than the total amount order, the cash machine will ask to put more money in machine. If the customer does not agree, the customer's order will be canceled and the customer will be asked to return the goods. If the inputted money is more than the total amount order, the machine will calculate and return the change back to the customer. Of course, the inputted money is equal to total amount order, a successful payment notification will be displayed on the screen.



1.4. App

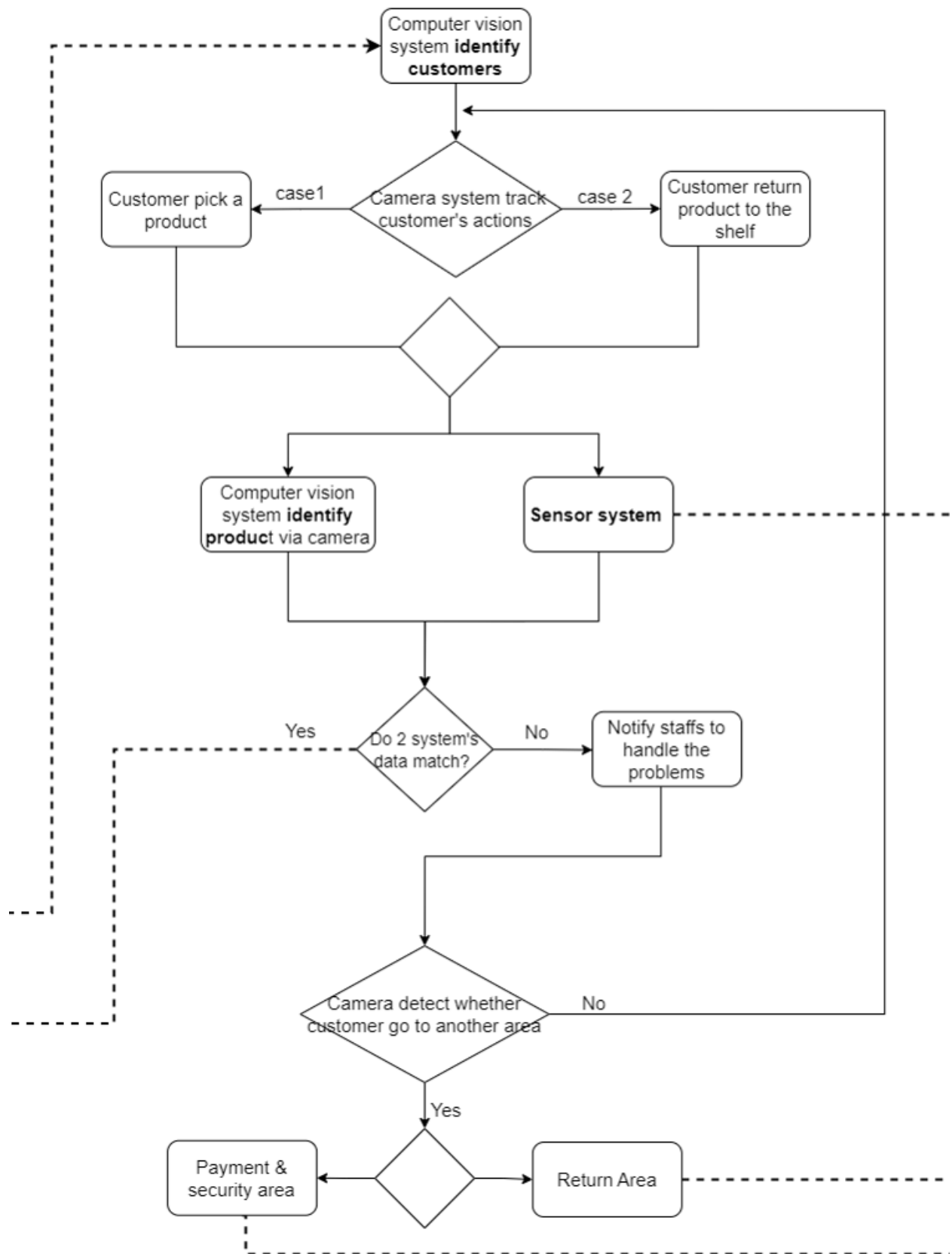


To open the door into the shop, customers must scan the QR code before approaching the gate, if their faces are detected as more than 50% similar, the system will successfully recognize and unlock the gate, as well as record the data. If on the other hand, the customer's face is detected as being different from the one used during registration, the system will save customer's data at that moment and correlate it with the order made

1.5. Camera system

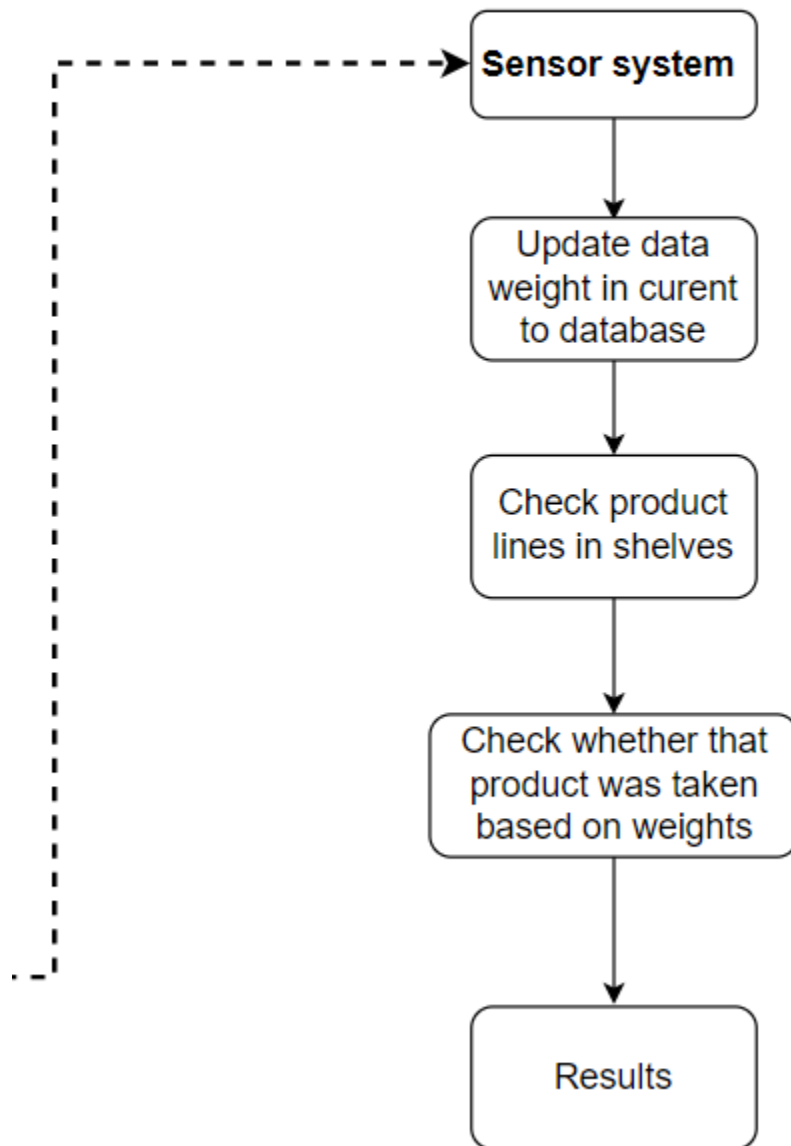
The customer's behavior will be recognized by the computer vision system. The technology will customer behavior, whether they take the goods or return it to the shelf. At that point, the camera and sensor systems will collaborate to collect product information. In case the customer selects the product and the data in the camera and sensor systems match and there is no error, the product will be added to the customer's virtual shopping cart. If the data from the camera and sensor systems do not match, the system will instantly contact the shift crew to handle the issue.

