Content

1. Introduction

1.1. Background and Business Requirements

Campus Card Service System (CCSS) is a web-based mobile application that allows students, faculty and staff to transfer funds from their Alipay or WeChat or bank accounts to their own campus cards, and use their own campus cards to pay for consumption on campus , In addition, CCSS also provides a consumption record query function, users can query their own campus card consumption records at any time to understand their consumption situation. CCSS focuses on recharge, consumption and record inquiry, its goal is to provide a convenient, fast and safe campus card management platform for students and faculty, reduce the risk and trouble of users carrying cash or other payment tools, and improve users' consumption on campus efficiency and experience.

1.2. Functional Overview and Constraints

CCSS supports the following main functions:

- **Campus Card Recharge**: Users can transfer money to their campus card via Alipay, WeChat or online banking, and the recharge amount will arrive in the campus card in real time and be displayed in the user's CCSS account. Users can freely choose the recharge amount, but it cannot exceed the maximum limit of the campus card
- **Campus card consumption**: Users can use their own campus card to spend in various places on campus, such as canteens, supermarkets, libraries, printing shops, etc. Users only need to scan the payment QR code and enter the consumption amount to complete the transaction. The consumption amount will be deducted from the user's CCSS account and displayed in the user's CCSS account
- **Account Inquiry**: Users can check their campus card balance through CCSS at any time, so as to master their consumption and budget planning; they can also check their campus card transaction records through CCSS, including recharge records and consumption records. Users can filter and sort by date, amount, type, etc., in order to analyze their consumption habits and patterns

CCSS has the following restrictions:

- The value on the Campus Card is non-refundable in our system. Once a user transfers funds to the campus card, they cannot be transferred out or withdrawn
- The campus card can only be used within the school and cannot be used in other schools or institutions
- The campus card has a maximum limit, beyond which no recharge can be made. This limit is set by the school administration and may be adjusted at any time
- According to school regulations, users must abide by relevant consumption rules and codes of ethics, otherwise they may face the risk of penalty or deactivation of campus card

2. Requirements Analysis

This section describes the scope of CCSS, functional and non-functional requirements, and the users and roles involved

2.1. Service Scope

The scope of CCSS includes the following aspects:

- **Users**: students, faculty, etc. on campus, they can use CCSS for recharge, consumption, query and other operations
- **Administrator**: The operator of CCSS, they can use the background management system for public bank account management, transaction data analysis, abnormal problem handling and other operations

- **Third-party payment platform**: such as Alipay, WeChat or online banking, etc., they provide an interface to CCSS to realize the transfer of funds into and out of the public bank account of the campus card, and return the transfer result
- **Database**: Store and manage data entities and attributes involved in CCSS, such as user information, administrator information, recharge records, consumption records, public bank account information, etc.

2.2. Functional Requirements

The functional requirements of CCSS include the following aspects:

- **User Functional Requirements**: Users need to use mobile applications or physical cards for recharge, consumption, query and other operations
  - **recharge function requirements**: users need to use Alipay, WeChat or online banking to recharge their campus cards, and get a notification of the recharge result
  - **Consumer Function Requirements**: Users need to scan the QR code provided by the merchant with the mobile application in the consumption places on campus (such as canteens, supermarkets, libraries, etc.), make payment, and get notification of the consumption result
  - **Query Function Requirement**: Users need to use the mobile application to query their campus card balance and transaction records, and get the display of the query results
- **Administrator Functional Requirements**: Administrators need to use the background management system for public bank account management, transaction data analysis, abnormal problem handling, etc.
  - **Public bank account management function requirements**: administrators need to view and modify the information of public bank accounts used by CCSS, including balance, flow and status, etc.
  - **Requirements for transaction data analysis function**: Administrators need to view and analyze CCSS transaction data, including recharge and consumption frequency, amount, method, location, etc., and generate reports and charts, etc.
  - **Abnormal Problem Handling Functional Requirements**: The administrator needs to deal with user feedback problems, such as recharge or consumption failure, fund loss or theft, etc., and conduct verification, compensation, and deactivation of campus cards, etc.

2.3. Non-functional Requirements

The non-functional requirements of CCSS include the following aspects:

- **Performance Requirements**: CCSS needs to ensure efficient response speed and processing capacity to meet the payment needs of users and merchants, as well as the management needs of administrators
  - **Response Speed Requirement**: CCSS needs to return the payment result as soon as possible after the user or merchant initiates the payment request, generally within 10 seconds
  - **Processing Capacity Requirements**: CCSS needs to be able to process payment requests from multiple users or merchants, and management requests from multiple administrators at the same time, generally no less than 1000 times per second
- **Security Requirements**: CCSS needs to ensure the financial security and information security of users and merchants, as well as the operational security of administrators
  - **Fund Security Requirements**: CCSS needs to use the interface provided by the third-party payment platform to realize the transfer of funds into and out of the public bank account of the campus card, and return the transfer result to avoid loss or theft of funds
  - **Information Security Requirements**: CCSS needs to use encryption, authentication, authorization and other technologies to protect the personal information and transaction information of users and

merchants, as well as the login information and operation logs of administrators, to avoid information leakage or tampering

- **Operational Security Requirements**: CCSS needs to use rights management, logging and other technologies to limit the scope and content of administrators' operations, and record the administrator's operation history to avoid operational errors or malicious operations

- **Usability requirements**: CCSS needs to ensure that users and merchants can use mobile applications for payment operations anytime and anywhere, and administrators can use the background management system for management operations anytime and anywhere

  - **Network Availability Requirements**: CCSS needs to use a stable network connection to ensure smooth communication between the mobile application and the background management system and the server to avoid network failure or interruption

  - **System Availability Requirements**: CCSS needs to use reliable servers and databases to ensure the normal operation of mobile applications and background management systems and avoid system failures or crashes

  - **Interface Usability Requirements**: CCSS needs to use a simple and clear interface design to ensure that users and merchants can easily use mobile applications for payment operations, and administrators can easily use the background management system for management operations

3. Business Division

According to the above demand analysis, we divide the business into the following three parts: user demand satisfaction, system platform design and system management

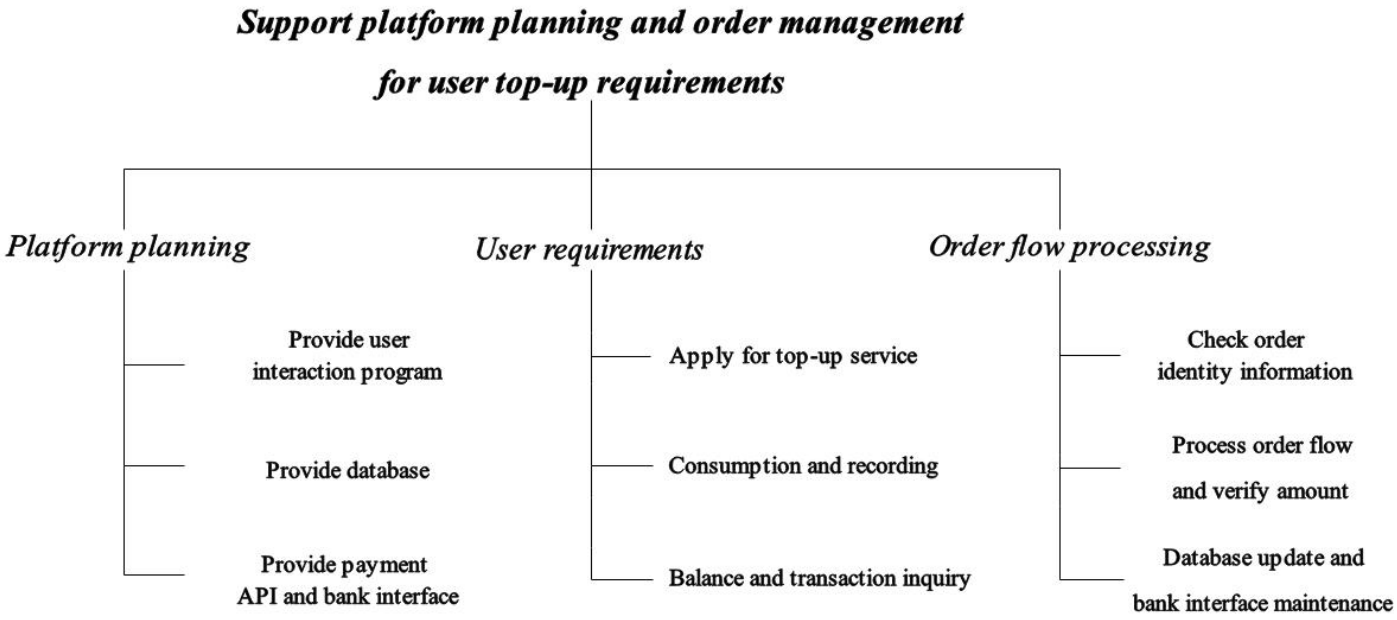


Figure 1 Function refinement tree

3.1. User Requirements

The user's functional requirements are divided under this part of the business. This part describes how users use the campus card service system to achieve their goals, including recharge, consumption, and query

