Stock Trading System Software Design Document

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Version: 1.2

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CATALOG

1 Introduction

1.1 Purpose

This software design document for Client End of Trading aim at presenting a detailed view on the whole design about the subsystem of Stock Trading System. There are four intentions on the following.

1. All the software system requirements will be realized in the system design.
2. The development of the system architecture.
3. Let the system adapt the environment and improve its performance.
4. Divide the system structure to modules and functions.

1.2 Scope

This project is to develop a subsystem of Stock Trading System. As the subsystem is Client End of Trading. The following tips will show its scope.

1. It must give users convenient and effective ways to deal with stocks.
2. Friendly interfaces are also necessary in this project.
3. It can't visit the database directly for it is only a Client End.

1.3 Definitions, Acronyms and Abbreviates

Client End of Trading	All the client related operations will be done in this part. The client-end should offer a user interface for client and has the function to provide all the needed information for the trading system.
Central Trading System	It is the central module for whole system. All the orders will be decided by the central trading system. This module also is responsible for maintaining the database. Central trading system will change the data and send a reply to other module.
Software Design Document	This document is used to present a detailed view on the whole design about the system.
ANSI/IEEE 9001	A generic standard that applies to any organization that wants to improve the overall quality of the products, systems, or services that it provides.
ACD	Short for Architecture Context Diagram
GUI	Short for Graphical User Interface
ER	Short for Entity Relation Diagram
CD	Short for Class Diagram
AO	Short for Activity Overview

1.4 References

《Stock Trading System》(given in the course)
《Software Engineering》
Author: Roger S.Pressman Press: McGraw Hill

Following standards are used as guides to develop this document:
ANSI/IEEE 9001: Standard for Software design
ANSI/IEEE 9001: Standard for System software design
ANSI/IEEE 9001: Standard for Software general design

2 Design Overview

2.1 Background Information

2.1.1 System Background

Nowadays, stock market has been an important part for economy. Every day, millions of trades are completed in the stock market. It has been difficult to deal these trades by handwork. The software for stock market is necessary.

This is what developers plan to do: stock trading system. The project is a system used in many fields, including stock trade, trade control, and market management. A serious of interfaces will be developed to suit different requirements of different kinds of people. A database will be set up to save the information intensively. And all the operations are based on this database. Besides the database and interfaces, a central trading system will be developed to deal with the trading and the changes on the database.

The whole system is departed into five modules: Central Trading System, Account & Fund, Client End of Trading, Information Display and Trading Management. Then there are five develop groups to finish corresponding modules. Problems about communicating and testing are solved by the meeting which all the developers of this system attend.

However, this system is a basic system, which means that our main attention will be paid to implementing its functions. All the functions will be implemented and some extra functions may come true. Well, the requirements for the safety will be lower than some big stock trading system. The communicated information is not encrypted and there is no firewall for database.

2.1.2 Assumption and Dependence

There are many factors that have great influence on the project. The design must implement all of the explicit requirements contained in the analysis model, and it must accommodate all of the implicit requirements desired by the customer. So it is important to make sure the primary conditions of the customers and develop environments. That is, assumptions and dependences.

Assumption:

1. In the analysis model, basic information of the requirements is clear. No big mistakes exist. If a big mistake is ignored in the beginning of the project, it will lead to a disaster that the whole work has to be checked.

2. All the developers are trained and familiar with the project. And the number of people in the project team is adequate to do the job. When the situation of lacking developers occurs, the delivery time for the software may be delayed.

3. The developer team has a good estimation for the technical problems and software size. When technology does not meet exception, there should be some alternative schemes.

4. The scope and requirements of the project is stable. Because the model is similar with FLOW model. The final work is accomplished in the last stage of the develop process. Any change after the requirements analysis stage will force the developers to modify the architecture of the system, which takes a lot of time and human resources.

Dependence:

1. Developers have had a clear view for the system and a detailed schedule has been made. Requirements analysis is treated carefully so that developers have the specification of software's operational characteristics.

2. The technology developers prefer has been used in some similar systems and it proves to work in gear. And a lot of jobs have been done. They can offer us great experience and ideas.

3. Well, this system is just a basic stock trading system. Developers can neglect the security. The number of the users is not very much, which reduce a lot of work on the communication.

2.2 Alternatives

All design alternatives considered, and the rationale for non-acceptance, should be briefly addressed in this section.

1. Developers prefer Socket as the communication method. Developers will use Java Socket API, to implement the communication between different modules. But one default of this method is that it can`t stand too many information. It may lead to the block of the communication. Developers plan to solve it by designing suitable algorithm to avoid the bad situation.
2. Multithread is used in our software. Another way that can take place of it is to check the server in fixed time. To make the UI more comfortable for users, the first one will be chosen by developers, which will make the structure of the software more complex.

3 User Characteristics

No matter how advanced a computer interface is. Users' characteristics will always be the most important element rather than the designers.

Our potential customers are those who are professional stockbrokers or public users. They may be teenagers, middle-aged and old ones. They also have different education levels and professions. Our task is to design a general and easy-to-use system for the customer.

3.1 Professional stockbrokers:

Classification:

- computer knowledge – moderate/high
- stock trading knowledge - high
- frequency of use – high

Interaction with the system:
They do transactions either by clicking buttons and mouse or by pressing hot keys. The latter one is a better choice for them.

3.2 Ordinary users

Classification:

- computer knowledge - varies, low-high
- stock trading knowledge - varies, low-high
- frequency of use - varies, low-high

Interaction with the system:

Most of them use mouse rather than the hot keys. Only a few of them who know more about computers use hot keys.

A suitable font size and color, large-enough buttons and helpful tool tips are required to meet the general requirements. Besides, error or warning messages must be clear and provide specific guidance.

4 Requirements and Constraints

4.1 Performance Requirements

The performance requirements of the Client end of trading will be divided into three parts:

1. The service life of the system.
2. The running rate of the system.
3. The stability of the system.

To meet all the performance requirements:

As the Client end of trading is one part of the Stocking trading system, the abilities of it depends on the center trading system. So to the Client end of trading, the data exchanging will be the most important. In the software design, orders which are accepted by both Client End of Trading and Central Trading System are used to meet the requirements.

Apart from the orders, functions that are used to send or receive orders are also very important. In the software design, Object-oriented programming is chosen. All the users' interface will be objects to meet different functions. As the system is multithreading, data exchanges between different objects are under control strictly to ensure the stability of the system. Otherwise, functions of objects must work effectively and quickly to safeguard the run rate of the system.

4.2 Security Requirements

The Stock Trading System is a small system, so the Instruction encryption may be abandoned. Therefore, the security requirements will be divided into only two parts:

1. The security of system.
2. The security of data.

To meet these requirements:

1. The security of system includes several aspects. For instance, one account can't login the system twice at the same time. To meet this requirement, the verify code is selected in our design. Besides, if the power failed suddenly, the completed orders should not loss. So data is recording promptly in our design.

2. The security of data includes three parts: Accounts, capital accounts and data in the database. To confirm the security of accounts and capital accounts, our design stipulates that users should input the account number and password again in every trade.

4.3 Design Constraints

There is a list of the general constraints imposed on the system that may limit designer's choices:

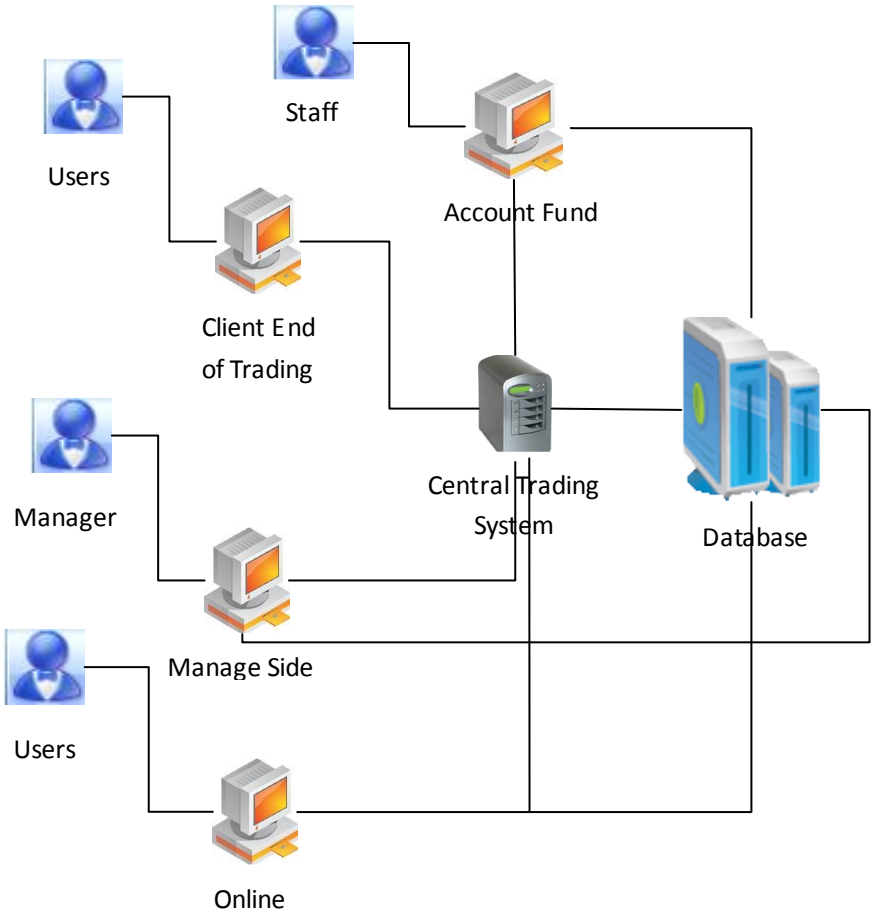
1. Information should not be lost when the orders are exchanged between client end of trading and center trading system.

2. The number of client end can be hundreds.

3. Transaction results depend on the order come from center trading system, they must come out quickly in less than 1 second.