Camera System



1.6. Sensor system

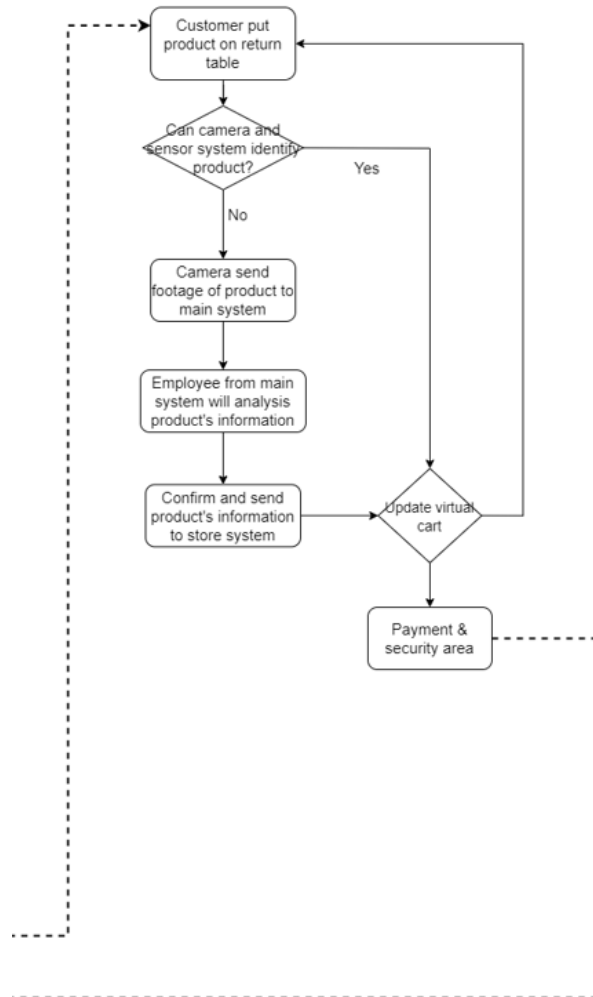
Sensor System



The sensor system's role is to constantly update the data weight in current to the database, check to see if the items on the shelf have been taken or returned, and report the findings to the camera system and other systems.

1.7. Return Area

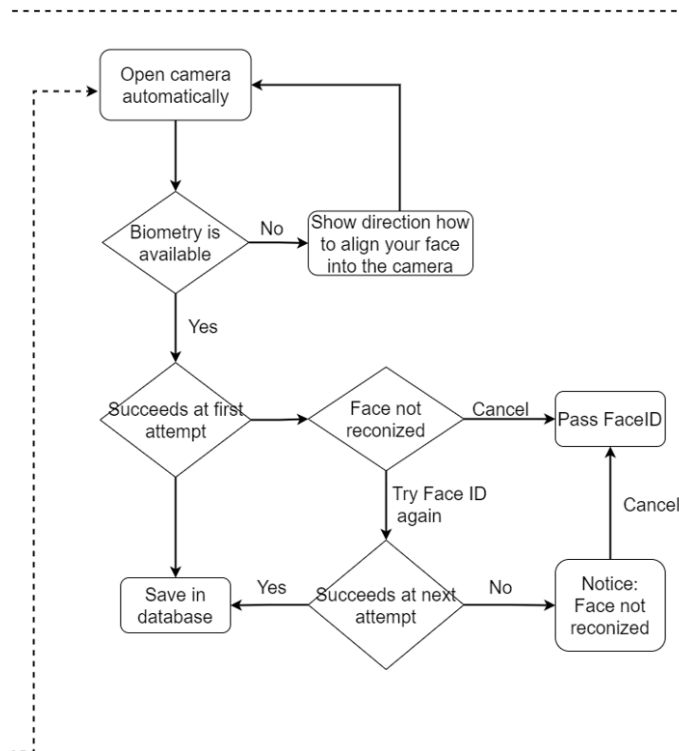
Return Area



If a customer is willing to return any product, they will go to the return area to return that product. When a customer puts a product on the return table, the camera system will scan that product for information. If the camera system can scan the product, the system will update the virtual cart. That product will be decreased from the order list. After that, if a customer wants to return another product, they will put the product on the return table and re-do the process. If the customer does not return any more product, they will go to the payment and security area. If the camera cannot scan the product, the camera system will send footage of the product to the main system of the company. In this stage, employees from the main system of the company will analyze that product's information themselves. After that, they will confirm and send that product's information to the store system.

1.8. FaceID

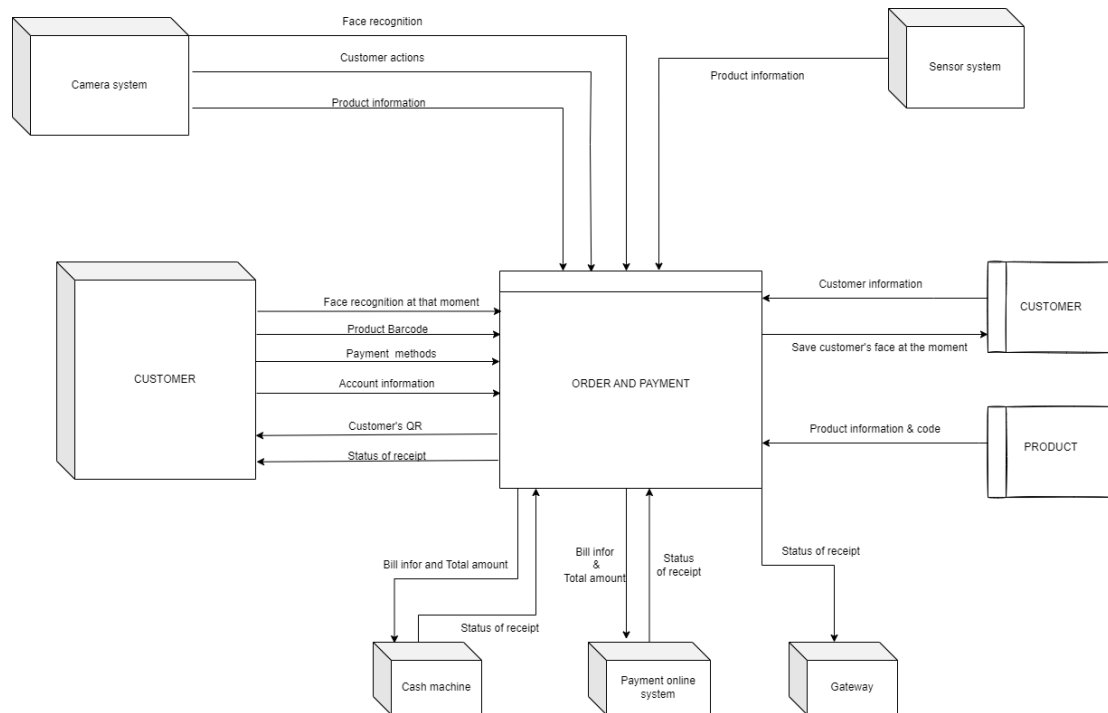
Face ID



The FaceID function is opened whenever a customer enters the store. The camera system is always open and it will capture the customer's face automatically. If the camera system fails to recognize the customer's face, there will be a notification for the customer. It will show the customer how to align your face into the camera. If the camera system succeeds at the first attempt but it does not recognize that face in the database, the system will let the customer choose between trying again and cancel the face recognition stage. When customers try face recognition again, if they succeed, the information will be saved in the database. If not, the system will show notice: "Face not recognized" and cancel the face recognition.

2. DFD

2.1. Context Diagram



2.1.1. Diagram

Context diagram for app “Order and payment” includes:

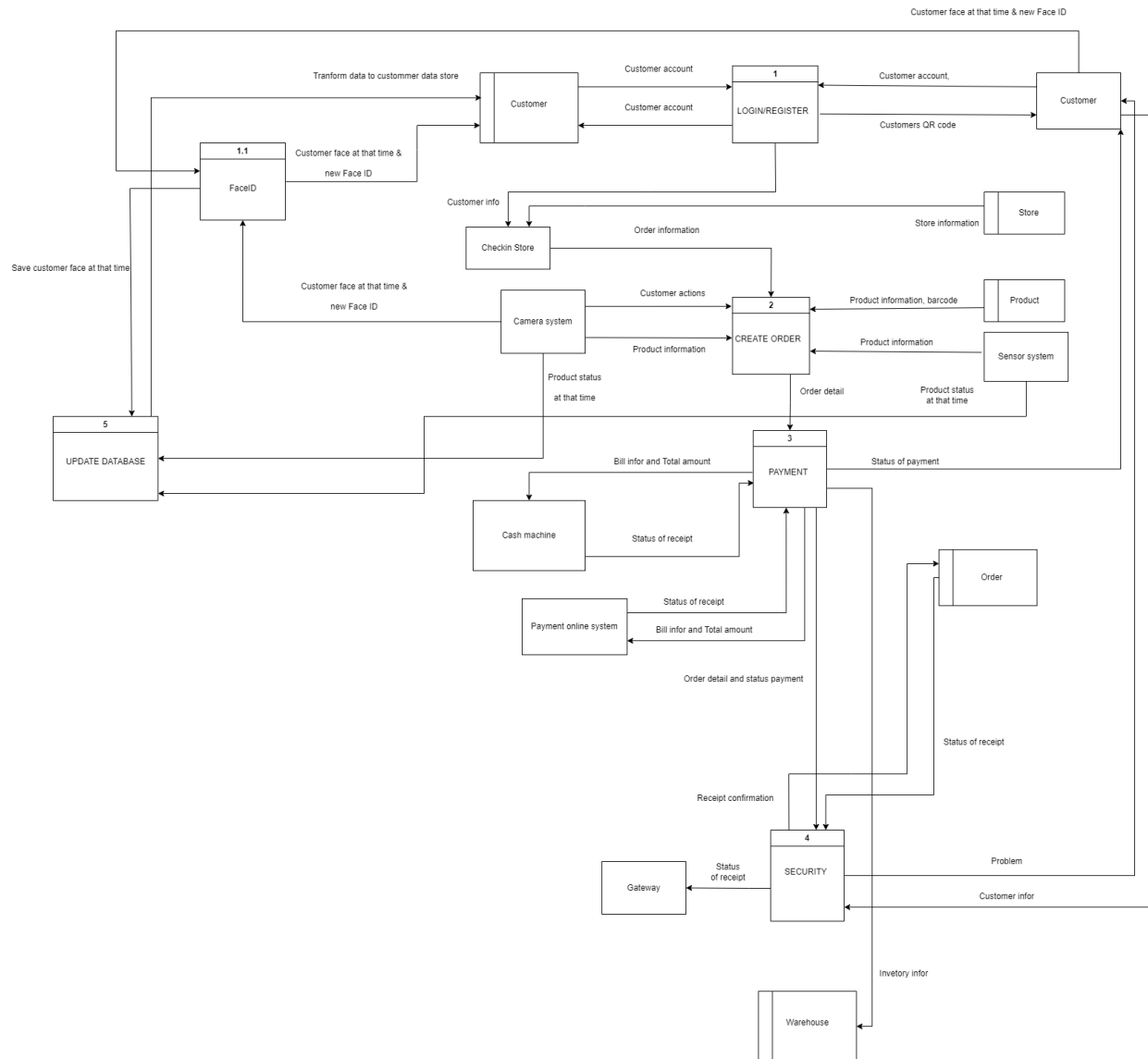
- Process
 - Order and payment
- External entity
 - Camera system
 - Customer
 - Cash machine
 - Payment online system
 - Gateway
 - Sensor system
- Data store
 - Product
 - Customer