- **Recharge Requirements**: Users need to select the recharge function through the mobile application, enter the recharge amount, choose Alipay, WeChat or online banking and other recharge methods, scan the QR code or enter the account password to complete the recharge operation and get the recharge result notice and record
- **Consumption Demand**: Users need to use mobile applications or campus cards in campus consumption places, such as canteens, supermarkets, libraries, etc., select the consumption function, enter the consumption amount, scan the QR code provided by the merchant, Complete the payment operation, and get the notification and record of the consumption result
- **Query requirements**: Users need to use the mobile application to select the query function, select the query type (recharge history or consumption history), enter query conditions (such as time range, amount range, method, location, etc.), and complete the query operation , and get the display and export of query results

3.2. System Management

System management refers to the administrator's management of the campus card service system, including the following aspects:

- **View and modify public bank account information**: The administrator needs to select the public bank account management function through the background management system to view and modify the information of the public bank account used by the campus card service system, including balance, flow and status, etc. , and record the administrator's operation log
- **View and analyze transaction data**: The administrator needs to select the transaction data analysis function through the background management system, and enter the analysis type (such as recharge analysis or consumption analysis, etc.) and analysis conditions (such as time range, amount range, method, location, etc.), view and analyze the transaction data of the campus card service system, including the frequency, amount, method, location, etc. of recharging and consumption, and generate reports and charts, etc., and provide export functions
- **Handling of abnormal problems**: The administrator needs to select the abnormal problem handling function through the background management system, view the list of problems reported by users or merchants, select a problem, view the detailed information of the problem, contact the user or business, and verify the problem Authenticity and seriousness, and according to the situation, compensation or refusal will be processed, and a notification of the processing result will be sent to the user or merchant, and the processing record of the administrator will be saved

3.3. System Platform

The system platform refers to the infrastructure and technical components that support the operation of the campus card service system, including the following aspects:

- **Provide client-side interactive interface**: The system platform needs to provide a mobile application, which allows users to install and use it on their mobile phones to realize the functions of recharging, consumption and query of campus cards. Mobile applications need to follow the principles of user experience design, provide clear and consistent interface elements and operation processes, as well as fast and stable data transmission, processing and display, as well as effective and reliable exception handling, error prompts and data encryption mechanisms
- **Server and database processing**: The system platform needs to provide a back-end server, which is responsible for processing requests from users and merchants, as well as interacting with the database. Back-end servers need to use appropriate hardware devices and software platforms to achieve high-speed and stable data receiving, sending, storage, and computing, and use appropriate architectural patterns and design principles to achieve clear and reasonable functional division, encapsulation, abstraction, and complexity. Use, as well as simple and convenient function addition, modification, deletion and other operations. The database needs to provide a relational database management system, which is responsible for storing and managing user, campus card, payment, merchant and other data
- **Communicate with external trading platforms via API**: The system platform needs to provide a message queue to be responsible for communicating with third-party payment platforms such as Alipay, WeChat or online banking. Message queues need to use appropriate technical protocols and standard formats to achieve accurate and complete data transmission, reception, conversion and verification, as well as effective and

timely data retransmission, confirmation, rollback and other mechanisms. Message queues also need to use appropriate technical architecture and algorithms to achieve flexible and optimized data queuing, distribution, caching and consumption, as well as powerful and stable data synchronization, asynchronous, parallel and serial processing
capabilities

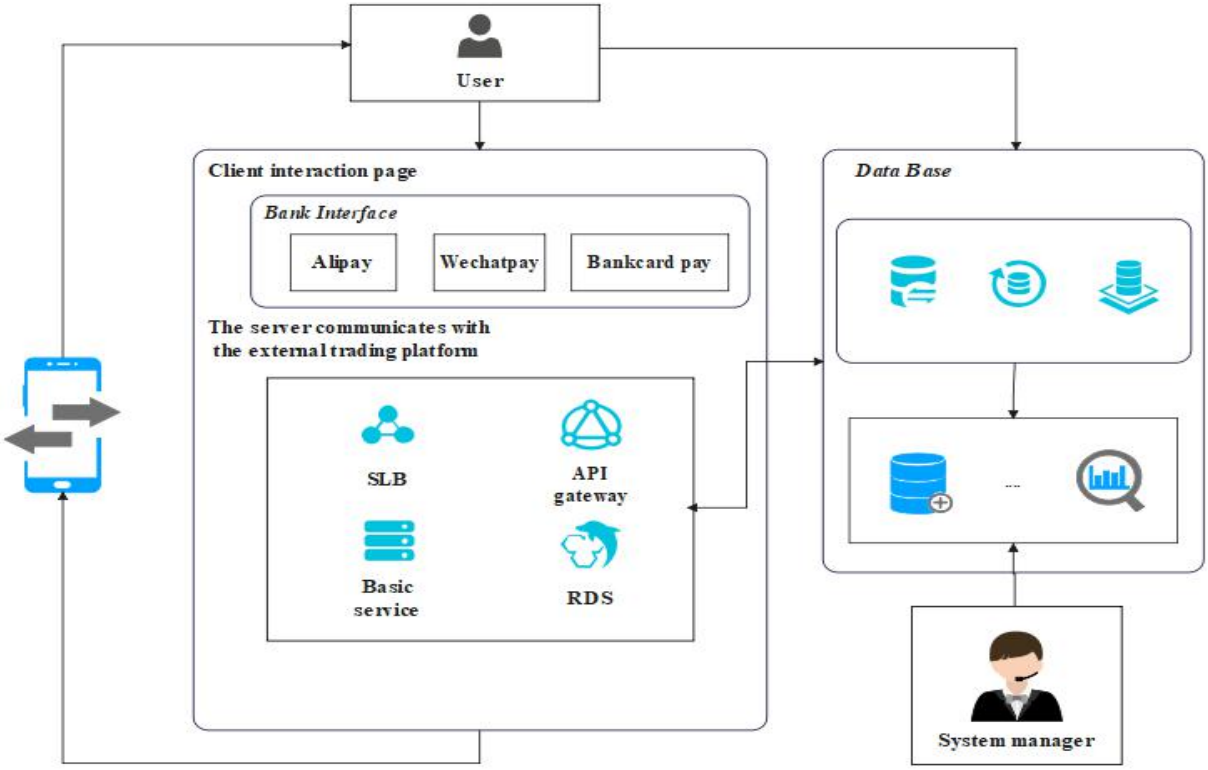


Figure 2 Integration of business units

4. Function and Context

4.1. Mission Statement

System Responsibilities:

- User
  - Campus card top-up
  - Campus card payment
  - Account Inquiry
- Administrator
  - View and modify public bank account information
  - View and analyze transaction data
  - Handle exceptions

Exclusions:

- CCSS does not process refunds for campus card balances
- CCSS does not support Alipay, WeChat or bank account payment directly on campus

- CCSS does not manage the point of sale system on campus
- CCSS is not responsible for the issuance and loss reporting of campus cards

Function refinement tree:

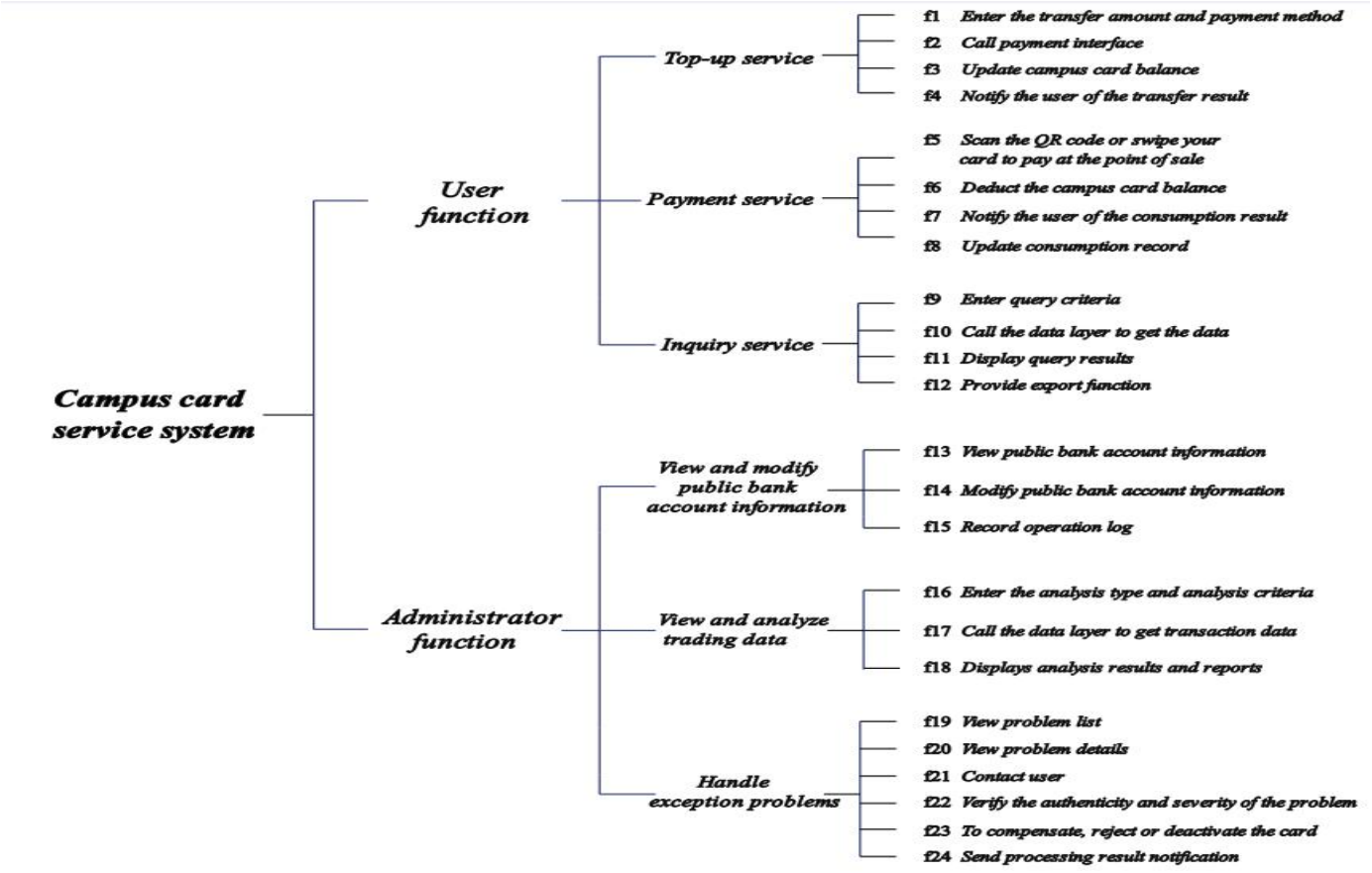


Figure 3 Function refinement tree for user and administrator in details

User functions of CCSS are divided into several main categories: campus card recharge, campus card payment, transfer record query.

The **Administrator functions** of CCSS are divided into several main categories: view and modify public bank account information, view and analyze transaction data, and handle abnormal problems.

When implementing these services, the basic operations involved are shown in the table below:

Operation Number	Name
A1	Enter transfer amount and payment method
A2	Call payment interface
A3	Enter password
A4	Compare payment results with transfer amounts
A5	Update database
A6	Consumption requirement
A7	Generate a zero-hour QRcode
A8	Verify user identity and campus card balance
A9	Deduct the campus card balance
A10	Update consumption record
A11	Enter the information and criteria to be queried

Operation Number	Name
A12	Call the data layer to get the data
A13	Display query results
A14	Provide evport function
A15	View public flow information
A16	Provide bank interface
A17	Vertify administator identity
A18	Process public bank account flow information
A19	Record operation log
A20	Request analysis of transaction data
A21	Call the data layer to get transaction data
A22	Display analysis results and reports
A23	Check results report
A24	Request to see a list of exception issues
A25	Select an exception problem to view details
A26	Contact users or merchants
A27	Verify the authenticity and severity of the problem
A28	To compensate, reject or deactivate the card
A29	Send processing result notification

Table 1 Specific operations for CCSS

4.2. User Service Description

The User Service Description section describes the details of each service provided by CCSS to users, including triggering events, providing services, supporting activities and assumptions, etc. The following is a description of each service:

4.2.1. Functions: Recharge

F1. Enter the transfer amount and payment method

- Trigger event: User requests to transfer funds to campus card
- Provide service: allow users to input transfer amount and choose payment method (Alipay, WeChat or online banking account)
- Supporting activities: A1
- Assumptions: None

F2. Call the payment interface

- Trigger event: user confirms transfer amount and payment method
- Provide service: call the corresponding payment interface and display the payment QR code or jump to the bank page
- Supporting activities: A2 A3

- Assumptions:
  - The payment interface is reliable and secure
  - The user has sufficient funds in the selected payment method

F3. Compare payment result and transfer amount

- Trigger event: the payment interface returns the payment result to the CCSS application
- Provide service: update the user's campus card balance in the database according to the payment result
- Supporting activities: A4
- Assumptions:
  - Campus card balances are stored in a database that can be accessed by the CCSS application
  - The transfer amount is within the limit set by the CCSS app

F4. Update Campus Card Balance

- Trigger event: campus card balance updated in the database
- Provide service: send notifications to user's mobile device about transfer result and updated campus card balance
- Supporting activities: A5
- Assumptions: None