4. Users may have some unexpected activities.

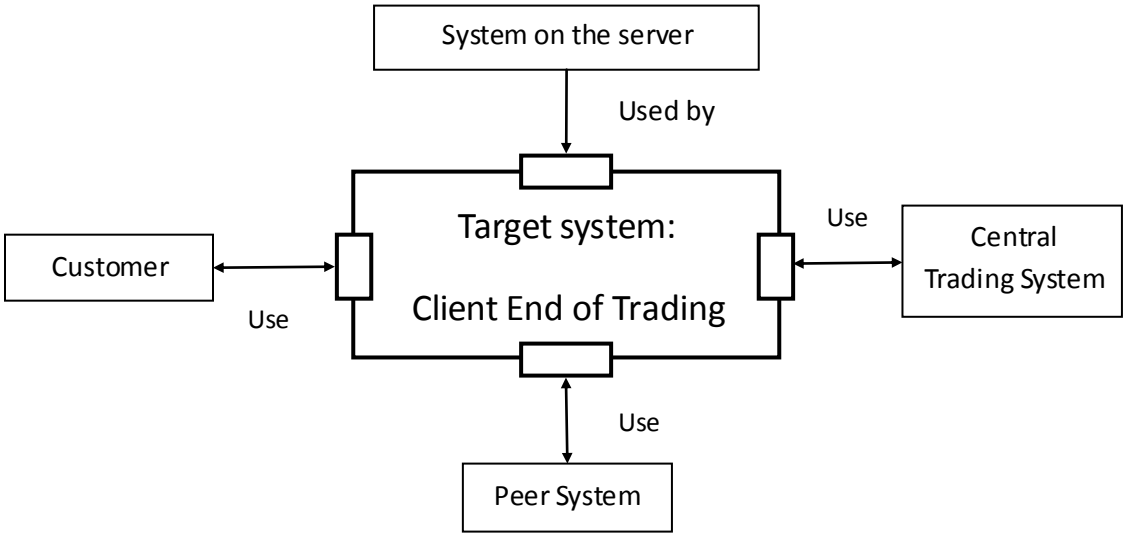
5 System Architecture



Architecture diagram of the whole system

In this diagram, Database contains all kinds of information: Accounts, capital accounts, information of stocks, relations between them and so on. Here, the Client End of Trading is used for users to carry on the transaction operations. Account Fund is used to manage each kind of account information. Manage Side is used to manage the stock information. Online is used to issue the stock information. The Central Trading System is used to handle all kinds of orders from other modules.

As this design document is for the Client End of Trading, relations between Client end of trading and other modules will be analysis here. The Client end of trading will mainly exchange orders with the Central Trading System and Account Fund to get information of stock, account and capital from them. However, those information is decided by the manage side. Besides, online service is the premise for users to buy or sell stocks because the detail information of all stocks will be shown there. In a word, all the other modules will influence our design.



Architecture context diagram

In this diagram, the system on the server is the up component of Client End of Trading while other components are equal to Client End of Trading. Their relations have been signed in the diagram. The following paragraphs will show the relations between Client end of trading and other components.

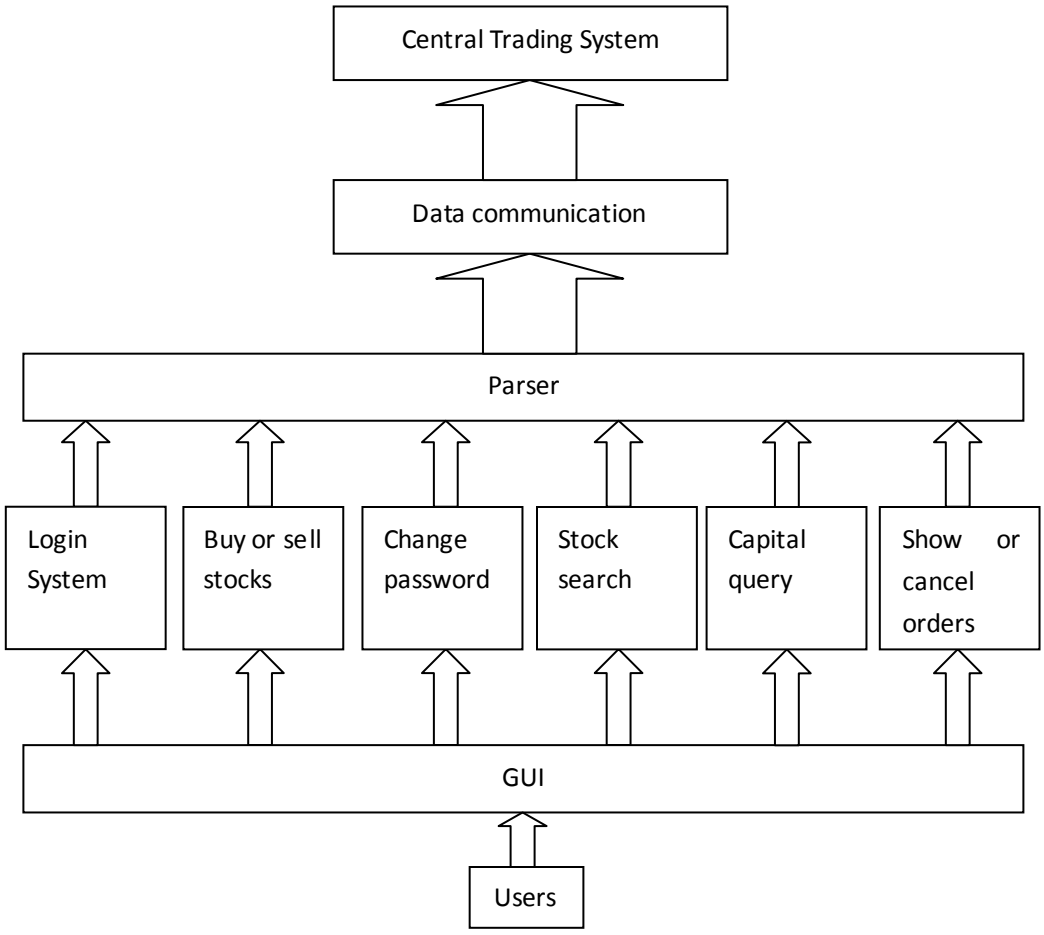
The Client end of trading is the most important interface between users and the whole system, so the orders exchanging between Client end of trading and Central trading system occupies the majority. For instance, if users want to buy stocks, he or she will input the stock name and quantity. According to his or her account information, the Client end will form an order that can be accepted by the Central trading system. Then the Central trading system will handle the order and return the request information to the Client end of trading. After receiving the information, the Client end of trading will analysis it and show users the correct result. This is the whole process of one exchange.

Apart from the relation with Central trading system, there are also exchanges between Client end of trading and Account Fund. For instance, when users login the system, he or she should input their account number and password, then the Client end will form an order contains the necessary information to send to the Account Fund. The Account Fund will check the information and return the result. Finally, the Client end of trading show the result to users.

6 Detailed Design

In this section, the detail design of Client End of Trading will be described. As it is used for developers to realize the project, every detail should be considered comprehensively. Module architecture, class Definition and Users' Activities will be analysis completely in this section.

6.1 Module architecture

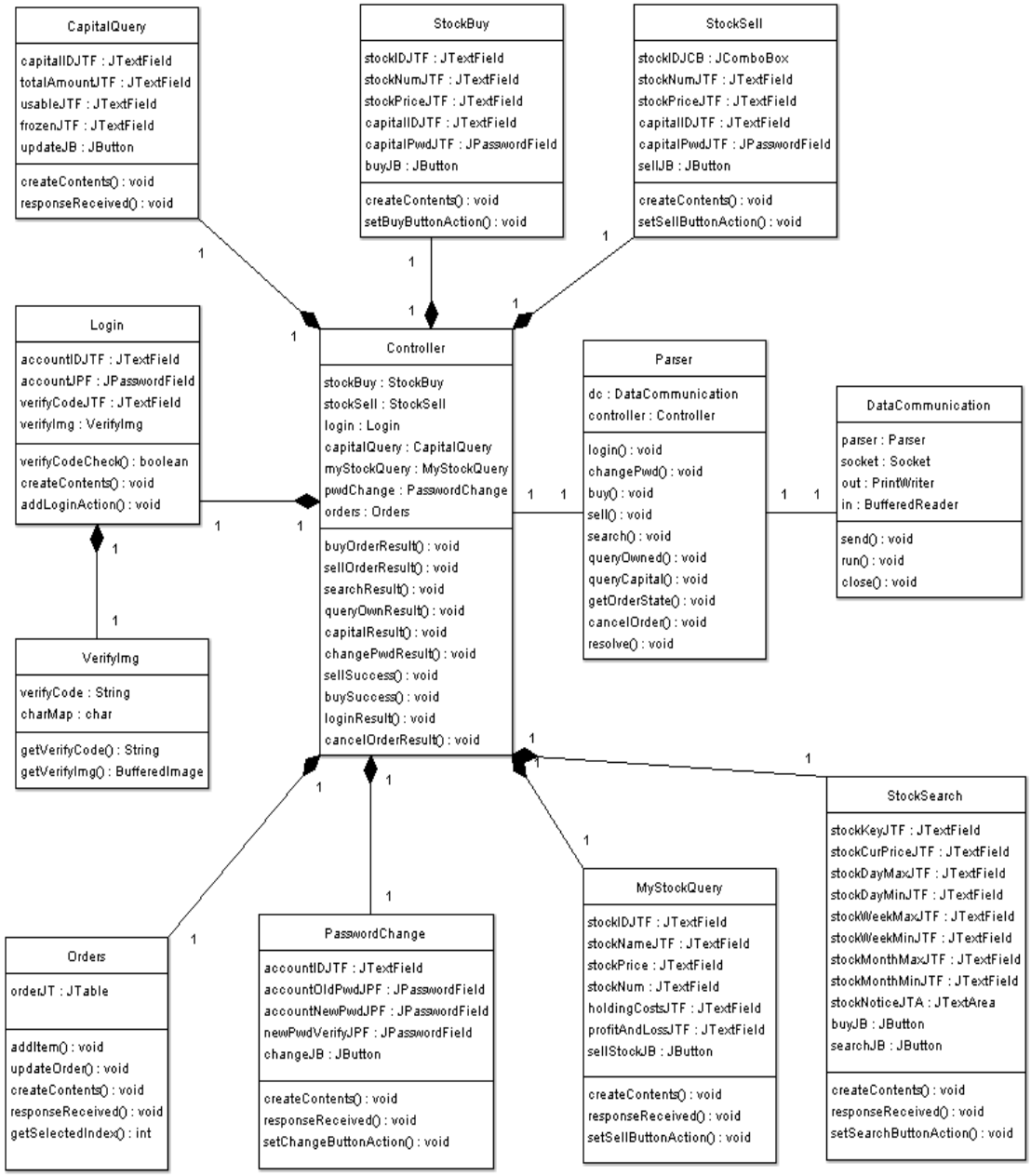


Level relation Diagram

This diagram shows the level relations of Client End of Trading. Users are in the bottom level, functions are in the middle level and Central Trading System is in the top level. The middle level can be divided into three parts through different functions. Parser is used to parse messages from user's input to a standard message form that the Central Trading System accepts. And it also parses the messages received from the Central Trading System to the form that the GUI Controller could recognize. The messages format is based on the protocol that achieved by our group and the group of the Central Trading System. Data communication is used to send messages to

Central Trading System and receive messages from it. Data Communication doesn't care about what the messages are, its duty is to send and receive messages. Socket is used for communication between the client and the Central Trading System.
User's inputs are from the functional GUI model, such as Stock Search GUI module. And then the Parser parses the inputs and asks the Data Communication to send the parsed messages to the Central Trading System. If a message is received from the Central Trading System, the Data Communication will inform the GUI Controller. Then the GUI Controller tells the user the results.