2.1.2. Description

When a customer enters the store, the face recognition will receive the customer’s face. Customer’s actions such as hold, lift the product will be saved. Customers also provide payment methods to the payment process and account information to the system. After

login, the system will send QR for each customer. The system also sends the status of receipt after the payment process to the customer. Camera system will send customer faces, customer actions and product information to the system after recognition. Sensor system sends product information such as weight and quantity to the system. Gateway receives status of receipt from the system to open the gate or not. Payment online system returns the status of receipt to the system when the customer paid and receives bill information and total amount or products in the order list. Cash machine returns the status of receipt to the system when the customer paid and receives bill information and total amount or products in the order list. Database of customer sends customer information to the system and receives the customer's face at the moment. Database of product sends product information and their QR.

2.2. DFD Level 0



2.2.1. Login/Register

If a customer has an account, the app system will return a QR code for each customer to enter the store. In this case, the function Login receives customer accounts from the database Customer. If a customer does not have an account, they will register. After that, they will receive a QR code. In this case, the function Register receives customer account's information from that customer.

2.2.2. FaceID

When customers enter the store, their faces at that time will be saved in FaceID. From this FaceID function, their faces will be transferred to the Customer database. At the same time,

FaceID will add that information to the function Update Database to save order information in detail every time.

2.2.3. Create Order

Each store has a check in store to save data of customers in that store at that time and use it to save into order information. Check in store will receive store information from the Store database and customer information after the customer has logged in successfully. Camera system will record and save customer actions while they are shopping and product information and send it to the system. When customers hold, grasp or take the product, the camera system will record that information into order. The Product database will send product information and barcodes to order. At the same time, the sensor system will send product information to the order while it was taken by the customer.

2.2.4 Payment

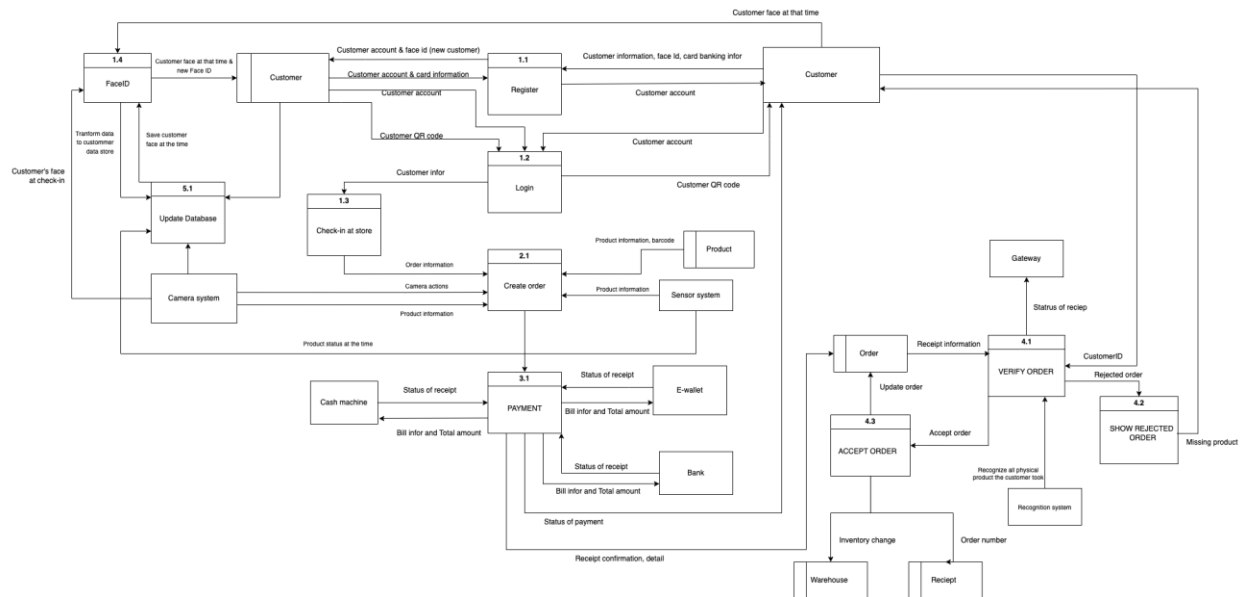
The customer will proceed to the payment phase after picking the products. In this step, the app system will take the information from order details to create bill information. Customers will be able to pick between two payment options at this point: online payment (e-wallet or banking) and cash machine. If the payment is successful or failure the system will notify the user through the app. When the payment process is successful, the app system will save the order details of the customer into database Order.

2.2.5 Security

To get out of the store, the customer must guarantee that the invoice has been paid, and the recognition system confirm that the goods correspond to the retrieved data. The security door will be opened if all processes are flawless.

When finishing, the app system will update the order status in database Order and update inventory change in database Warehouse.

2.3. DFD Level 1



First process, “Register” will receive data from customers (Customer information, Face ID, Card Banking,...) and check with received data from the customer database whether they have already existed or not. If customers register successfully, data from new customers will be sent to the database.

At the process Login, customers will send their information to it. The process will send to customer QR code to check in at the store. Beside that, the process request customer account data to check whether input account data has already exist or not. At the same time, in process “Face ID”, new Face ID from new customers data will be saved.

After check in successfully, the process “Check-in” will transmit order information to process “Create order”. To start creating an invoice, this process needs to receive accurate data from the camera system and sensor system whether the customer has picked or returned the goods on the shelf. And once a conclusion is reached, this process will take data from the product datastore to determine which products to update in the virtual cart. At the same time, the data generated during the day such as damage volume data (from the sensor) or customer images (from the camera system) will be saved in the process of “updating database”.

The order detail is the input of the process Payment. The default method assigned by the system is E-wallet. If the default payment method fails, the system may suggest other payment methods such as Internet Banking and Cash Machine. Whichever method is selected, detailed invoice and total amount order will be transmitted to the payment entities.