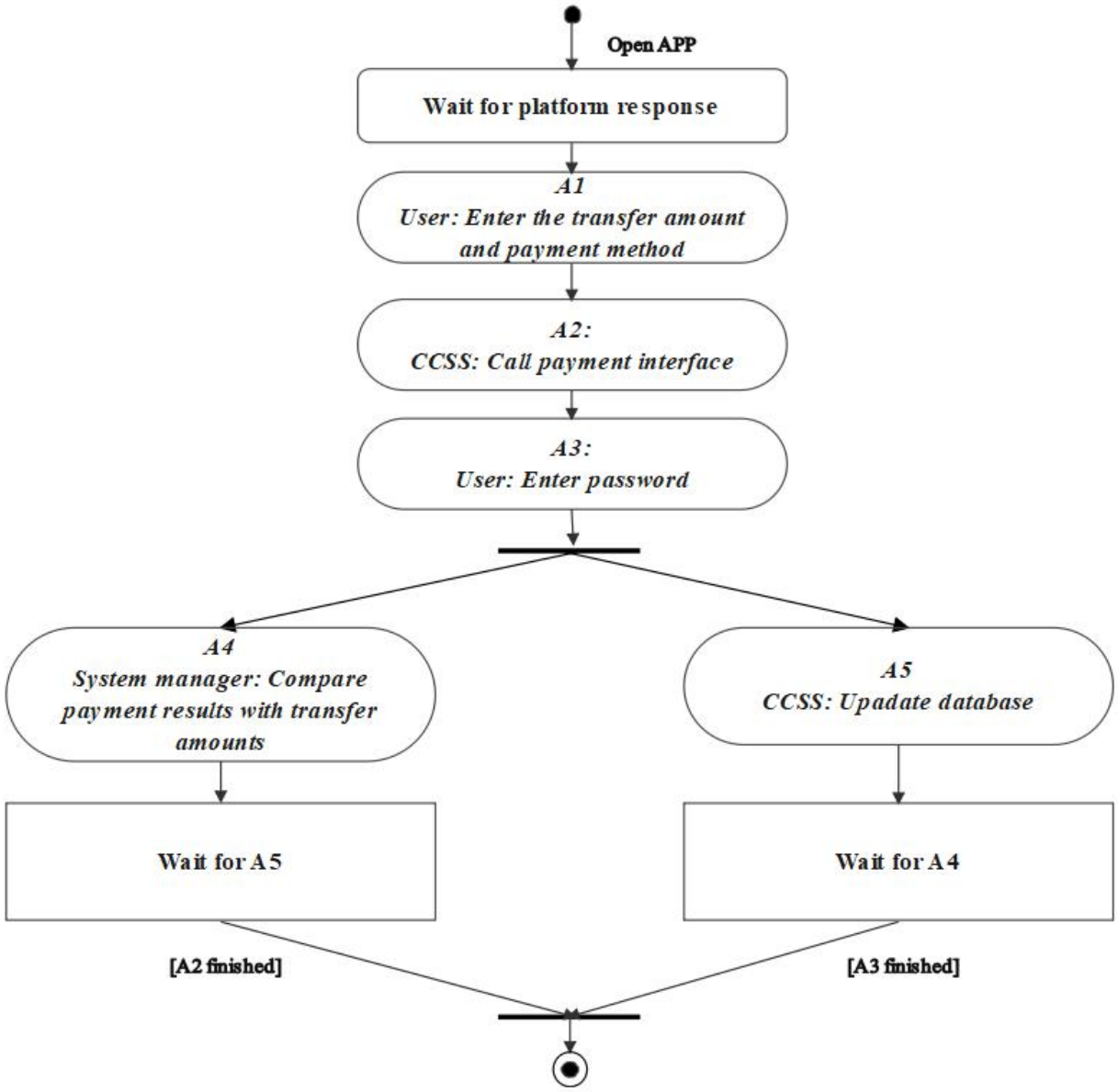


Figure 4 Workflow of the user to apply for top-up

Table 2 Specific functions for users to top-up

4.2.2. Functions: Payment

F5. Scan the QR code to pay at the point of sale	**F6. Verify user identity and campus card balance**
● Trigger event: the user requests to use the campus card for consumption in designated places on campus ● Provide service: Allow users to scan QR codes to pay at point of sale and verify user's identity and campus card balance ● Supporting activities: A6 A7 ● Assumptions: ■ Point of sale system compatible with CCSS	● Trigger event: The point of sale system verifies the user's identity and campus card balance ● Provide service: deduct the consumption amount from the user's campus card balance in the database, and generate a consumption record ● Supporting activities: A3 A8 ● Assumptions: The amount spent is within the limit set by the CCSS app

application ■ User has a valid campus card with sufficient balance	

Table 3 Specific functions for users to consume

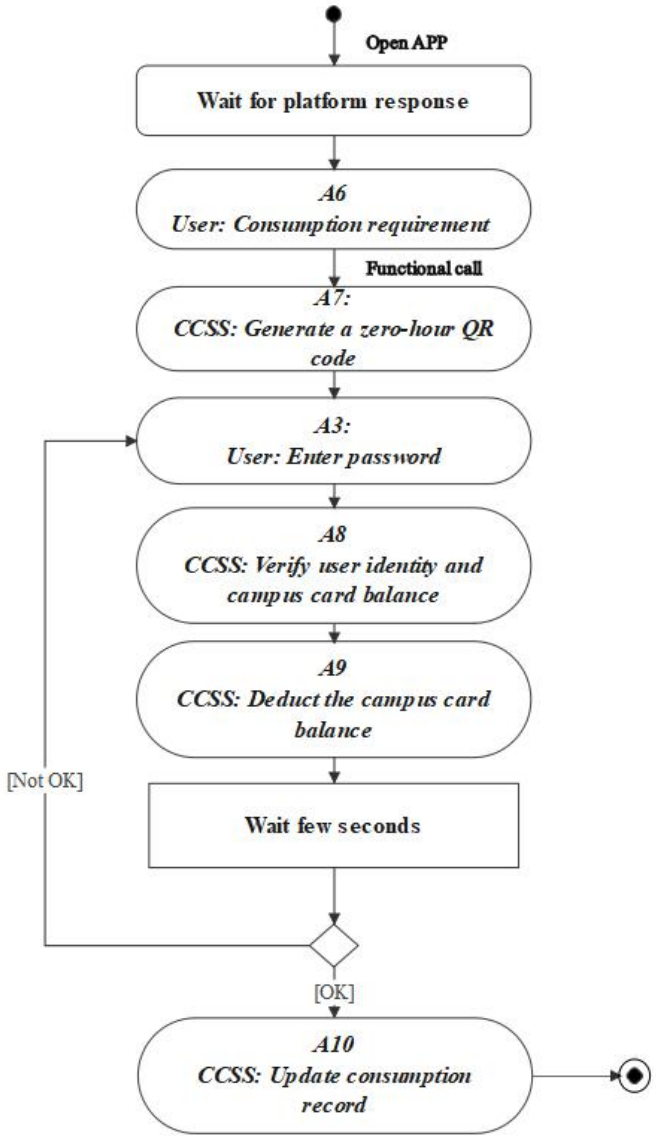
F7. Deduction of campus card balance ● Trigger event: the campus card balance is deducted from the database ● Provision of services: Send notifications to users' mobile devices about consumption results and updated campus card balances ● Supporting activities: A9 ● Assumptions: None	
F8. Update consumption records ● Trigger event: a consumption record is generated in the database ● Provide service: display the consumption record in the user's CCSS application and allow the user to view the history of the consumption record ● Supporting activities: A10 ● Assumptions: None	

Figure 5 Workflow of the users to consumption

Table 3 Specific functions for users to consume

4.2.3. Functions: Inquiry

F9. Enter query criteria

- Trigger event: user requests to query his own transfer records
- Provide services: allow users to input query conditions, such as time range, amount range, method, etc.
- Supporting activities: A3 A11
- Assumptions: None

F10. Call the data layer to get data

- Trigger event: user confirms the query condition
- Provide services: call the data layer to obtain the transfer record data that meets the query conditions, and return the query results
- Supporting activities: A12
- Assumptions:
  - The data layer is reliable and secure
  - Transfer record data is stored in a database that can be accessed by CCSS applications

F11. Display query results

- Trigger event: the data layer returns the query result
- Provide services: display the query results in the user's CCSS application and provide the export function
- Supporting activities: A13
- Assumptions: None

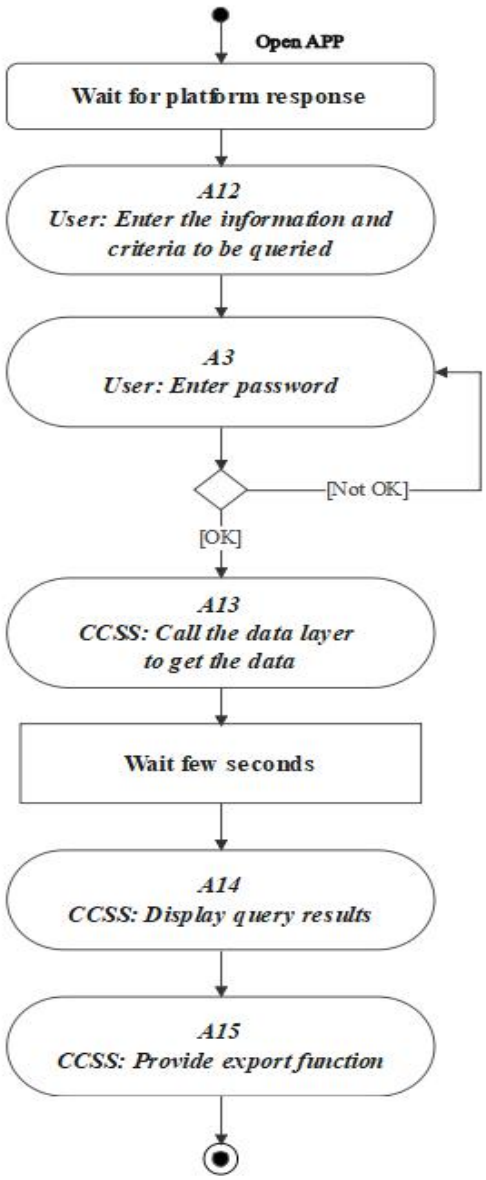
F12. Provide export function ● Trigger event: User requests to export query results ● Provide services: Allow users to choose the export format (such as PDF, Excel, etc.), and export the query results to the location specified by the user or send them to the mailbox specified by the user, etc. ● Supporting activities: A14 ● Assumptions: ■ The export function is reliable and safe ■ The user has sufficient resources such as storage space or network connection to perform the export operation	 **Figure 6** Workflow of the users to enquiry

Table 4 Specific functions for users to enquiry

4.3. Administrator Service Description

The Administrator Service Description section describes the details of each service provided by CCSS to administrators, including triggering events, providing services, supporting activities and assumptions, etc. The following is a description of each service:

4.3.1. Functions: Public Bank Account Management

F13. View public bank account information ● Trigger event: Admin request to view public bank account information ● Provide services: allow administrators to view the basic information of public bank accounts, such as	**F14. Modify Public Bank Account Information** ● Trigger event: Admin request to modify public bank account information ● Provide services: allow administrators to modify the basic information of public bank accounts, such