6.2 Class Definition



Class Diagram

It's a general class diagram, not all attributes and methods of each class are included in this diagram. In this Class Diagram, there are twelve classes. All functional modules illustrated in section 6.1 are implemented as classes.

Class Name	Controller
Description	Its responsibility is to control all the GUI functional modules, including Login, StockBuy, StockSell, StockSearch, PasswordChange, CapitalQuery, Orders and MyStockQuery. The Controller gets fields information from the eight GUI functional modules. It also validates whether the contents of the fields are legal or not by calling static methods in class Parser. If responses are received from the server, the Parser will inform the Controller, and then the Controller will popup dialogs to the user.
Method	For example, if the user tries to login the system, then the method login() in class Parser will be called. And the method loginResult() in class Controller will be called after the login result has been received from the Central Trading System. The methods sellSuccess(), buySuccess(), sellOrderResult() and buyOrderResult() in this class each has two overloads.

Class Name	VerifyImg
Description	Its responsibility is to produce an image which contains four randomly generated characters.
Method	1. getVerifyImg(): generate a BufferedImage object 2. verify(): check whether the target string matches the current image or not.

Class Name	Login
Description	Its responsibility is to show a login window, in which user types the required account information.
Method	1. createContents():a private method in this class, which is used to create the contents of the login window. 2. verifyCodeCheck(): be used to check if the characters inputted by the user match the verify image. 3. addLoginAction(): be used to add an actionListener to the login button. The class Controller invokes this method. 4. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JFrame.

Class Name	CapitalQuery
Description	Its responsibility is to show the capital information of the user.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. responseReceived(): capital information has been received from the Central Trading System, this method gets capital information and then displays it on the screen. 3. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

Class Name	StockBuy
Description	Its responsibility is to provide a place where user can input necessary information to buy stocks.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. setBuyButtonAction(): be used to add an action to the buying button. The class Controller invokes this method. 3. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

Class Name	StockSell
Description	Its responsibility is to provide a place where user can input necessary information to sell stocks.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. setSellButtonAction(): be used to add an action to the selling button. The class Controller invokes this method. 3. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

Class Name	PasswordChange
Description	Its responsibility is to provide a place where user can input necessary information to change his account password.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. setChangeButtonAction(): be used to add an action to the change button. The class Controller invokes this method. 3. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

Class Name	StockSearch
Description	Its responsibility is to provide a place where user can search stocks through stock id or stock name, and view the detailed stock information.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. setSearchButtonAction(): be used to add an action to the search button. The class Controller invokes this method. 3. responseReceived(): information of stocks has been received from the Central Trading System, this method gets this information and then displays the detailed stock information on the panel. 4. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

Class Name	MyStockQuery
Description	Its responsibility is to provide a place where user can view his or her holding stocks.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. setSellButtonAction(): be used to add an action to the buy button in this panel. It provides a shortcut way to sell the current holding stock. The class Controller invokes this method. 3. responseReceived(): information of holding stocks has been received from the Central Trading System, this method gets this information and then displays it on the panel. 4. Other methods used for getting or setting contents of textfields are not listed in the class diagram.
Extend	javax.swing.JPanel

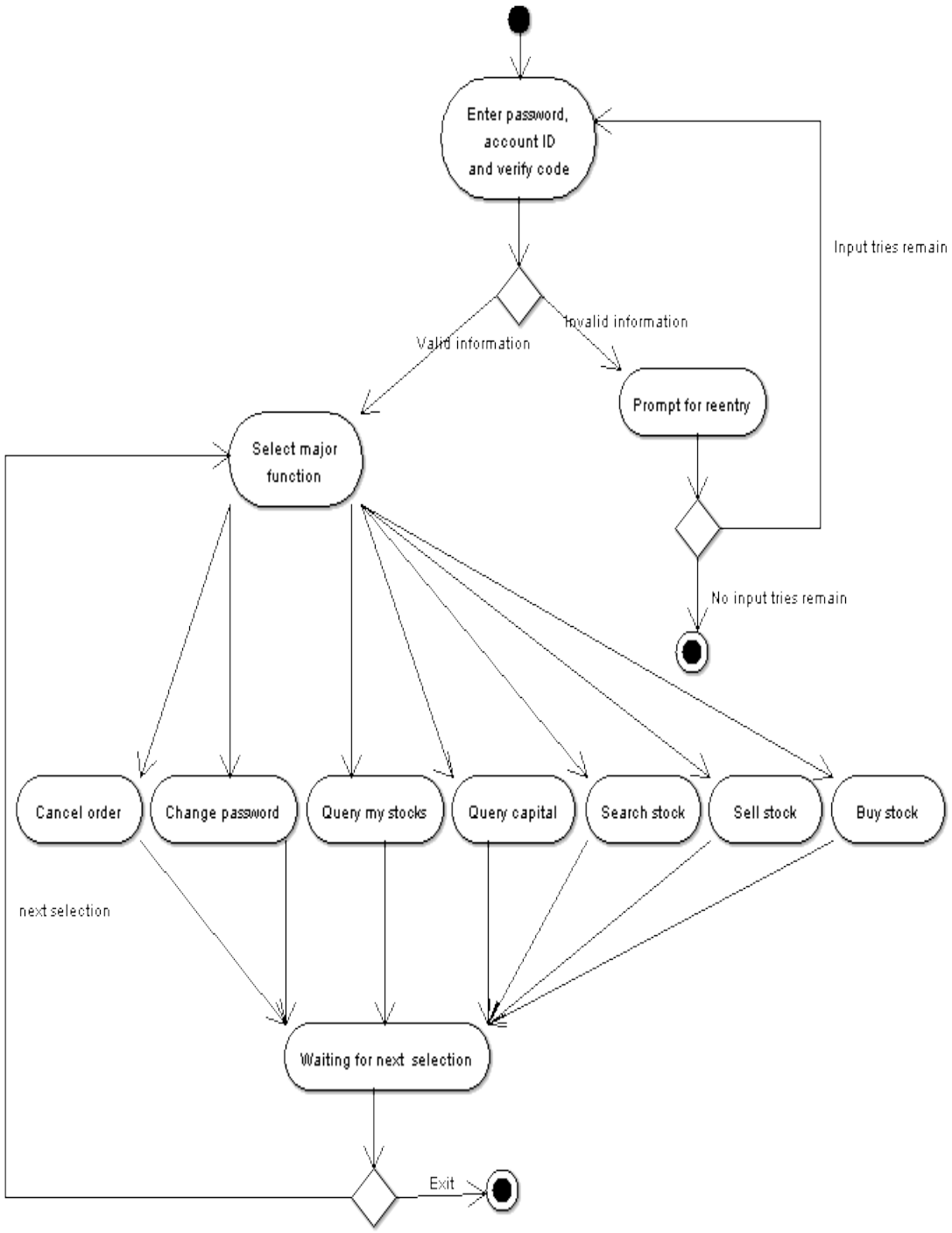
Class Name	Orders
Description	Its responsibility is to show the buying orders and selling orders of the user. Each order includes order id, stock id, order price, order amount, order state and order type.
Method	1. createContents(): a private method in this class, which is used to create the contents of the panel. 2. addItem(): add an order to the orders list. 3. updateOrder(): update one order in the orders list when the order state is changed. 4. responseReceived (): used to update the orders list when

	today's orders have been received from the Central Trading System. 5. getSelectedIndex (): get the index of the selected item in the orders list, ranges from 0 to the list size.
Extend	javax.swing.JPanel

Class Name	Parser
Description	Its responsibility is to parse messages from user's input to a standard message form that the Central Trading System accepts, and it also parses the messages received from the Central Trading System to the form that the GUI Controller could recognize.
Method	The following methods: login(), changePwd(), buy(), sell(), search(), queryOwned(), queryCapital(), getOrderState() and cancelOrder() are used to parse user's input. While the method resolve() is used to parse the messages from the Central Trading System.

Class Name	Data Communication
Description	Its responsibility is to send messages to Central Trading System and receive messages from it.
Method	1. close(): used to end the threading for receive messages. 2. send(): used to send parsed messages to Central Trading System. The messages are parsed by class Parser. 3. run(): used for multi-threading, because socket will block while waiting for a message. The main function of this method is waiting for messages, and then informs class Parser to parse the messages.