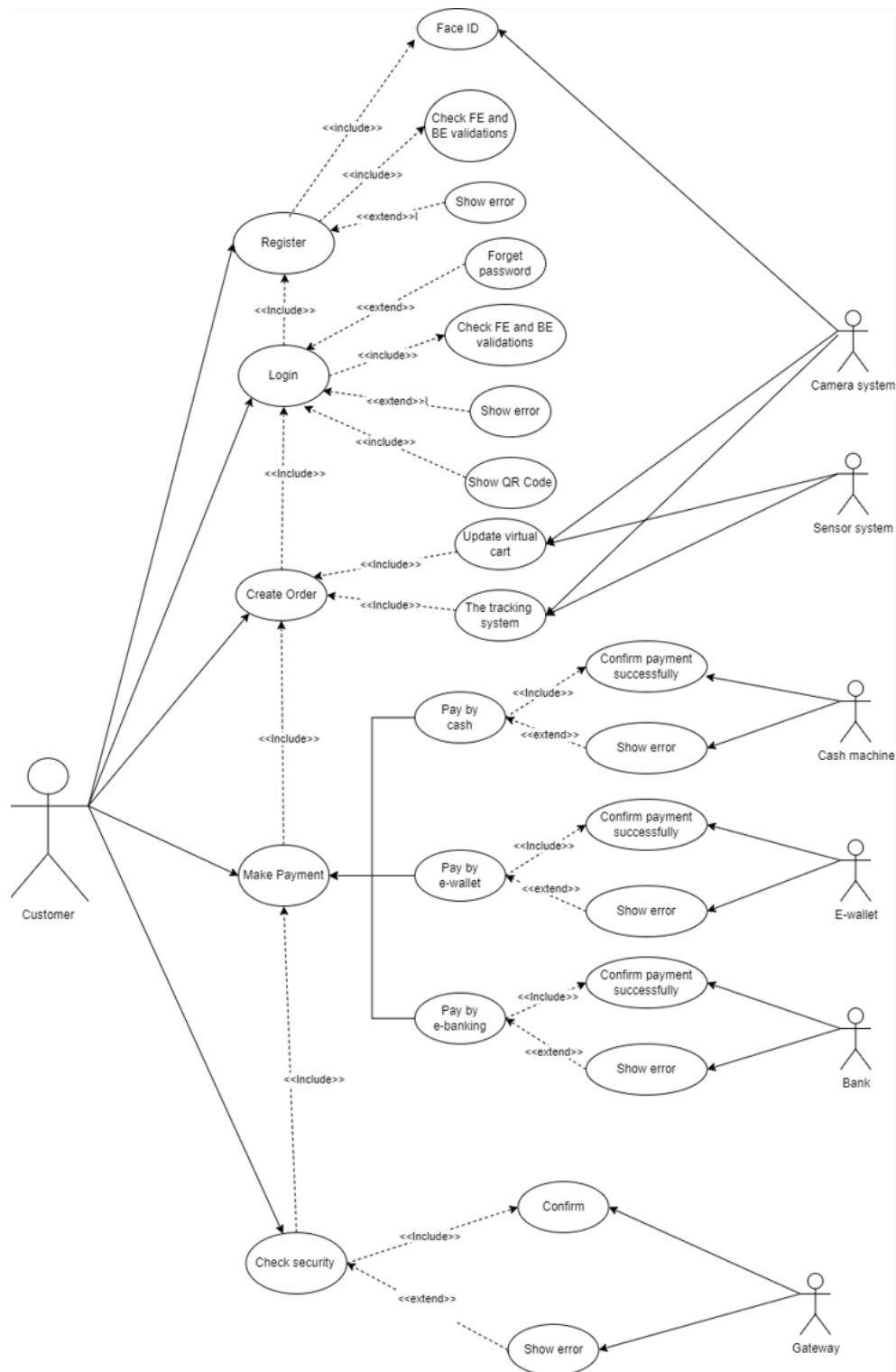
After that, a payment message status will be sent from those entities to the process Payment. Output of this message is order details which have successfully paid and would be sent to the Order database.

When customers intend to leave the store, they have to be security checked at the “Payment & Security” area. This process will receive the receipt details data (the order has already been paid) from Order datastore. At the same time, Recognition System will recognize all product that the customers took in real. This process will compare these data product and decide to whether order is accept or not. After verified order, it will send result (accept or reject order) to Accept Order and Show Reject Order process:

- If accept order, this process sends the accepted order to the process Accept order. This process will:
 - Update order status from Not checked security to Done.
 - Save order number into the Receipt database.
 - Give the inventory change to the Warehouse database to update related quantity products.
- If Reject order, send the rejected order to the process Rejected order. This process will show the missing product to the customer.

3. Use Case & Sequence

3.1. Use Case



This app has 5 main use cases (Register, Log in, Create order, Make payment and Check security) and 7 actor (Customer, Camera system, Sensor system, Cash machine, E-wallet, Bank, Gateway)

When a customer registers a new account, *Register* requires *Face ID* data, username and password. *Register* always calls *Check FE* and *BE* validations. When there is an error in FE or BE, the *Show error* will be called by *Register* when username available

Login will be used when the *Register* has been completed or the customer already has an account. Like *Register*, *Login* also always calls *check FE* and *BE* validations and will provide the user with a QR code for their account. When there is an error in FE or BE, the *Show error* will be called by *Log in*. But when the customer forgot the password, the *Forgot password* may be called by the *Login*.

The *Create order* is only used when the customer logs in successfully. This process will include updating the virtual cart and is tracked by the system.

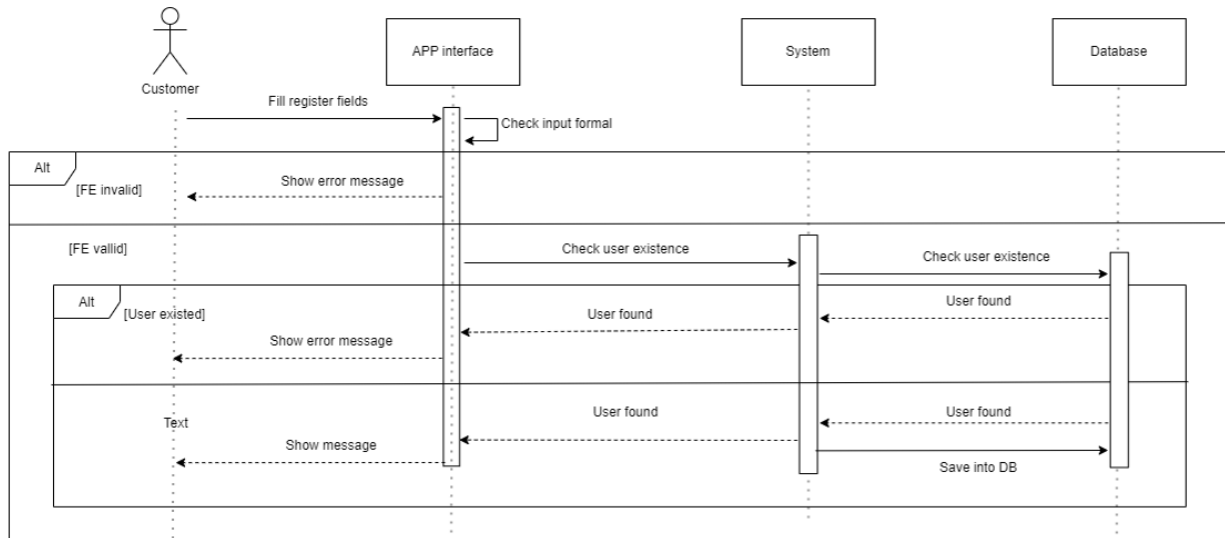
When the customer selects pay, just the *Make payment* button is utilized. *E-wallet* are utilized initially, and when they run out of funds, customer can pick between cash machine and Internet banking. *E-wallet*, *Internet banking* and *Cash machine* call successful payment confirmation. And *Show Error* will be called if a payment error occurs.

The *Check security* always calls the *Make payment* when complete payment or the customer doesn't make a purchase and needs to go outside. When the customer leaves, the gateway will check the reality order. So the *Confirm* is always called by the *Check security*. If it finds an error, the *Show error* will be called.

3.2. Sequence

3.2.1. Register

Register



In the register process, the customer fills the register field in the APP interface. Then, it will check the input format.