<table>
<tr>
<td>account number, bank, balance, etc.
● Supporting activities: A15 A16 A17
● Assumptions:
■ The administrator has been authenticated
■ Public bank account information is stored in a database that can be accessed by CCSS applications</td>
<td>as account number, bank, etc.
● Supporting activities: A18
● Assumptions:
■ The administrator has been authenticated
■ The administrator has sufficient rights to modify the operation
■ The modification operation does not affect the user's transfer and consumption functions</td>
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<tr>
<td colspan="2">F15. Record operation log
● Trigger event: Admin completes modification of public bank account information
● Provide services: record operation logs in the database, including operation time, operator, operation content, etc.
● Supporting activities: A19
● Assumptions:
■ Operation logs are stored in a database and can be accessed by CCSS applications</td>
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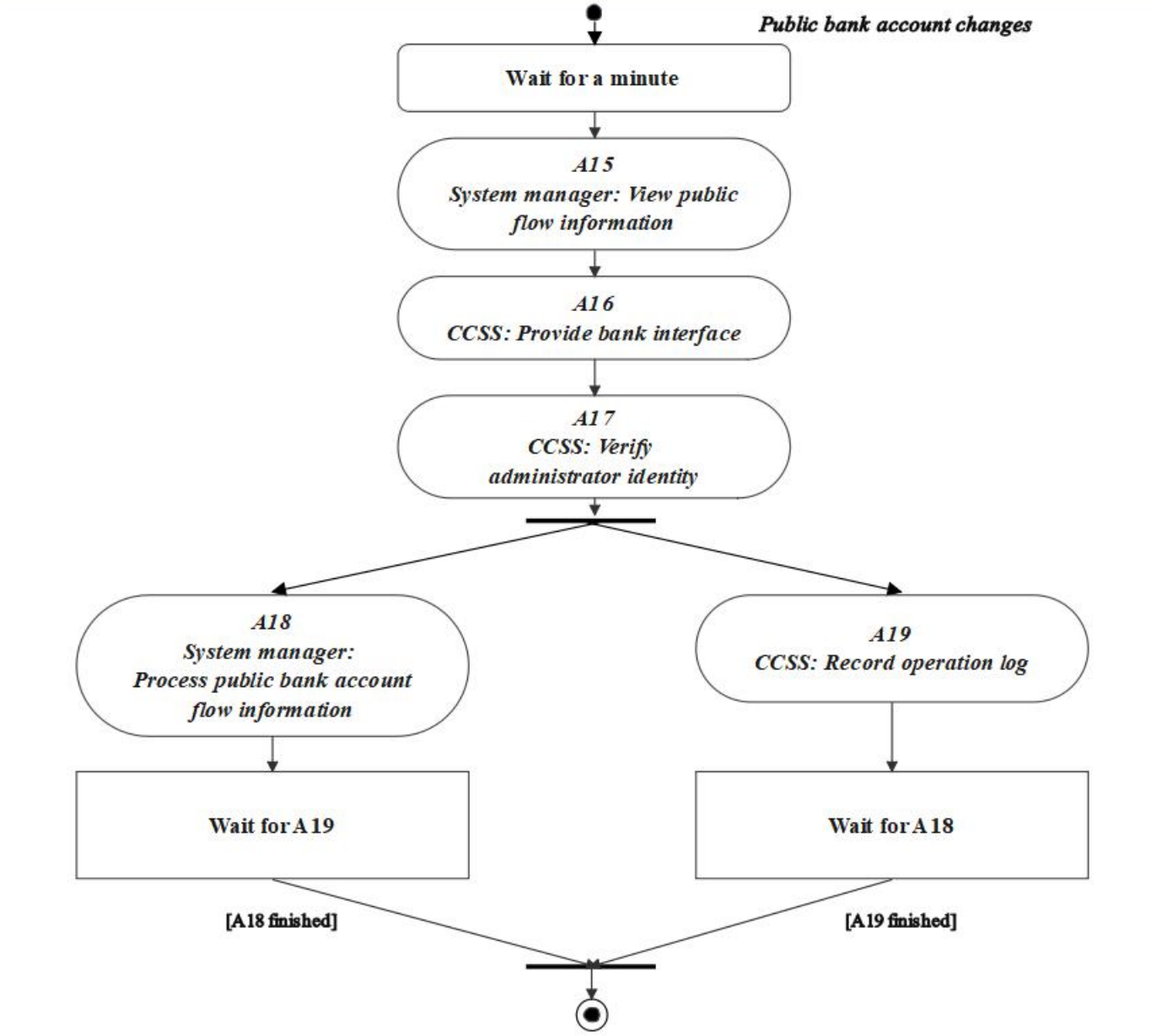


Figure 7 Workflow of administrators to manager the public bank account

Table 5 Specific functions for public bank account

4.3.2. Functions: Transaction Data Analysis

F16. Enter analysis type and analysis conditions

- Trigger event: Admin request to analyze transaction data
- Provide services: allow administrators to input analysis types and analysis conditions, such as time range, amount range, user type, merchant type, etc.
- Supporting activities: A17 A20
- Assumptions:
  - The administrator has been authenticated

F17. Call the data layer to obtain transaction data

- Trigger event: Administrator confirms analysis type and analysis conditions
- Provide services: call the data layer to obtain transaction data that meets the analysis conditions, and perform corresponding analysis and processing on the transaction data, such as statistics, classification, aggregation, etc.
- Supporting events: A21
- Assumptions:
  - The data layer is reliable and secure
  - Transaction data is stored in a database and can be accessed by CCSS applications

F18. Display analysis results and reports

- Trigger event: the data layer returned the analysis result
- Provision of services: display analysis results and reports in the administrator's CCSS application, and provide an export function
- Supporting activities: A22 A23
- Assumptions:
  - Analytical results and reports are accurate and reliable

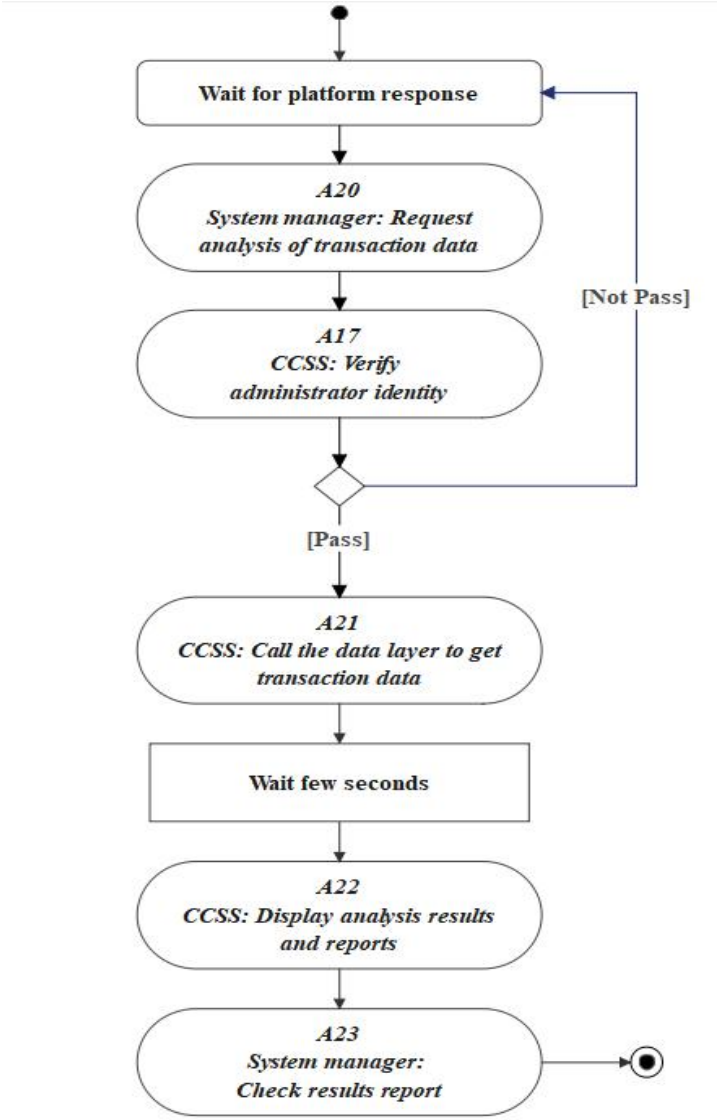


Figure 8 Workflow of administrator to analysis data(supported by CCSS)