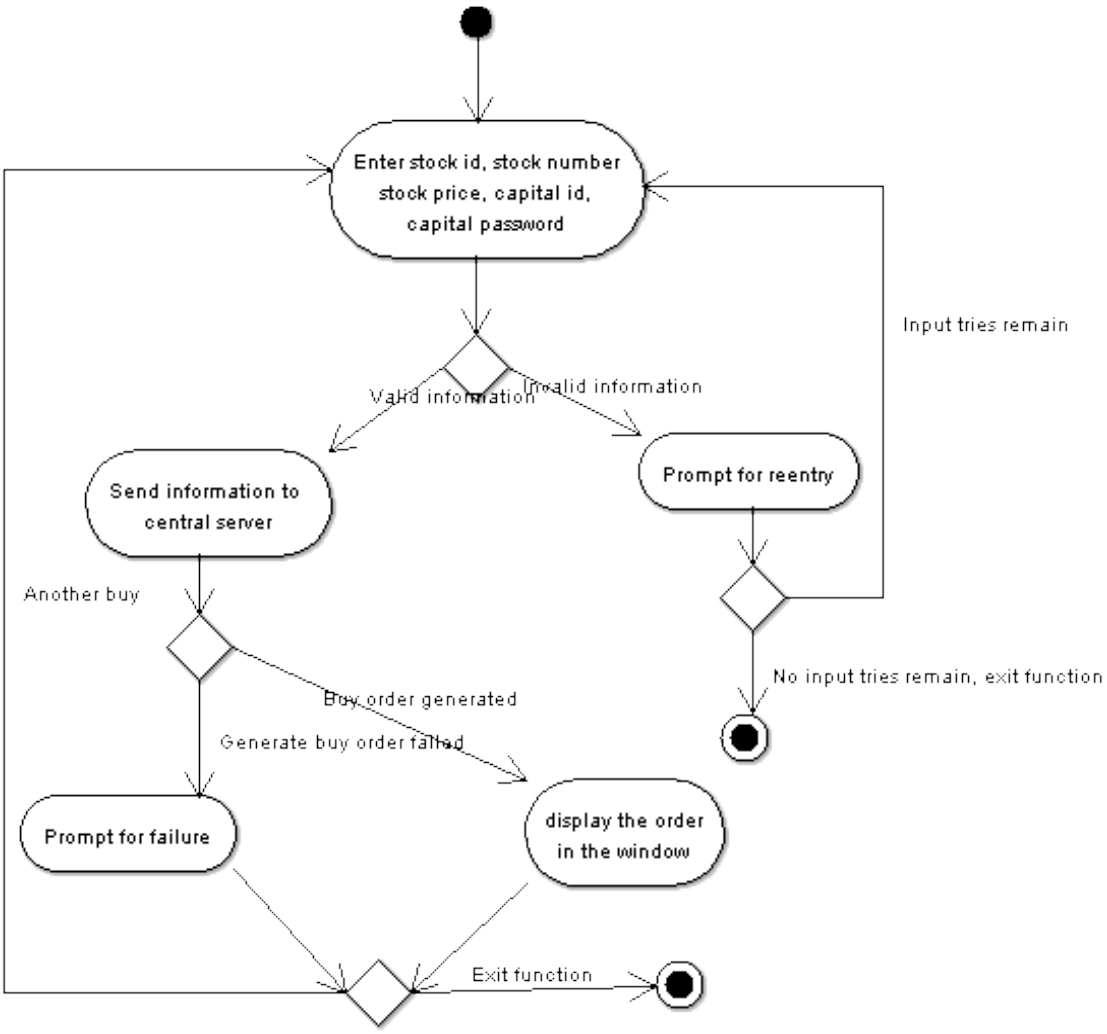
6.3 Users' activities



Activity Overview Diagram

This is the Activity Overview diagram of Client End of Trading. According to this diagram, login system is the basic activity for users. Only if users login the system successfully, he or she can do the other things. There are seven major functions in this diagram. Every function has its own activity and will be described later.

6.3.1 Buy Stock Activity



Buy stock Activity Diagram

Activity: Enter stock id or stock name, quantity, price, capital account and password.
Related classes: StockBuy
Description: user enters in this panel

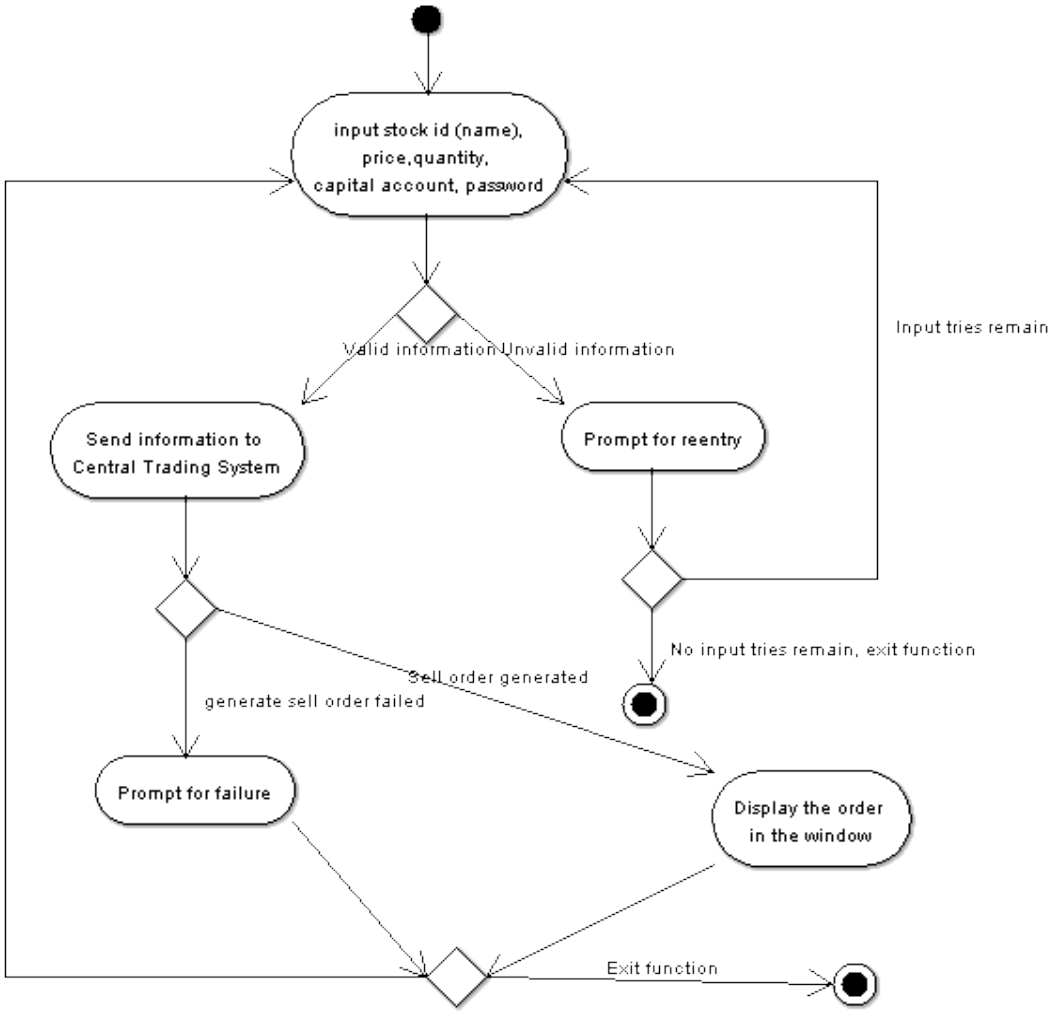
Activity: Validate the information
Related classes: Parser
Description: validate whether the inputs are legal or not using static methods in class Parser

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method buy() in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Display the order in the window
Related classes: Orders, Controller, Parser, DataCommunication
Description: if the buy order generated successfully, then a confirm message will be received in class DataCommunication. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the class Controller by invoking method buyOrderResult(). Class Controller then invokes addItem() to add the order to the panel class Orders.

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.2 Sell Stock Activity



Sell stock Activity Diagram

Activity: Enter stock id or stock name, quantity, price, capital account and password.
Related classes: StockSell
Description: user enters in this panel

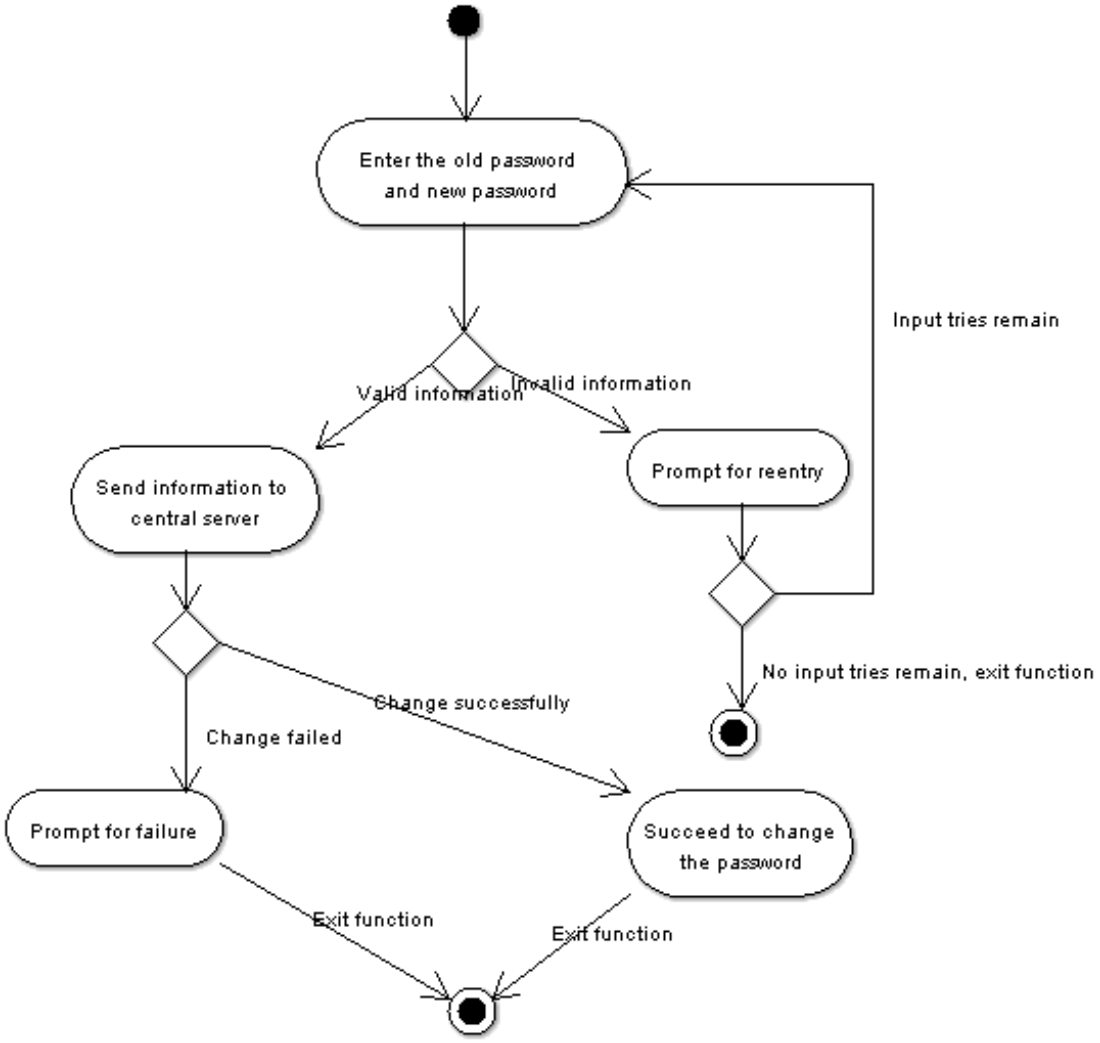
Activity: Validate the information
Related classes: Parser
Description: validate whether the inputs are legal or not using static methods in class Parser