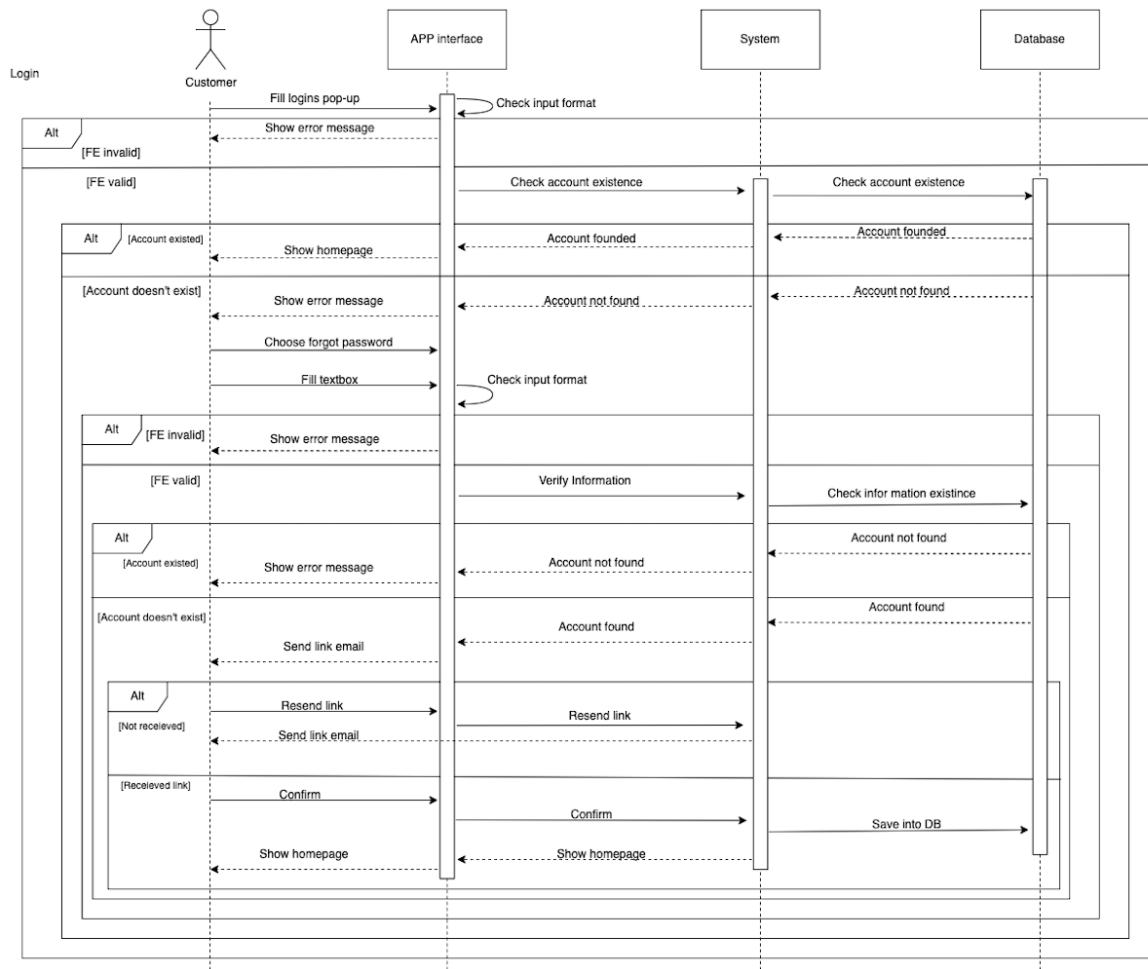
- If FE invalid, the APP interface will show an error message.
- If not, continue to step checking username existence at system and step checking username existence at user database. If the user is found, it sends this info to the system, and from the system to the APP interface to show an error message. Else, it sends info to System, and from the System to APP interface to show the message. Besides, save this account into the user database.

3.2.3. Login

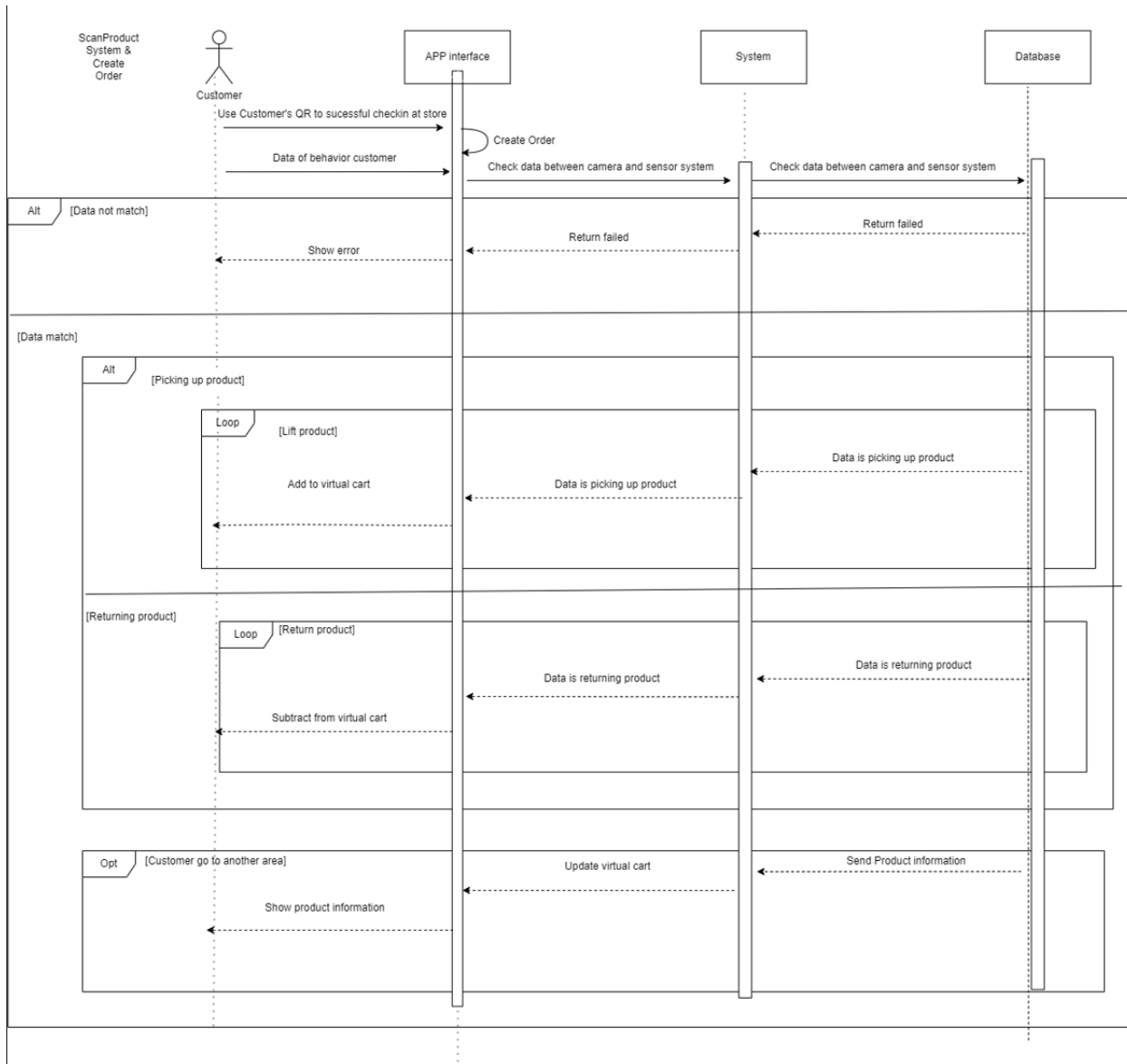
In the login process, the customer fills all fields on pop up page in the APP interface. Then, system will check the input format.

- If FE invalid, the APP interface will show an error message.
 - If not, continue to step Checking username existence at System and step Checking username existence at User Database. If the user is found, it sends this information to System, and from the System to APP interface to show the homepage. Else, it sends info to System, and from the System to APP interface to show the error message. Next, the customer chooses the Forgot password and fills the all required textbox. All steps for checking FE and BE are the same as register. Particularly in the case of the user found, the customer must confirm the link sent to the mail. If not received link, customer choose resend link and this action will send to system and the system will resend link email to

customer. On the other hand, they confirm the link email and it is sent to the system. System will save new passwords under the database. At the same time, call show homepage to the APP interface to show homepage for customers.



3.2.4. Scan Product System & Create Order



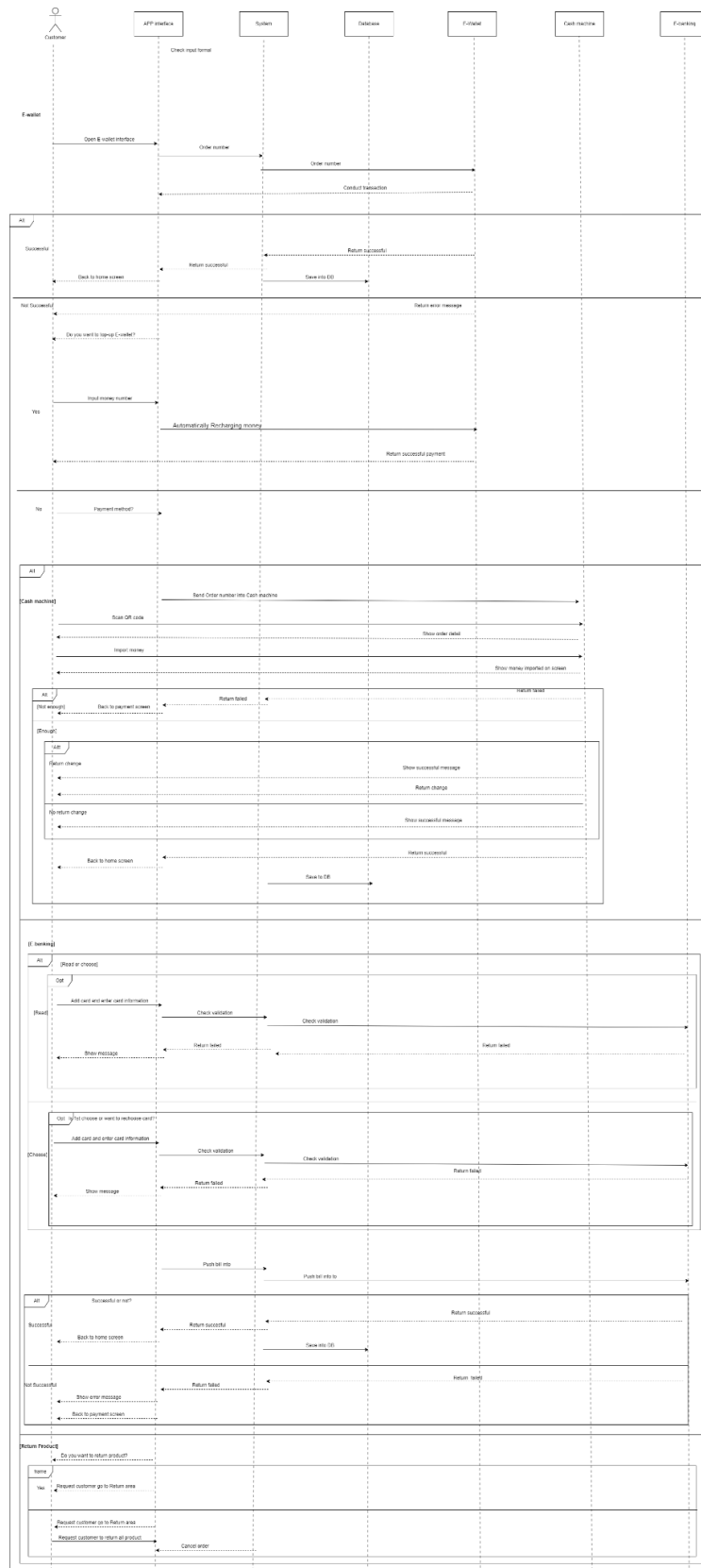
The system will immediately create an order for the customer and launch the tracking system after they successfully check in.