Table 6 Specific functions for administrator to analysis data

4.3.3. Functions: Exception Handling

F19. View Question List

- Trigger event: Admin request to view list of exception issues
- Provide service: Allow administrators to view the list of abnormal problems, and sort or filter according to different filtering conditions, such as time, severity, status, etc.
- Supporting activities: A17 A24
- Assumptions:
  - The administrator has been authenticated
  - The list of exception issues is stored in a database and can be accessed by CCSS applications

F20. View Issue Details

- Trigger event: The administrator has selected an abnormal problem to view the details
- Provide service: Allow administrators to view detailed information of abnormal problems, such as problem description, problem source, problem impact, etc., and provide the function of contacting users or merchants
- Supporting activities: A17 A25
- Assumptions:
  - The administrator has been authenticated
  - Details of exception issues are stored in a database and can be accessed by CCSS applications

F21. Contact user or merchant

- Trigger event: Admin request to contact user or business
- Provide services: allow administrators to contact users or businesses by phone, SMS, email, etc., and record contact content and results
- Supporting activities: A26
- Assumptions:
  - The contact information of the user or business is valid
  - Contact content and results are stored in a database that can be accessed by CCSS applications

F22. Verify the authenticity and severity of the issue

- Triggered event: Admin completed action to contact user or business
- Provide service: allow the administrator to verify the authenticity and severity of the problem based on the contact content and results, as well as other relevant information, and give corresponding handling suggestions
- Supporting activities: A27
- Assumptions:
  - The administrator has sufficient professional knowledge and judgment to carry out the verification

operation

F23. Compensation, refusal or deactivation of cards, etc.

- Trigger event: Admin confirms disposition proposal
- Provide services: Allow administrators to perform corresponding processing operations according to processing suggestions, such as compensating users or merchants, rejecting users or merchants' appeals, deactivating users' campus cards, etc., and updating the status of abnormal problems
- Supporting activities: A28
- Assumptions:
  - The processing operations are lawful and reasonable
  - The processing operation does not affect the normal use of other users or merchants

F24. Send processing result notification

- Event triggered: Admin completed processing action
- Provide services: send notifications about the processing results to users or merchants, and record notification content and results
- Supporting activities: A29
- Assumptions:
  - The contact information of the user or business is valid
  - Notification content and results are stored in a database that can be accessed by CCSS applications

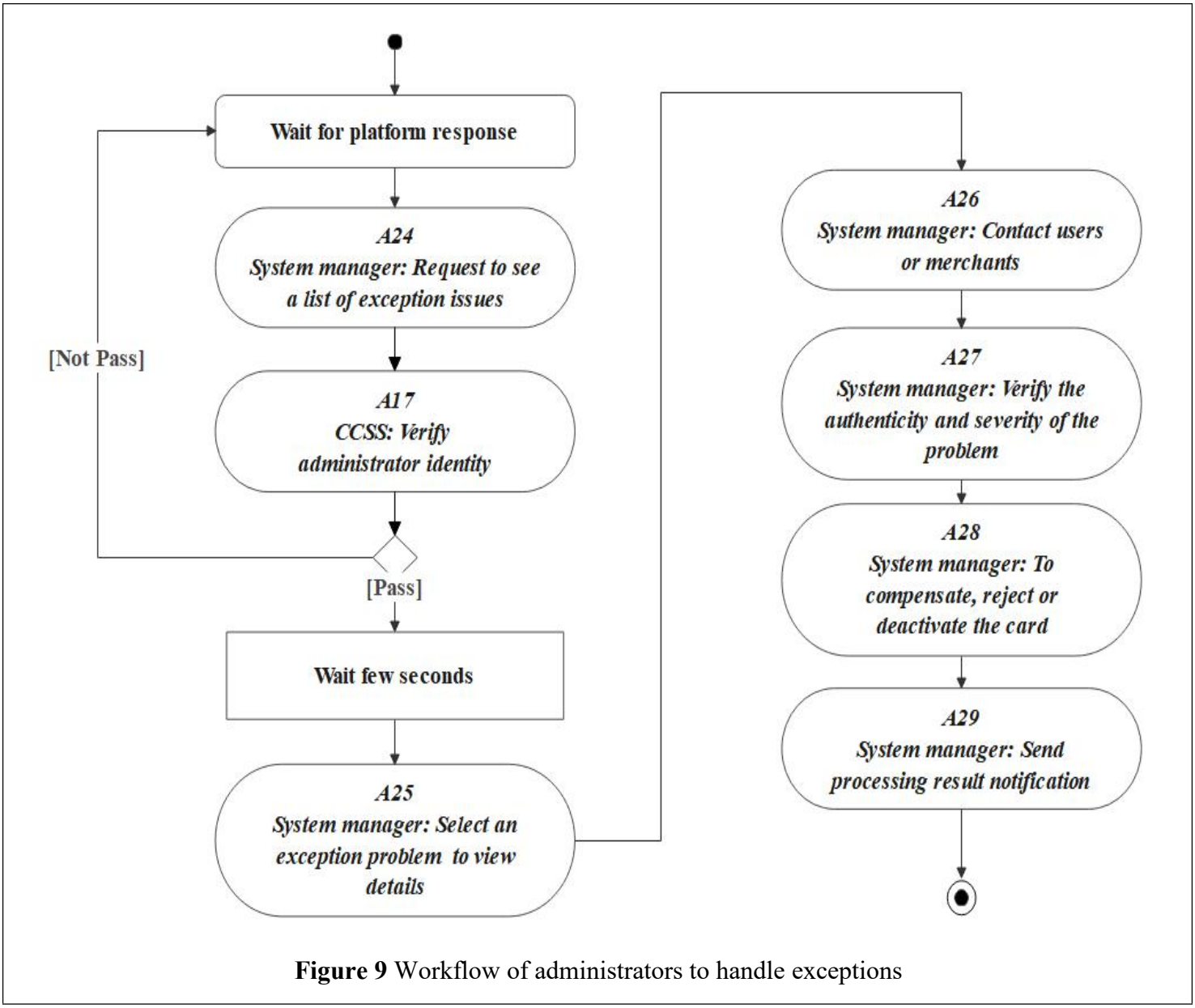


Figure 9 Workflow of administrators to handle exceptions

Table 7 Specific functions for to handle exceptions

5. Dictionary and Subject Domain

We use dictionaries and ERDs to describe CCSS's lexicons and subject domains. Dictionaries define domain-specific terms and concepts for uniform understanding and communication. ERD presents the data structures and relationships of subject domains for the design and implementation of databases

5.1. Glossary of Terms

The dictionary of CCSS is as follows, which defines some terms and concepts related to CCSS, and their meanings:

Term	Meaning
CCSS Account	An account provided by CCSS to manage your own campus card
Campus Card Balance	The amount stored in the Campus Card available for consumption
Recharging method	The way users transfer money to their own campus card, including Alipay, WeChat, online banking, etc.
Recharge Amount	The amount that a user transfers to their own campus card cannot exceed the maximum

Term	Meaning
	limit of the campus card
Recharge result	After the user transfers money to his campus card, the result returned by CCSS, success or failure
Amount of Consumption	The amount that users spend on campus with their own campus card cannot exceed the balance of the campus card
Consumption Result	After the user uses his campus card to consume on campus, the result returned by CCSS, success or failure
Query conditions	The conditions entered by the user when querying their own campus card transaction records, including date, amount, type, etc.
Transaction records	The records generated by users who use their own campus cards to recharge or consume, including transaction time, amount, type and other information
Maximum limit	The maximum amount that can be stored in the campus card is set according to the school's regulations. After exceeding this limit, it cannot be recharged
Public bank account	A bank account opened by the school to receive funds transferred from Alipay, WeChat or online banking by students, faculty and staff, and convert them into campus card balances and deposit them into the corresponding campus cards

Table 8 Glossary of Terms

5.2. Entity-relationship Diagram

The ERD of CCSS is shown in the figure below, which shows the data structure and relationship of the subject domain:

Data structure refers to the attributes and types of data. Relationships are the connections and constraints between data. In ERD, entities are represented by rectangles, attributes are represented by ellipses, relationships are represented by diamonds, primary keys are represented by underlines, and foreign keys are represented by dotted lines