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method sell() in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Display the order in the window
Related classes: Orders, Controller, Parser, DataCommunication
Description: if the sell order generated successfully, then a confirm message will be received in class DataCommunication. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the class Controller by invoking method sellOrderResult(). Class Controller then invokes addItem() to add the order to the panel class Orders.

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.3 Change password Activity



Change password Activity Diagram

Activity: Enter the old password and new password.
Related classes: PasswordChange
Description: user enters in this panel.

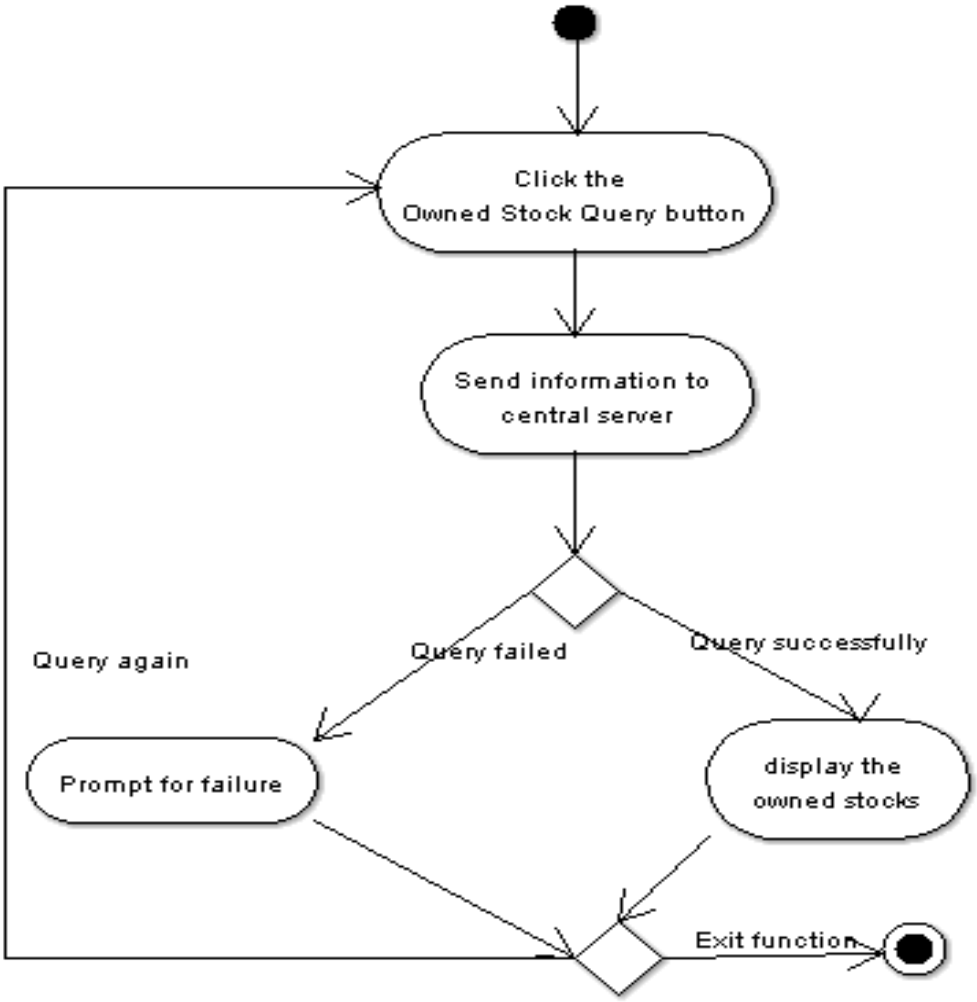
Activity: Validate the information
Related classes: Parser
Description: validate whether the passwords are legal or not using static method isValidPassword() in class Parser.

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method changePwd() in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Succeed to change the password
Related classes: Orders, Controller, Parser, DataCommunication
Description: if the user changes password successfully, then a confirm message will be received in class DataCommunication. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the Controller to display the result.

Activity: Prompt for failure
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.4 Search owned stock Activity



Search owned stocks Activity Diagram

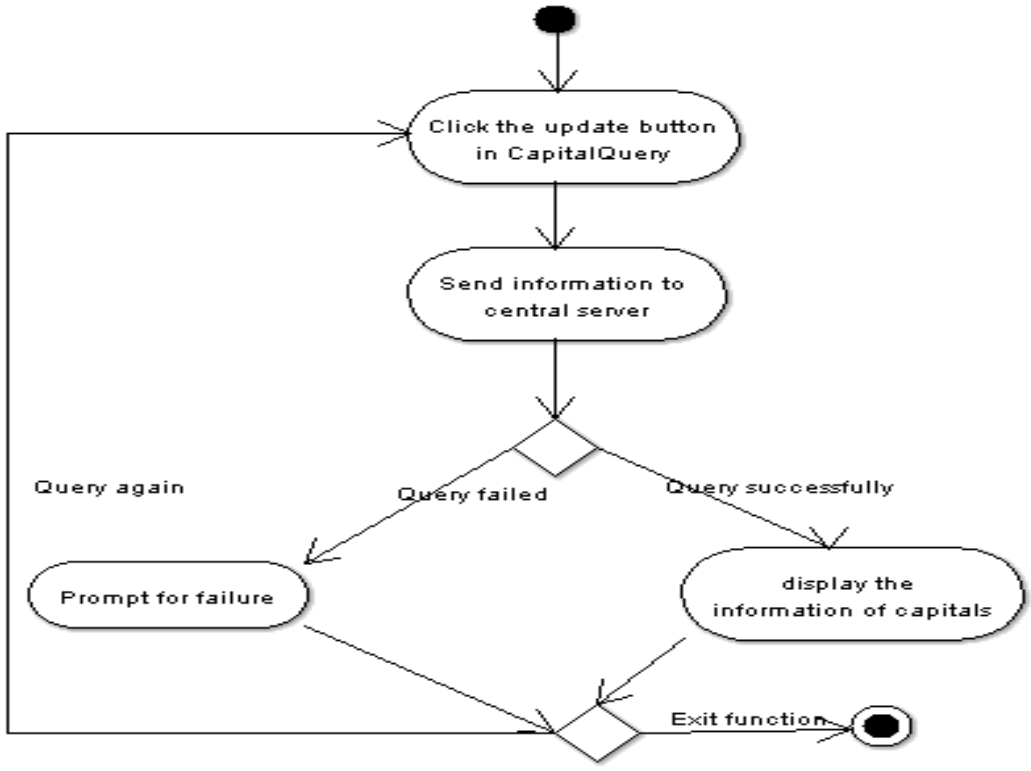
Activity: Click the Owned Stock Query button.
Related classes: MyStockQuery
Description: the detailed information of stocks is shown in this panel.

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method queryOwned () in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Display the owned stocks
Related classes: MyStockQuery ,Controller, Parser, DataCommunication
Description: class DataCommunication receives stock information from the Central Trading System. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the Controller by invoking method queryOwnResult(). Class Controller then invokes method responseReceived() in MyStockQuery to display the result