If data in camera and sensor system are not matched, database returns failed status to system and system gives failed status to APP interface. The customer see an error notice on the APP interface.

If data in camera and sensor system are matched, consider whether the customer take the product or returns it to the shelf, if it is take product, the database will return the product data to the system, the system will transmit the data back to the App interface, and the App interface will update the customer's shopping cart. This establishes a loop till the consumer performs another action. And if the product is returned to the shelf, the operating actions

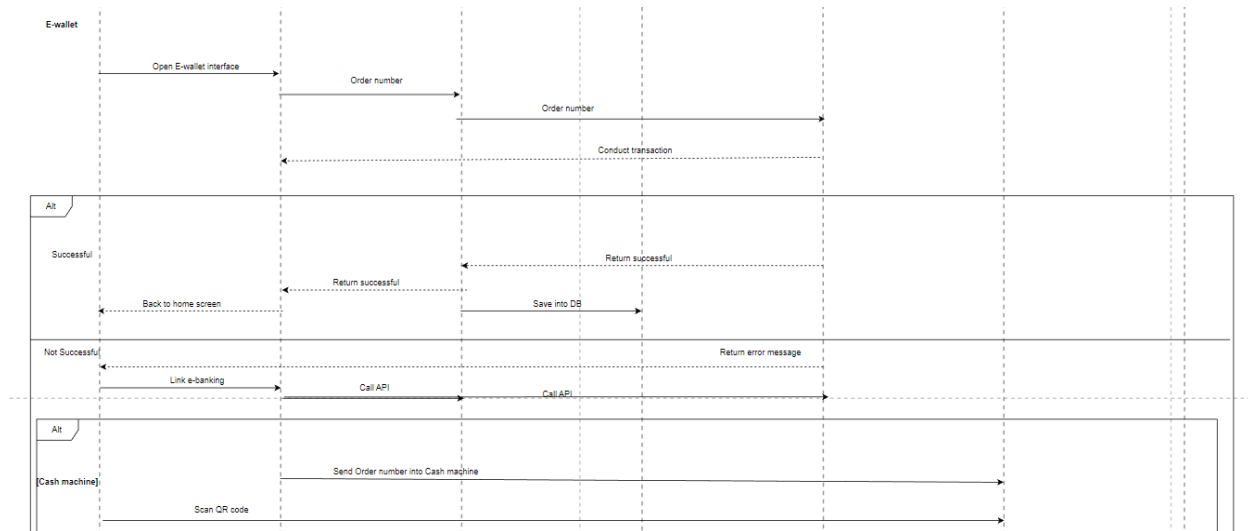
are the same as if the product was taken, both lead to the product being updated in the virtual cart. The database will transmit the customer's order data to the system of that area (Return area, Security) and the system will provide the results to the customer if there is an error in the Return area or a successful payment message in the Security area.

3.2.5. Payment



After the customer walks in the payment area, the system will automatically prioritize the payment method by e-wallet for the customer.

3.2.5.1. E-Wallet



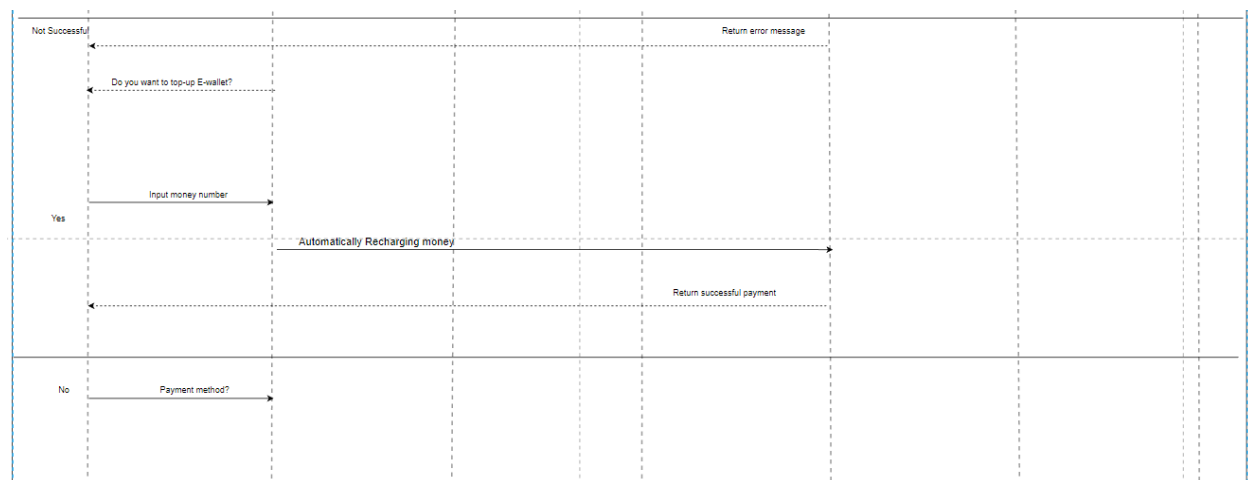
When the system receives the payment signal from the customer, the system will automatically send the order number to the E-wallet, and activate the E-wallet payment method to process the transaction. At this time, the system will have 2 cases that describe the successful or failed payment process by E-Wallet.

- Case 1: Successful

The system will notify the customer that the payment has been successful and save the payment successfully in the database.

- Case 2: Failed

The system will notify the customer that the payment has failed and ask if the customer wants to pay by top-up method?



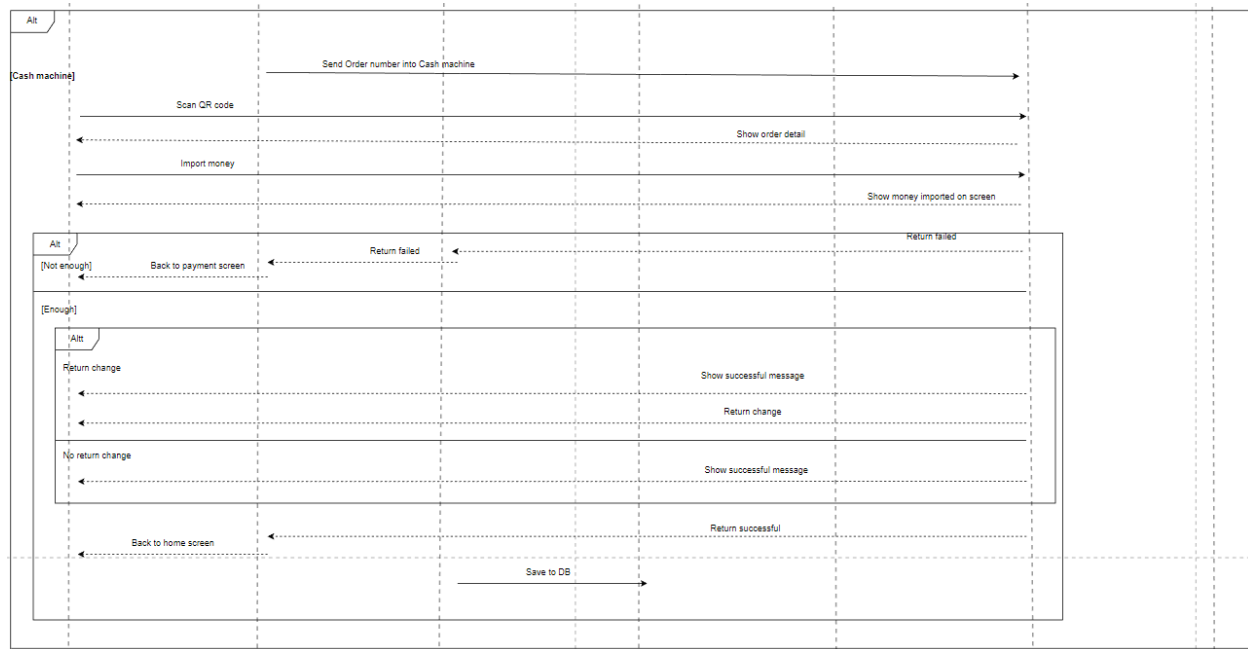
+ Case 1: Yes

The system will automatically link with the 3rd party and support to top up the customer's e-wallet for payment. Then the system will notify the successful payment to the customer.