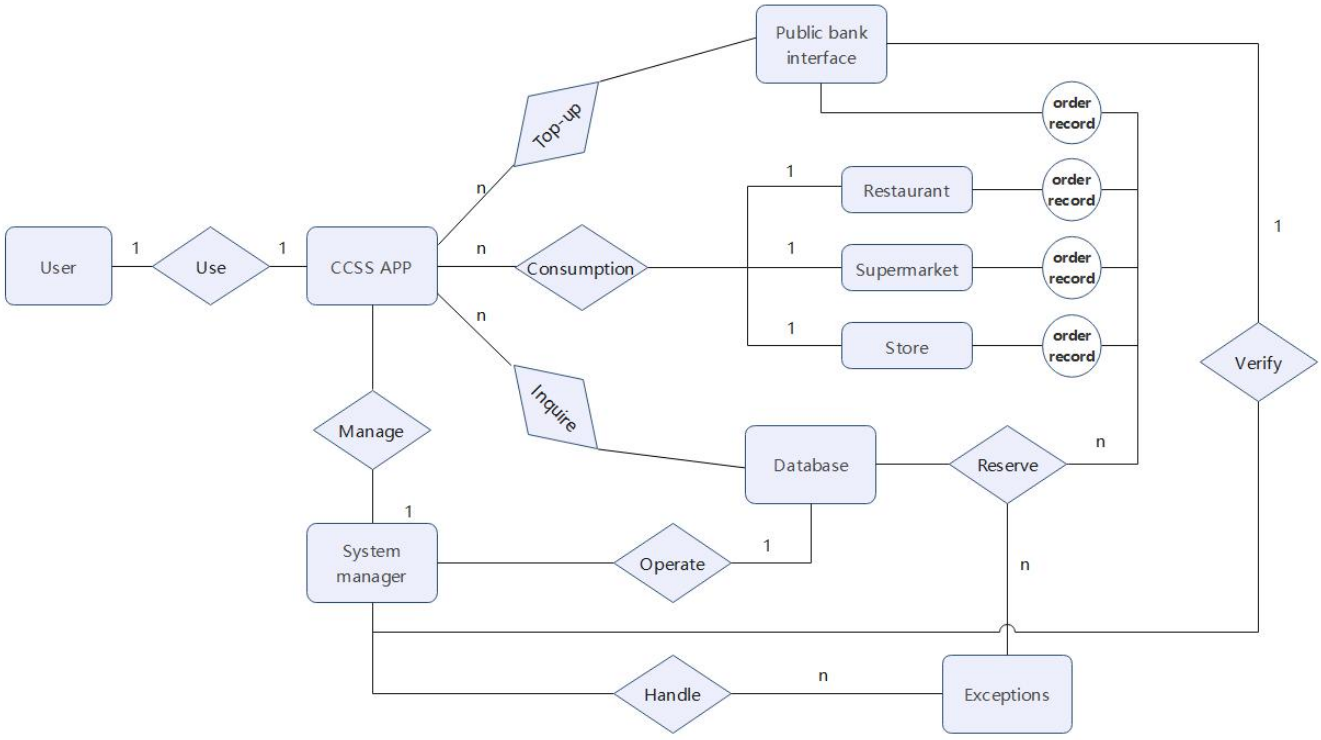


Figure 10 Entity-relationship Diagram for CCSS

6. Requirements-Level Architecture

We use data flow diagram and CRUD table to describe the requirement-level architecture of CCSS, and give its corresponding data field requirements. The data flow diagram shows the data flow and processing of CCSS, as well as the relationship between them. CRUD tables check CCSS for data consistency and integrity, and their relationship to functions. Finally, the data field is used to describe the type and limitation of the data to be stored and exchanged, etc.

6.1. Data Flow Graph

The data flow diagram of CCSS is shown in the figure below, which shows the data flow and processing of CCSS, as well as the relationship between them:

In the data flow diagram, external entities are represented by rectangles, data flow is represented by arrows, processing is represented by rounded rectangles, and data storage is represented by double lines

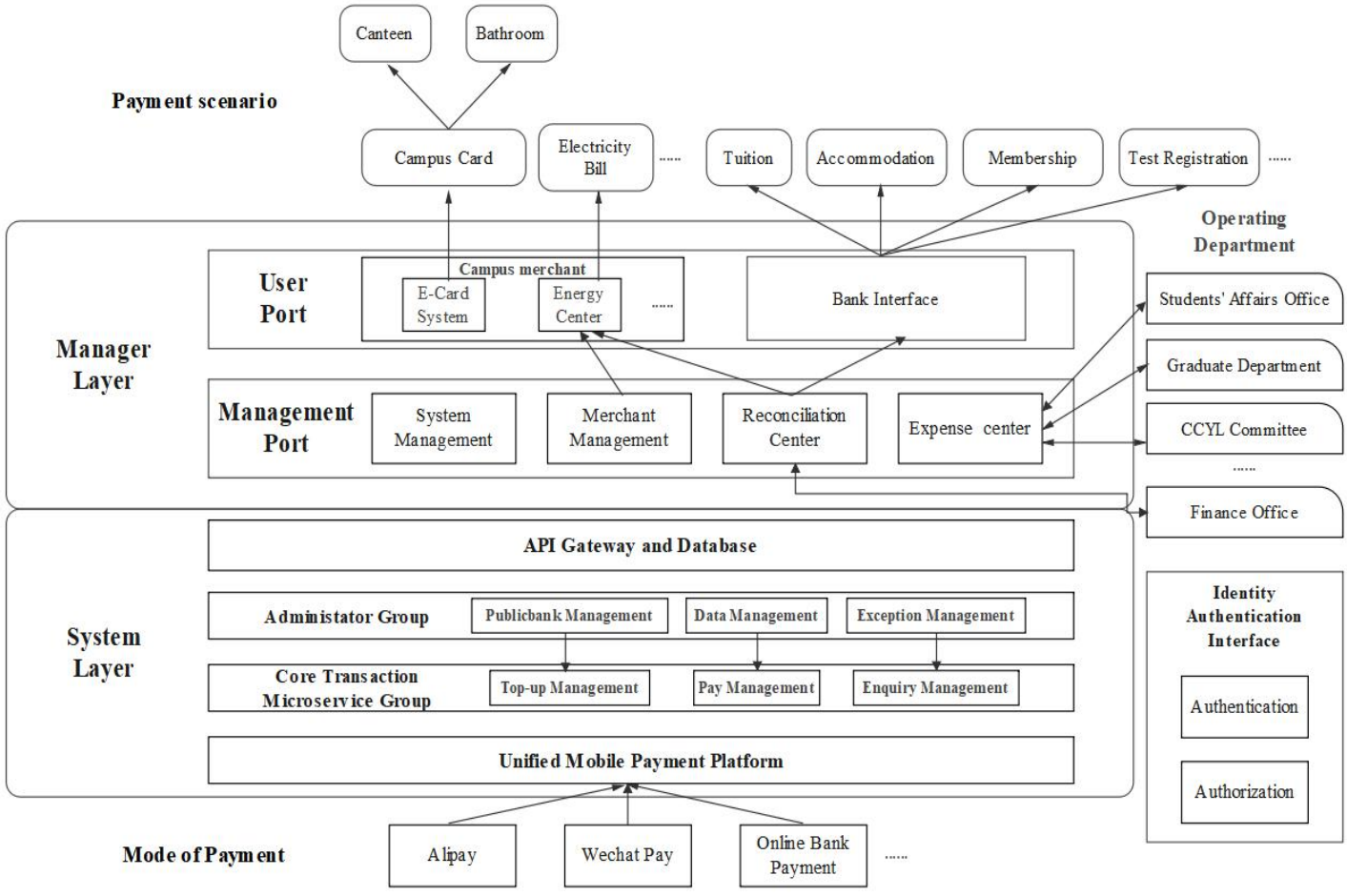


Figure 11 Data Flow Graph for CCSS

The data flow diagram of CCSS can be explained as follows:

1. The user logs in to CCSS through the CCSS account, selects the recharge method and recharge amount, and sends it to the recharge processing process

2. The recharge process calls the Alipay/WeChat/Online Banking interface, sends a payment request to the user, and waits for the user to complete the payment operation in Alipay/WeChat/Online Banking

3. The Alipay/WeChat/Online Bank interface sends payment operations to the public bank account, receives the user's payment result, and returns the payment result to the recharge process

4. The recharge processing process updates the user's campus card balance and transaction records according to the payment result, and sends the recharge result and recharge notification to the user

5. The user scans the QR code provided by the merchant, enters the consumption amount, and sends it to the consumption processing process

6. The consumption process checks whether the balance of the user's campus card is sufficient, deducts the corresponding amount, updates the balance and transaction records of the user's campus card, and sends the consumption result and consumption notification to the user

7. The user selects the function of querying the balance of the campus card and sends it to the query processing process

8. The query processing process obtains the balance of the user's campus card from the database and sends it to the user

9. The user selects the function of querying the transaction records of the campus card, and enters the query condition, and sends it to the query processing process

10. The query processing process obtains qualified transaction records from the database and sends them to the user

6.2. CRUD Table

The CRUD table of CCSS is shown in the table below, which checks the data consistency and integrity of CCSS, and their relationship with functions. In the CRUD table, C means create, R means read, U means update, and D means delete. Each cell represents an operation performed by a function on a datastore.