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.5 Capital Query Activity



Capital Query Activity Diagram

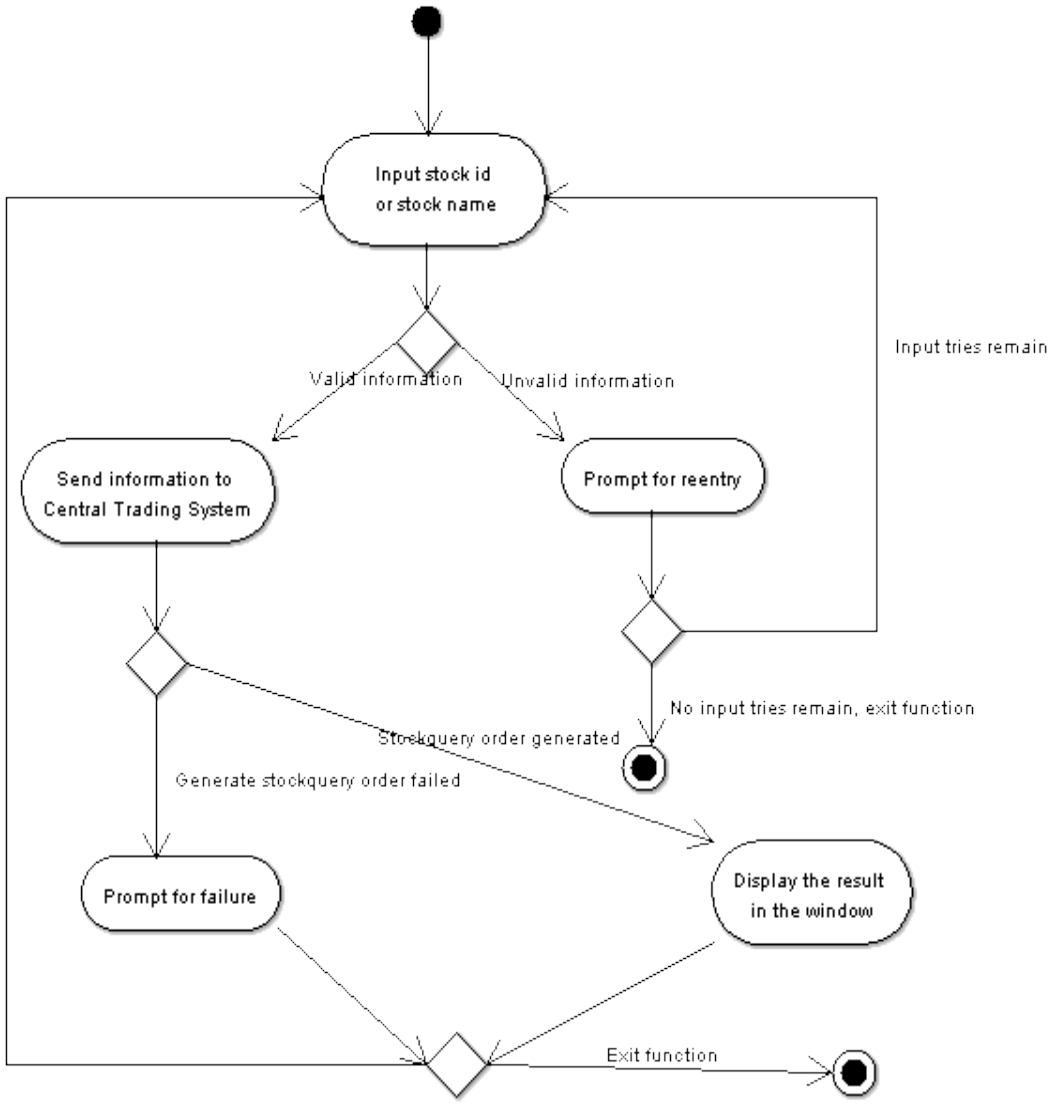
Activity: Click the update button in CapitalQuery
Related classes: CapitalQuery
Description: the detailed information of capitals is shown in this panel. User can click the update button to get the latest information from the Central Trading System. Actually, the request of querying capitals will be sent to the Central Trading System automatically after login.

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method queryCapital () in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Display the information of capitals
Related classes: CapitalQuery, Controller, Parser, DataCommunication
Description: class DataCommunication receives information of capitals from the Central Trading System. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the Controller by invoking method capitalResult(). Class Controller then invokes method responseReceived() in CapitalQuery to display the result

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.6 Stock Query Activity



Stock Query Activity Diagram

Activity: Input stock id or stock name.
Related classes: StockSearch
Description: user enters stock id or stock name in this panel

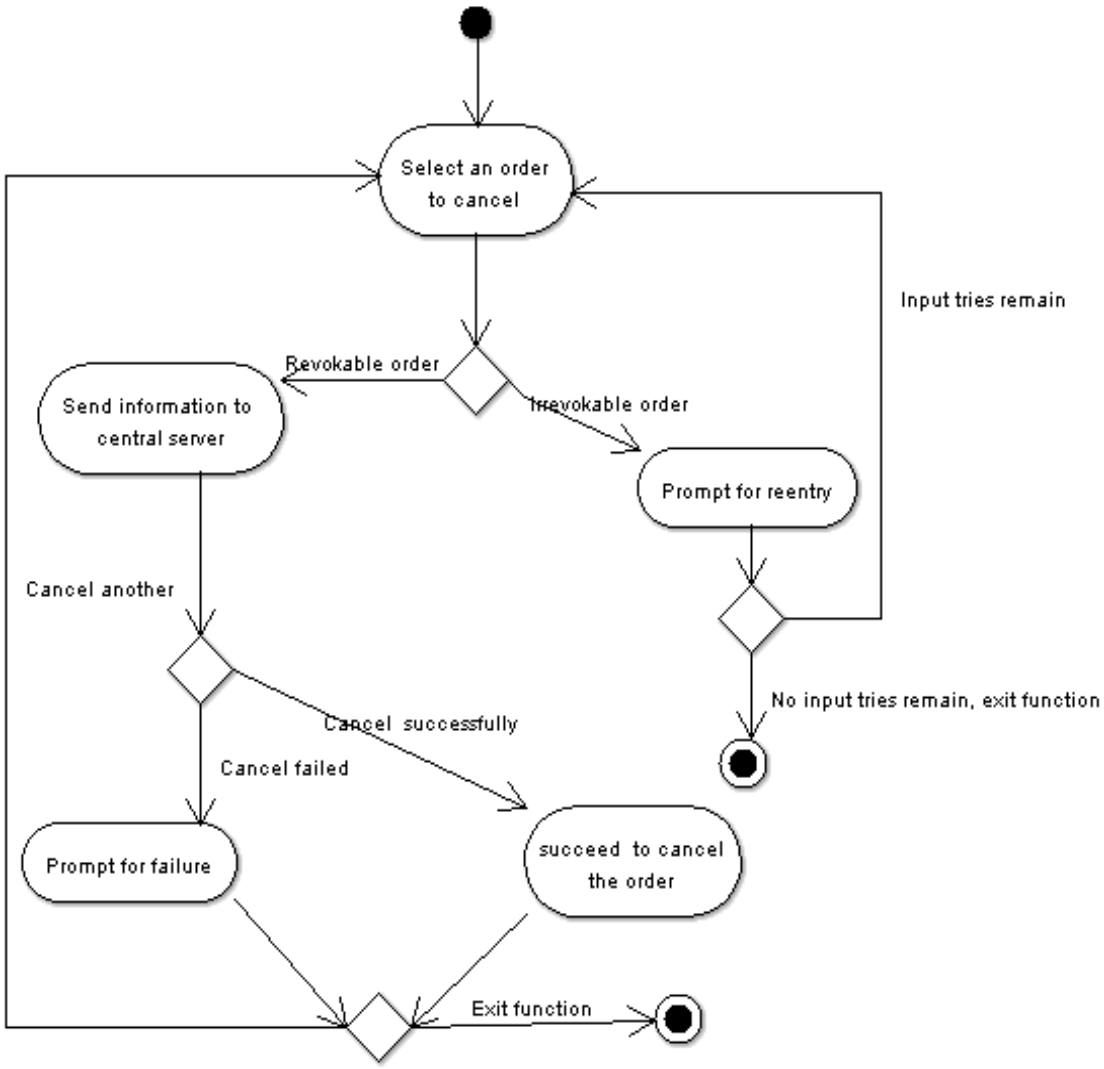
Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method search() in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.

Activity: Display the information of the stock
Related classes: StockSearch, Controller, Parser, DataCommunication
Description: class DataCommunication receives information of stocks from the

Central Trading System. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the Controller by invoking the method searchResult(). Class Controller then invokes responseReceived() in class StockSearch to display the result

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

6.3.7 Cancel Activity



Cancel Activity Diagram

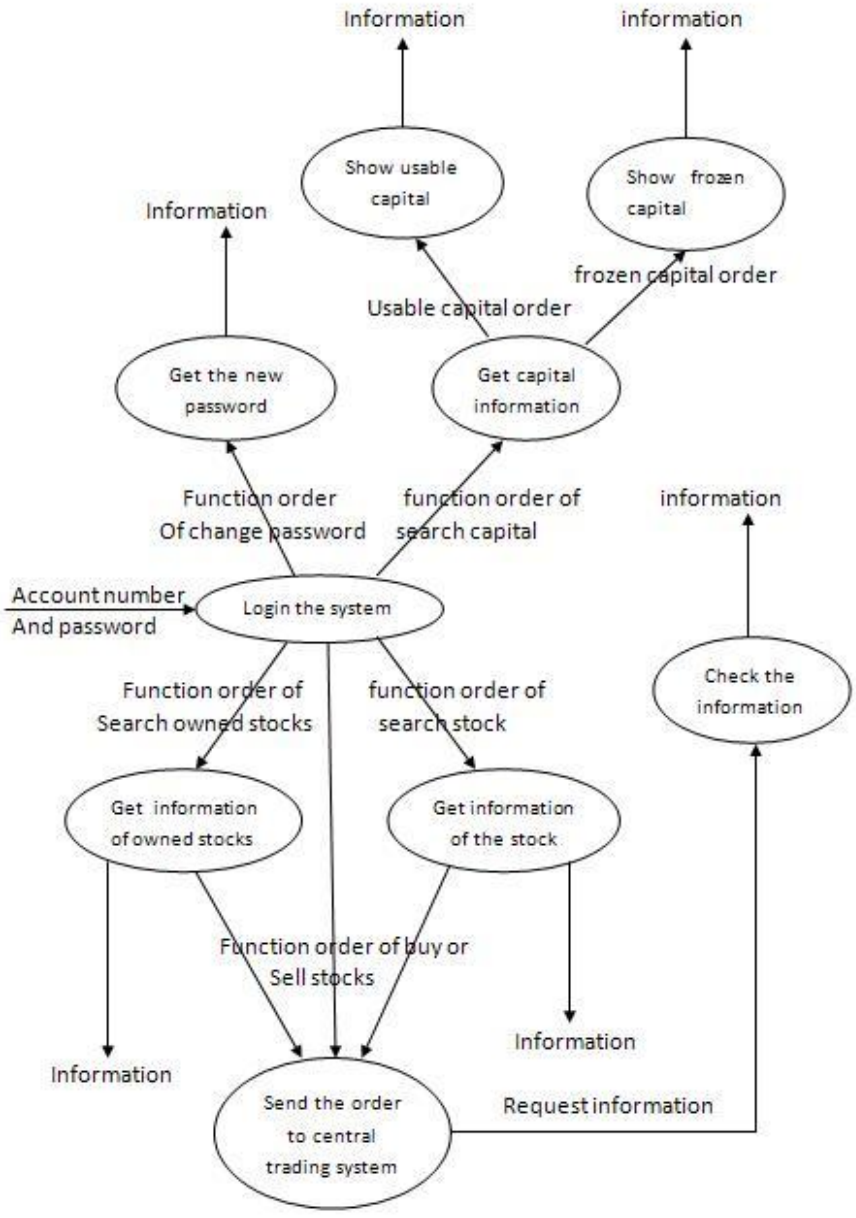
Activity: Select an order to cancel
Related classes: Controller, Orders
Description: user selects one order in the orders list and clicks the cancel menu to cancel the selected order.