+ Case 2: Không

The system will ask if the customer wants to use another method? The system will offer 3 options for customers: Pay by Cash machine, Pay by e-banking, Return area.

● Case 1: Pay by Cash machine



The system will send Order information to the Cash machine system. Customers will use the QR Code generated on the app to link with the Cash machine. At this time, Cash machine will display order details for customers to Import money. Now there will appear 2 possible cases: The customer imported enough money and the customer imported not enough money.

○ Case 1: Not enough money

Cash machine system will call FE and notify Payment failed.

The FE will then exit the processing screen and return to the Payment screen.

○ Case 2: Enough money

In this case, there will be 2 separate cases, that is, the deposit amount is equal to the payable amount and the deposit amount is more than the payable amount. In the second case, the cash machine will return the change.

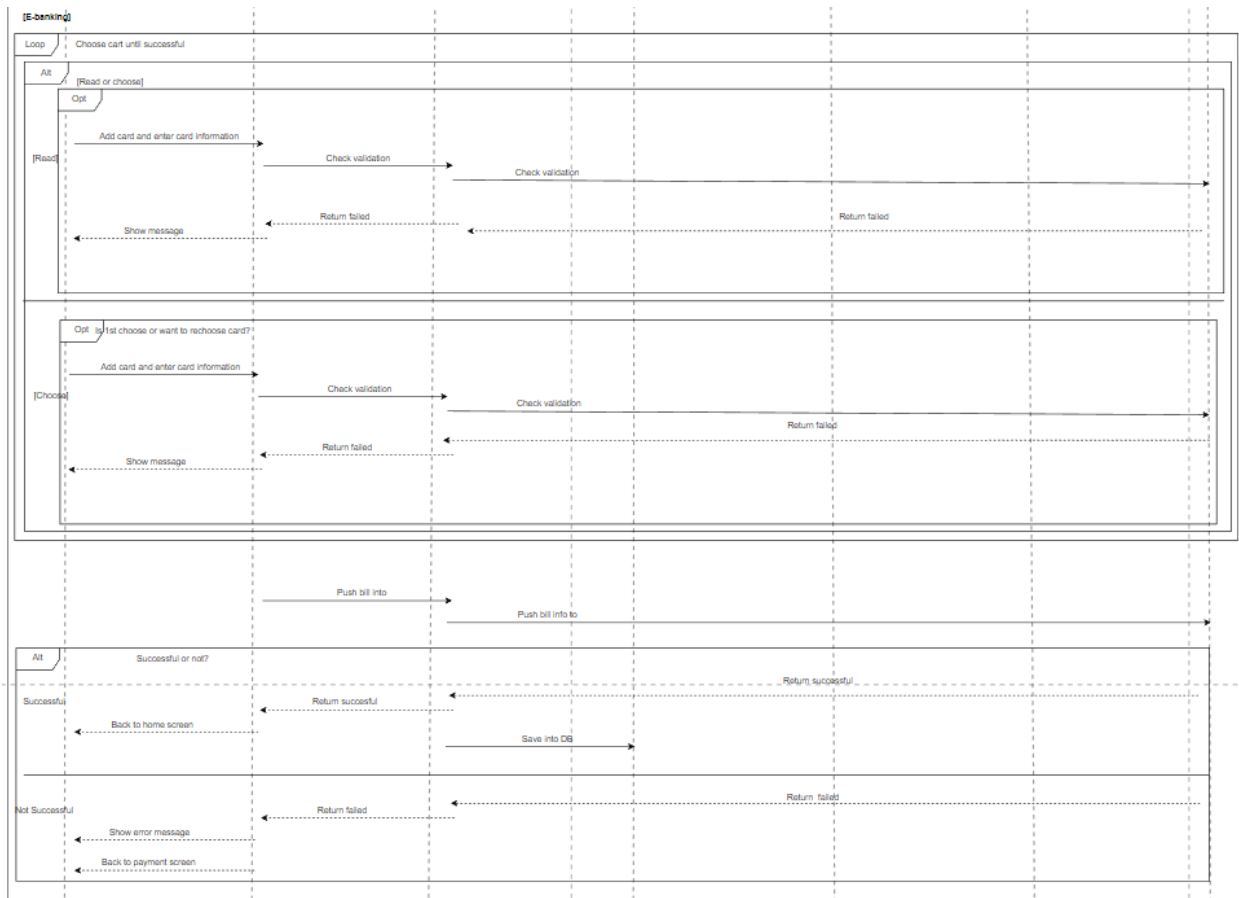
Case 1: Return change

Cash machine returns the change to the customer and informs that the payment has been successful. Then save to the database and back to the home screen.

Case 2: Return change

The system informs that the payment is successful, saves to the database and back to the home screen.

- Case 2: Pay by e-banking



First of all, to pay by E-banking, customers must choose the card of that bank. So there will be 2 cases in this situation and it will be included in the loop in case the customer wants to continue to pay using the E-Banking method and wants to retry if there is a system error during the selection process. choose card.

In a loop, there will be 2 choices for the customer: Read card information and Choose card. The loop will end until the tag selection is successful.

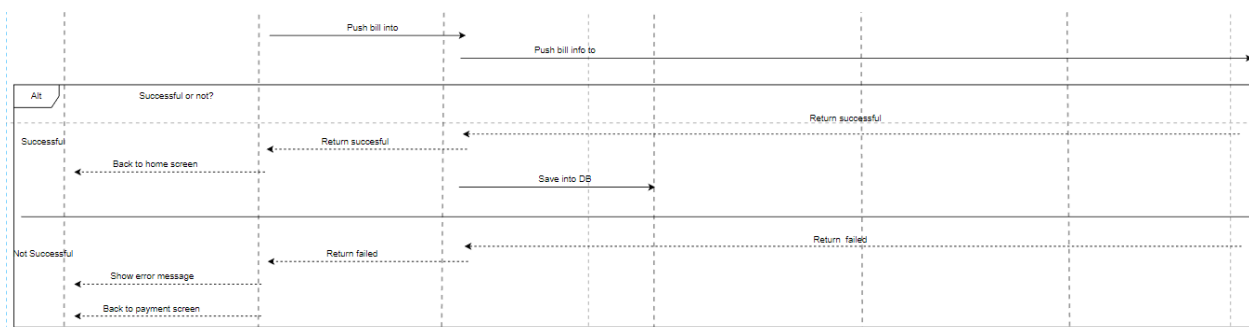
o Case 1: Read card

Customers enter card information and the App system will push this information to the banking system. The banking system will check the card authentication and send feedback

to the App system. In case of failure, the application system will call the Sales Department to notify the customer. FE displays an error message on the screen.

○ Case 2: Choose card

In this case, there will be an optional condition of “Is 1st choose or want to rechoose card?” Customers choose a bank and send information to confirm the selected card, the App system will push the confirmation information to the banking system. The banking system will check the card authentication and send feedback to the App system. In case of failure, the application system will call the Sales Department to notify the customer. FE displays an error message on the screen. When the loop ends (successfully), the system will push the bill into the banking system to start the payment.



After finishing the process, the e-banking system shows whether the payment was successful or not. There will be 2 cases in this situation.