Function/Data Storage	User Information	Campus Card Balance	Transaction Records
Recharge Campus Card	R	U	C
Consumer Campus Card	R	U	C
Check the balance of the campus card	R	R	-
Query campus card transaction records	R	-	R

Table 9 CRUD of CCSS

The CRUD table of CCSS can be explained as follows: - The function of recharging the campus card needs to read user information, update the balance of the campus card, and create transaction records - The function of consuming campus cards needs to read user information, update the balance of the campus card, and create transaction records - The function of querying the balance of the campus card needs to read the user information and the balance of the campus card - The function of querying campus card transaction records needs to read user information and transaction records

6.3. Data Dictionary

The fields that need data exchange and data storage in CCSS are as follows:

- **Payment Service Field**

Field	Type	Length	Range of Valid Values	Description
amount	decimal	-	≥ 0 (0.01 precision), < 5000	total amount to pay
payment_id	string	32	-	Unique identifier for payment
payment_status	boolean	-	0, 1	payment status (eg: pending, paid)
product_id	string	32	-	unique identifier of the purchased product
product_name	string	255	-	The name of the purchased product

Field	Type	Length	Range of Valid Values	Description
user_id	string	32	-	The unique identifier of the payment user, that is, the CCSS account ID
transaction_time	string	19		yyyy-mm-dd-h-m-s

- **Recharge service field**

Field	Type	Length	Range of Valid Values	Description
amount	decimal	-	≥ 0 (precision is 0.01), < 5000	total amount to be recharged
recharge_id	string	32	-	unique identifier for recharge
recharge_status	boolean	-	0,1	Recharge status (eg: pending, paid)
recharge_type	string	20	-	Recharge type (for example: WeChat, Alipay, online banking)
user_id	string	32	-	The unique identifier of the top-up user, that is, the CCSS account ID
transaction_time	string	19		yyyy-mm-dd-h-m-s

Table 10 Payment and recharge service of CCSS

7. Graphical User Interface (GUI) Design

7.1. GUI Design Specification

The GUI design of a CCSS application should follow the following guidelines:

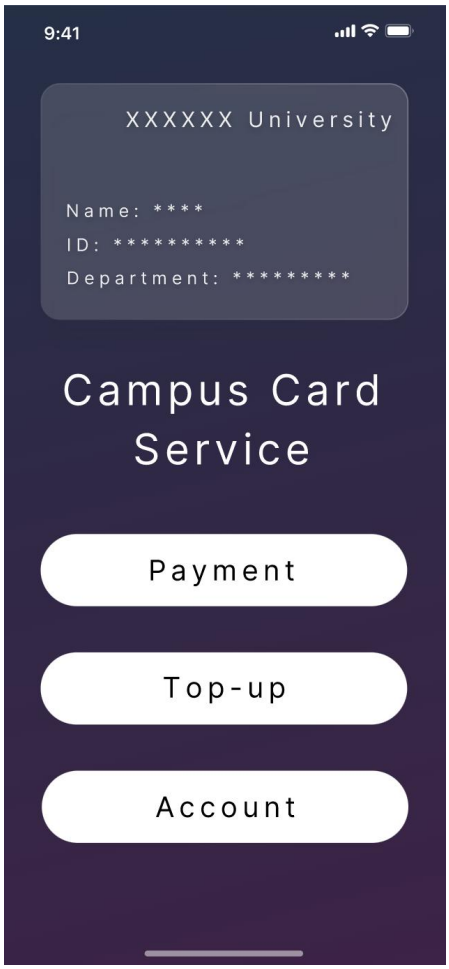
- **Layout specification**: The layout of the interface should be clear, concise, and beautiful, and proper spacing and alignment should be maintained between elements
- **Color Specifications**: The interface color should be simple, crisp, and coordinated, and avoid using too bright or too dim colors
- **Font specification**: The interface font should be clear, easy to read, and beautiful, and avoid using too small or too large font size
- **Icon Specifications**: Interface icons should be simple, clear, and beautiful, and avoid using overly complex or overly simple icons

7.2. GUI Prototype

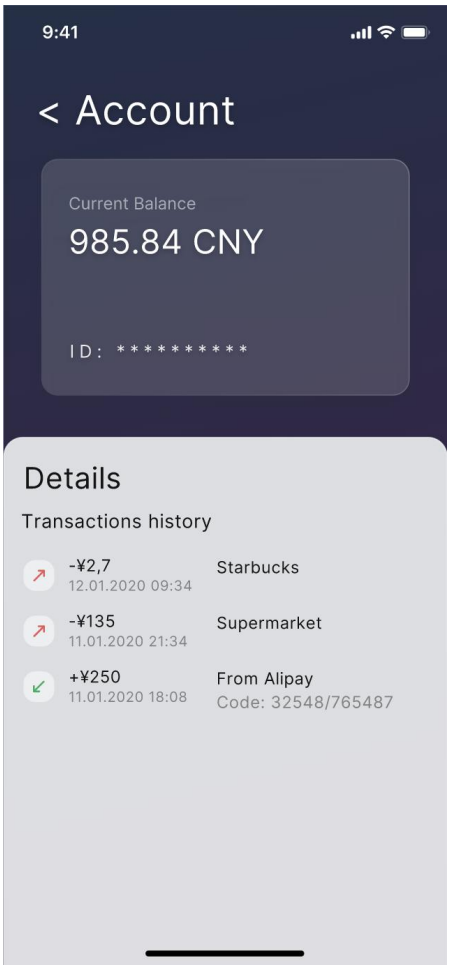
A GUI prototype for a CCSS application should include the following parts:

- **Main interface**: This interface should display the basic information of the user's campus card, such as name, student number, and department, etc., and provide a quick entry to facilitate users to quickly enter various functional modules
- **Account interface**: This interface should provide account management functions, including campus card balance query and campus card consumption record query
- **Recharge interface**: This interface should provide a recharge function, support users to recharge campus cards by using Alipay, WeChat or bank cards, and display historical recharge records
- **Consumption interface**: This interface should provide consumption functions, support users to use campus cards for consumption at designated merchants on campus, and display historical consumption records

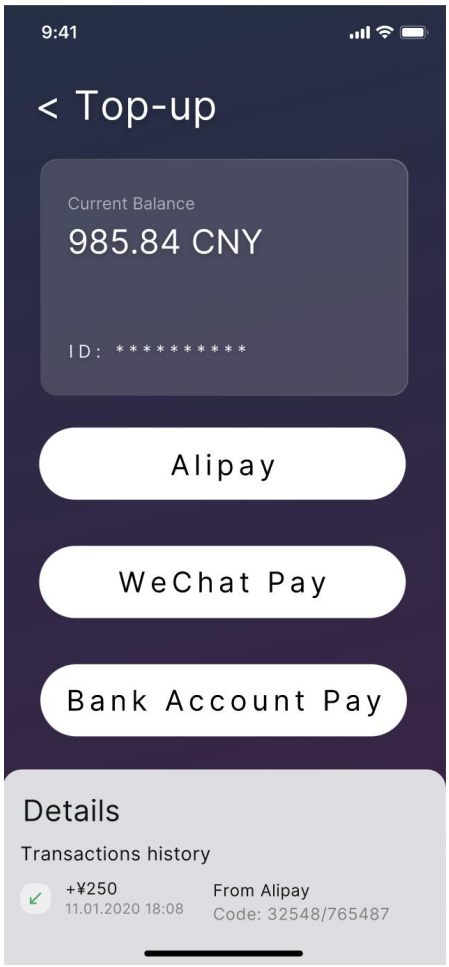
The following is the prototype of the GUI framework:



Main Interface



Account Interface



Recharge Interface

Consumption Inteface

Figure 12 GUI prototype for CCSS