Activity: Send information to central sever
Related classes: Parser, DataCommunication
Description: invoke method cancel() in class Parser and then class Parser invokes method send() in class DataCommunication to send parsed messages.
Activity: Succeed to cancel the order
Related classes: Orders, Controller, Parser, DataCommunication
Description: if the order canceled successfully, then a confirm message will be received in class DataCommunication. And then DataCommunication invokes method resolve() in class Parser to parse the coming message. After parsing it, class Parser informs the Controller by invoking the method cancelResult() to display the result.

Activity: Prompt for failure/ reentry
Related classes: JOptionPane
Description: invoke the static method showMessageDialog() in class JOptionPane to display messages.

7 Data Architecture

7.1 Local Data



Data Flow Diagram

7.2 Physical Data Structure

Parser: a class to parse messages on the basis of custom-defined protocol

Data: dc type: DataCommunication
Meaning: the layer used for communication with the server
controller type: Controller
Meaning: the GUI controller of the entire system

DataCommunication: a class to transfer messages between Client End of Trading and Central Trading System.

Data: Socket type: Socket
Meaning: Send and receive messages
Parser type: Parser
Meaning: Parse messages on the basis of custom-defined protocol
Out type: PrintWriter
Meaning: Output data flow
In type: BufferedReader
Meaning: Input data flow

PasswordChange: a class to implement the function that changes the password of the account.

Data: AccountIDJTF type: JPasswordField
Meaning: Check the account ID
AccountOldPwdJTF type: JPasswordField
Meaning: Get the old password
AccountNewPwdJTF type: JPasswordField
Meaning: Get the new password
ChangeJB type: JButton
Meaning: trigger the method the execute the function
NewPwdVerify type: JTextField
Meaning: show the result of the action

StockSearch: a class to query the database to find stock information

Data: stockKeyJTF type: JTextField
Meaning: Show the stock ID
Stock type: JTextField
Meaning: Show the stock name
stockDayMaxJTF type: JTextField
Meaning: Show the highest price in this day
stockDayMinJTF type: JTextField
Meaning: Show the lowest price in this day

stockWeekMaxJTF type: JTextField
Meaning: Show the lowest price in this week
stockWeekMinJTF type: JTextField
Meaning: Show the lowest price in this week
stockMonthMaxJTF type: JTextField
Meaning: Show the lowest price in this month
stockMonthMinJTF type: JTextField
Meaning: Show the lowest price in this month
stockCurPriceJTF type: JTextField
Meaning: Show current price
stockNoticeJTF type: JTextField
Meaning: Show remind information
buyJB type: JButton
Meaning: Trigger the method the execute the function

Order: a class to show the state and result of the orders which has been handed up to the central trading system

Data: orderJT type: JTable
Meaning: The table to show the state of the orders, including the order information and the result

Login: a class to allow the user login the system and check the validity of the account ID and password

Data: accountIDJTF type: JTextField
Meaning: Get the account ID
accountJPF type: JPasswordField
Meaning: Get the account password
VerifyCodeJTF type: JTextField
Meaning: Get the verify code
VerifyImg type: VerifyImg
Meaning: Show the picture that contains the verify code

VerifyImg: a class to create the verify image randomly

Data: verifyCode type: String
Meaning: Create a string randomly as the verify code
charMap type: char
Meaning: Get characters from the string

Controller: a class to control the switch of different classes

Data: stockBuy type: stockBuy
Meaning: Call the stockBuy class

stockSell type: stockSell
Meaning: Call the stockSell class
Login type: Login
Meaning: Call the Login class
CapitalQuery type: CapitalQuery
Meaning: Call the CapitalQuery class
myStockQuery type: MyStockQuery
Meaning: Call the MyStockQuery class
pwdChanges type: PwdChanges
Meaning: Call the PwdChanges class
orders type: Orders
Meaning: Call the Orders class

StockBuy: a class to accomplish the buy functions and related operations

Data: stockIDJTF type: JTextField
Meaning: Get the stock ID
stockNumJTF type: JTextField
Meaning: Get the quantity the user wants to buy
stockPriceJTF type: JTextField
Meaning: Get the limit price
capitalIDJPF type: JTextField
Meaning: Get the fund account ID
capitalPwdJPF type: JPasswordField
Meaning: Get the fund account password
buyJB type: JButton
Meaning: Trigger the method the execute the function

StockSell: a class to accomplish the sell functions and related operations

Data: stockIDJTF type: JTextField
Meaning: Get the stock ID
stockNumJTF type: JTextField
Meaning: Get the quantity the user wants to sell
stockPriceJTF type: JTextField
Meaning: Get the limit price
capitalIDJPF type: JTextField
Meaning: Get the fund account ID
capitalPwdJPF type: JPasswordField
Meaning: Get the fund account password
sellJB type: JButton
Meaning: Trigger the method the execute the function

CapitalQuery: a class to query the fund account information

Data: capitalIDJTF type: JTextField
Meaning: Get the fund account ID
TotalAmountJTF type: JTextField
Meaning: Show the total number of the fund
usableJTF type: JTextField
Meaning: Show the usable capital in the fund
frozenJTF type: JTextField
Meaning: Show the frozen capital in the fund
nextCapitalJB type:JButton
Meaning: Operation that gets the next fund account
previousCapitalJB type:JButton
Meaning: Operation that gets the previous fund account

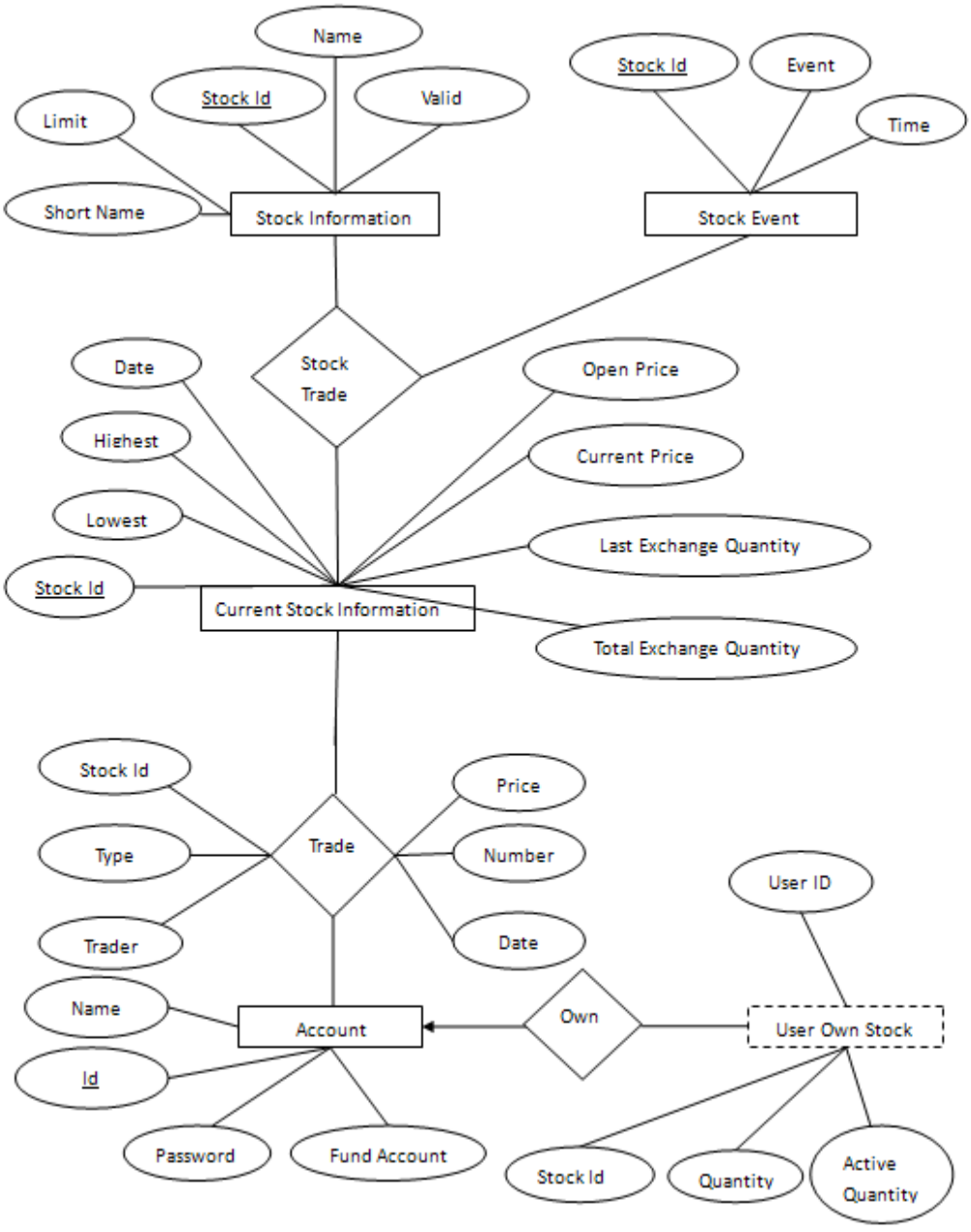
MyStockQuery: a class to query the stock that belongs to the user

Data: stockIDJTF type: JTextField
Meaning: Show the stock ID
stockNameJTF type: JTextField
Meaning: Show the stock name
stockNumJTF type: JTextField
Meaning: Show the stock quantity
stockPriceJTF type: JTextField
Meaning: Show the stock price when user buys it
holdingCostsJTF type: JTextField
Meaning: Show the total cost of the stock
profitsand lossesJTF type: JTextField
Meaning: Show the profit or the loss of trade
parser type: Parser
Meaning: Method to transfer the information
nextStockJB type:JButton
Meaning: Operation that gets the next stock information
previousStockJB type:JButton
Meaning: Operation that gets the previous stock information
sellStockJB type: JButton
Meaning: Operation that sells the own stock

7.3 Database Design

There is a database which stores all the information associated with this system. The information is formed as different tables. Among the tables, there are about six tables whose attributes will be used in the Client End.