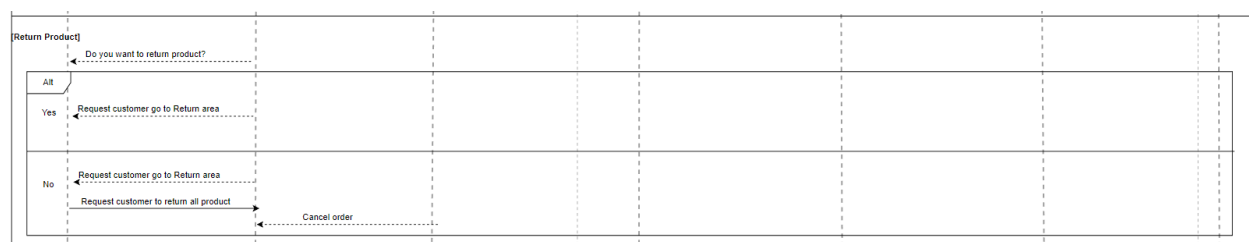
○ Case 1: Success

The App interface informs the customer that the payment has been successful and the payment has been successfully saved to the database and back to the home screen.

○ Case 2: Failed

App interface informs customers of unsuccessful payment and back to the payment screen.

Case 3: Return product



For the return product method. There will be 2 cases in this situation.

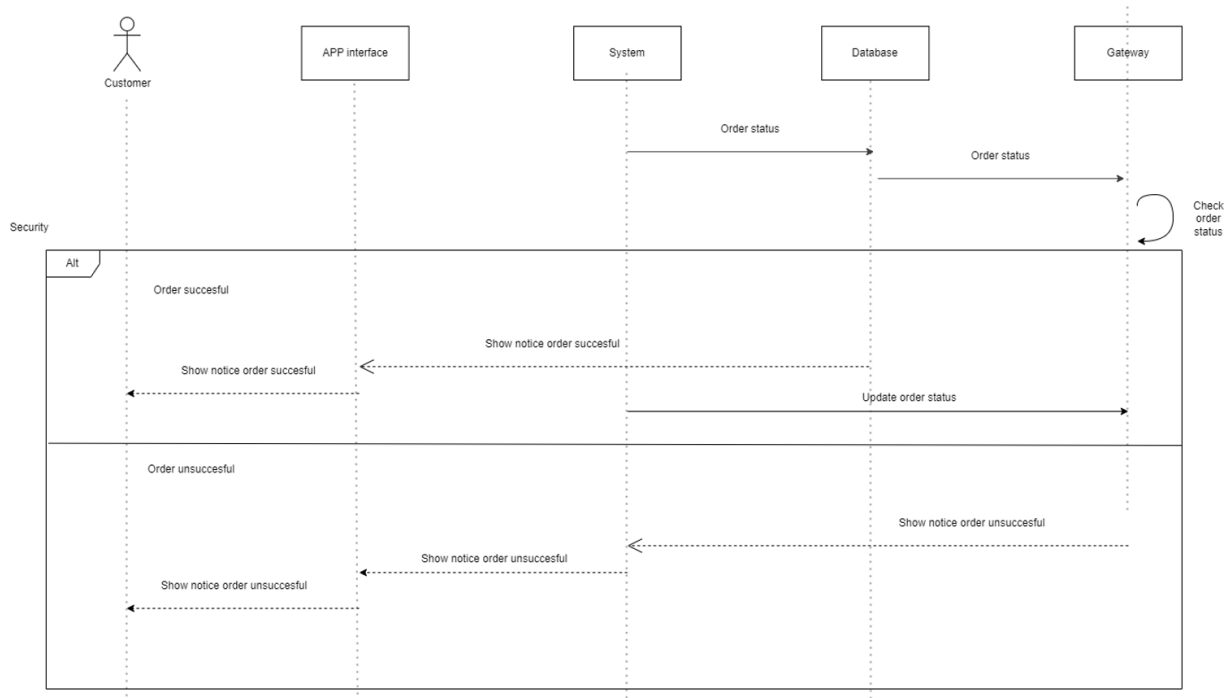
○ Case 1: Customer returns product

The App interface notifies the customer to the Return area for processing.

○ Case 2: Customer refuses to return product

The App interface will send a request to the customer to return all selected products and cancel the order.

3.2.6. Security



In the security process, the customer enters the exit way. In that line, their order will be checked automatically. The system sends order status to the database and it will be updated to the gateway.

- If the order was successful, the database will send a notification to the customer. The system will send the information to the gateway so that it opens the gate for customers.
- If the order was unsuccessful, the gateway will not open. The notification will be sent to the customer.

4. Mockup

We have illustrated some images of the app below:



Welcome Back!

Sign In

Email

Password



[Forget Password?](#)



Or continue with





Register

Sign Up

Name

Email

Password



Confirm Password



Or continue with



[Terms & Conditions](#)

QR code



Account Name

DaVuTru

Account ID

123456



Download QR code



Shopping cart



Choux à la crème
Cream puff - 11oz

2
\$3

\$6



Cup cake
Strawberry -50oz

3
\$4

\$12



Water
Mineral water-80oz

10
\$2

\$20

TOTAL

\$38

Successful payment!



Choux à la crème
Cream puff- 11oz

2

\$3

\$6



Cup cake
Strawberry 60oz

3

\$4

\$12



Water
Mineral water-80oz

10

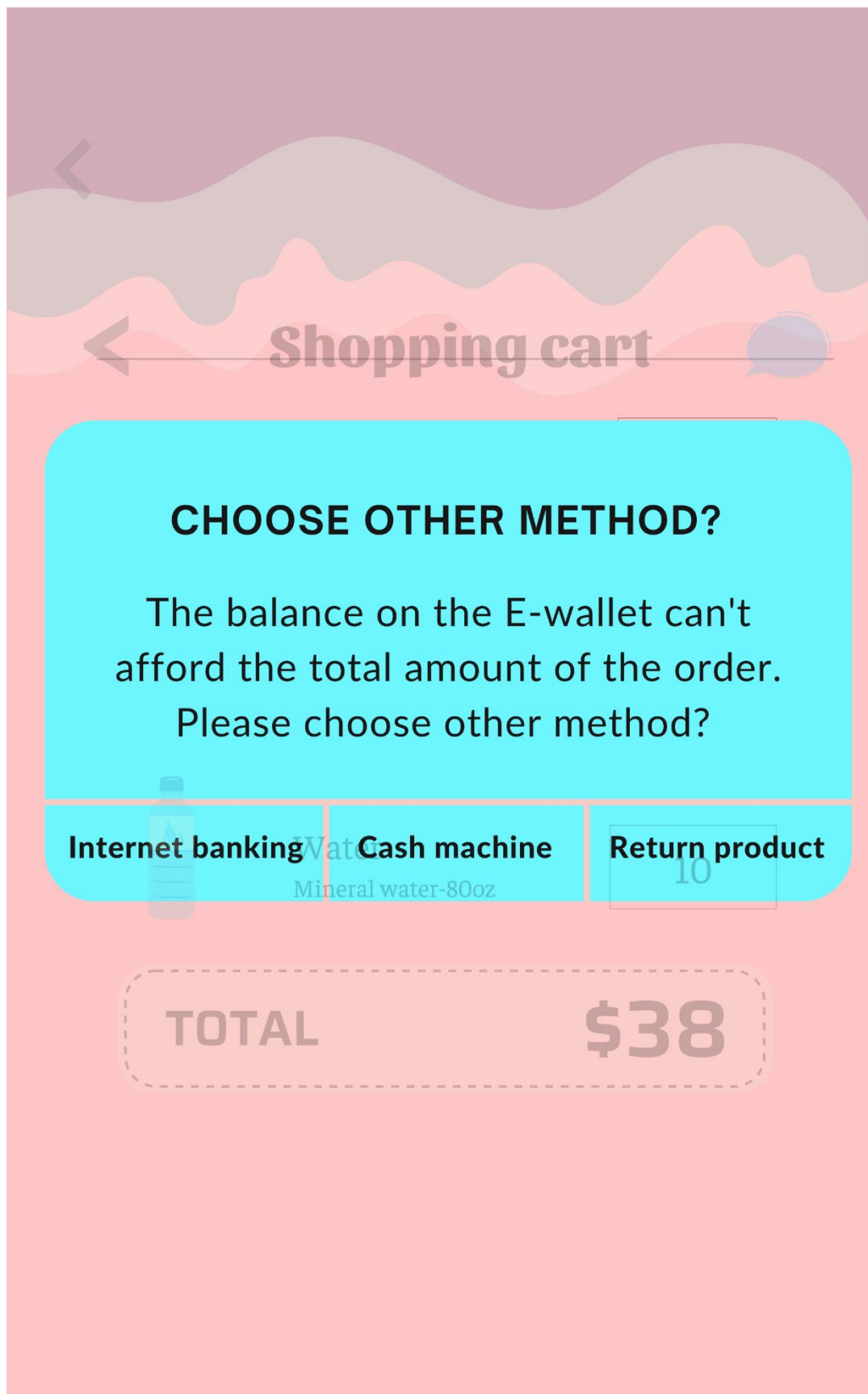
\$2

\$20

TOTAL

\$38

The order has been successfully
paid. Thank you for your chosen.
Wish you a lucky day!



Failed!



Sorry, process is failed.
Please try again!

Try Again