Following is the E-R diagram for these tables:



E-R diagram

Table descriptions

Stock Information: the table records the basic information of the stock

Name	Type	Description
Stock ID	int	The serial number of the stock
Name	varchar(20)	The full name of the stock
Short Name	varchar(20)	The spell short name of the stock
Limit	tinyint	If the stock can be traded
Valid	float	The percent change of the stock

Stock Event: the table records big events associated with the stock

Name	Type	Description
Stock ID	int	The serial number of the stock
Time	timestamp	The time when putting out the event
Event	varchar(5000)	The detailed description of the event

Trade: the table records the trade orders which have been executed successfully

Name	Type	Description
Stock ID	int	The serial number of the stock
Date	timestamp	The time when orders are executed
Price	decimal(10, 2)	concluded price
Trader	char(15)	The account ID of the trader
Type	int	0 stands buying; 1 stands selling
Quantity	int	quantity transacted

Current Stock Information: the table records the newest information of the stock and some statistics about the stock

Name	Type	Description
Stock ID	int	The serial number of the stock

Date	datetime	Current time
Open Price	decimal(10, 2)	The primary price today
Current Price	decimal(10, 2)	Current price
Highest	decimal(10, 2)	The highest price in this day
Lowest	decimal(10, 2)	The lowest price in this day
Last Exchange Quantity	int	The trade quantity in last exchange
Total Exchange Quantity	int	The total quantity of all the trade on the stock

Account: the table records the name, quantity and the corresponding rights and interests and the change which the account investor holds

Name	Type	Description
Account ID	int	The serial number of the account
Name	char(50)	Holder name of the account
Password	char(15)	Password of the account
Fund	char(15)	Fund account ID related with the account

User Own Stock: the table records what stock, how much stock the user owns

Name	Type	Description
Stock ID	int	The serial number of the stock
User ID	char(15)	The serial number of the user`s account
Quantity	int	The total quantity of the stock user owns
Active Quantity	int	The quantity of the stock which user can sells currently

Data Dictionary

Data Name	Account ID
Description	necessary record for stock trader
Definition	A unique series of numbers to confirm the account
Where used	input for client trading system
Data Type	Char
Restriction	000000~999999

Data Name	Fund (Fund ID)
Description	necessary record for the fund capital
Definition	A unique series of numbers to confirm the fund account
Where used	input for client trading system
Data Type	Char
Restriction	000000~999999

Data Name	Account ID
Description	necessary record for stock trader
Definition	A unique series of numbers to confirm the account
Where used	input for client trading system
Data Type	Char
Restriction	000000~999999

Data Name	Useable capital
Description	useful part in the fund account
Definition	the money user can invest in the stock market
Where used	input for client trading system
Data Type	int
Restriction	0~999999999

Data Name	Frozen capital
Description	frozen part in the fund account
Definition	the money user has invested in the stock market
Where used	input for client trading system
Data Type	int
Restriction	0~999999999

Data Name	Stock ID
Description	necessary record for stock information
Definition	A unique series of numbers to distinguish the account
Where used	input for client trading system
Data Type	Char
Restriction	000000~999999

Data Name	Valid
Description	The biggest percent stock can change in one day
Definition	The limit margin for stock price which stock can rise or fall in one day
Where used	output when querying the stock information
Data Type	float
Restriction	>0

Data Name	Event
Description	Show the changes and latest information about the stock and the company
Definition	The description of important news of the stock
Where used	output when querying the stock information
Data Type	Char
Restriction	Can’t be too long (5000 characters)

Data Name	Open Price
Description	The start price of the stock on this day
Definition	The foremost price when no trade about the stock occurs
Where used	output when querying the stock information
Data Type	decimal(10, 2)
Restriction	>0

Data Name	Trade Orders
Description	A form including the stock ID, quantity, type, price and account ID to implement the trade
Definition	The order which users send to buy or sell stocks
Where used	input for client trading system
Data Type	Stock ID (char) + Quantity (int) + Type (int) + Price (int) + Account ID (char)
Restriction	Up to the request

Data Name	Active Quantity
Description	In all the stocks which belong to the user, some have been declared to be sold, then other stocks are the active ones
Definition	The quantity of the stock which belong the user that can be sold
Where used	output when querying the account information
Data Type	int
Restriction	>0

8 Interface Requirements

8.1 Required Interfaces

The Client end of trading mainly relates with the center trading system, so all the interfaces should support the correspondence between them. In our design, we use socket to realize orders exchanging between Client end of trading and center trading system. These orders are accepted by both groups. The following diagrams show the orders that will be sent to center trading system.

Function name	Login the system		
Order format	Function code(login)	Account number	password

Function name	Buy stocks					
Order format	Function code(buy)	Stock number	price	quantity	Capital account	password

Function name	Sell stocks					
Order format	Function code(sell)	Stock number	price	quantity	Capital account	password

Function name	Cancel orders			
Order format	Function code(recall)	Stock number	Order number	0(buy)
Order format	Function code(recall)	Stock number	Order number	1(sell)

Function name	Exit	
Order format	Function code(exit)	None

Function name	Search owned stocks	
Order format	Function code(QueryHoldStocks)	None

Function name	Change password			
Order format	Function code(ChangePassword)	Account number	Old password	New password

Function name	Search trade orders in one day	
Order format	Function code(QueryTradeInstruction)	None

Function name	Search stock information	
Order format	Function code(QueryStock)	Stock number

Function name	Search capital information	
Order format	Function code(QueryMoney)	None

Because the Client end will be several hundred at the same time, the order exchange will be very frequently. In this way, the system will be designed as multiprocessing system to meet the requirements.

8.2 External System Dependencies

The Client end of trading will mainly depend on the return orders from the Central trading system. So the following diagrams will show the return orders of each function from the Central Trading System.

Function name	**Login the system**
Return Order	LoginSuccess
Return Order	LoginReject; 2(Wrong account number or password)
Return Order	LoginReject; 3(duplicate login)

Function name	**Buy stocks**
Return Order	BuyInstructionSuccess, order number
Return Order	BuyInstructionReject; -5(Have not login the system)
Return Order	BuyInstructionReject; -1(The stock is not existed)
Return Order	BuyInstructionReject; 0(The stock trading is stopped)
Return Order	BuyInstructionReject; -2(The quantity is too small)
Return Order	BuyInstructionReject; -3(Wrong capital account or password)
Return Order	BuyInstructionReject; -4(Usable capital limited)

Function name	**Sell stocks**
Return Order	SellInstructionSuccess, order number
Return Order	SellInstructionReject; -4(Have not login the system)
Return Order	SellInstructionReject; -1(The stock is not existed)
Return Order	SellInstructionReject; 0(The stock trading is stopped)
Return Order	SellInstructionReject; -2(The quantity is too small)
Return Order	SellInstructionReject; -3(Quantity is more than owned)

Function name	**Cancel orders**
Return Order	RecallInstructionSuccess
Return Order	RecallInstructionReject; -2(Have not login the system)
Return Order	RecallInstructionReject; 0(The stock is not existed)
Return Order	RecallInstructionReject; 2(This buy order is not existed)
Return Order	RecallInstructionReject; 3(Syntax error)

Function name	Exit
Return Order	ExitSuccess
Return Order	ExitReject

Function name	Search owned stocks
Return Order	Stock number, stock name, quantity, current price, cost, profit and loss
Return Order	QueryHoldStacksReject; -2(Have not login the system)

Function name	Change password
Return Order	ChangeSuccess
Return Order	changeReject; -2(Wrong old password)

Function name	Search trade orders in one day
Return Order	QueryTradeInstruction; Buy(sell), stock number, stock price, quantity, order number, condition
Return Order	QueryTradeInstructionReject; -2(Have not login the system)

Function name	Search stock information
Return Order	QueryStock; stock number, stock name, current price, highest price in buy orders, lowest price in sell orders, highest price in that day, lowest price in that day, highest price in that week, lowest price in that week, highest price in that month, lowest price in that month, important notice of this stock.
Return Order	QueryStockReject; -2(Have not login the system)
Return Order	QueryStockReject; -1(This stock is not existed)

Function name	Search capital information
Return Order	Capital account, total capital, frozen capital, usable capital
Return Order	QueryMoneyReject; -2(Have not login the system)

Function name	After Central Trading System handle buy or sell orders
Return Order	BuySuccess, stock number , original price, current price, original quantity, current quantity
Return Order	SellSuccess, stock number , original price, current price, original quantity, current quantity

After the Client end of trading get these orders, system will check the information to confirm the accurate. Then the Client end of trading will show the results to users.

9 User Interface

The Client end of trading is the bridge between users and system, so the users' interfaces are very important. To users, usable and comprehensive functions are the most important. Besides, a friendly and convenient Contact surface is the key element, too. As the user community is varied, all the possible situations should be considered carefully. The following diagram shows the user community.

Age	From 20 to 60 years old
Education condition	From primary school to university
Computer familiar degree	Beginner in majority

9.1 Interface Design

A login interface is necessary in the design. In order to meet the users' requirement, a friendly and clear interface is necessary. Therefore, only the account, password and verify code will be added to the login interface. The purpose of verify code is to confirm the security of users' accounts. After users input all the information, they can click the "login" button.

To users, convenience and efficiency are the most important elements for function interface. All the functions will be combined in only one interface. After login successfully, the function interface will be shown to users. On the function interface, we can see all the function buttons: search stocks, search owned stocks, buy stocks, sell stocks and change password. On the right side, we can get information of capital with the account and capital account. On the bottom is the information of all the orders in one day.

With the function interface, users can do their operations. For example, if users want to buy stocks, he or she can click the buy stock function button. Then the following diagram will been shown to users. After inputting the necessary information, click the “buy” button to finish the activity.

9.2 Functionality

The following diagrams will show the relation between users' input and each function.

Function name	Login the system		
Users' input	Account number	password	Confirmation code
General output	Success(Function interface)	Failed(Error Dialog Box)	

Function name	Buy stocks			
Users' input	Stock number (stock name)	quantity	Capital account	Capital password
General output	Success(owned stocks and capital change)	Failed(Error Dialog Box)		

Function name	Sell stocks			
Users' input	Stock number (stock name)	quantity	Capital account	Capital password
General output	Success(owned stocks and capital change)	Failed(Error Dialog Box)		

Function name	Change password	
Users' input	Old password	New password(twice)
General output	Success	Failed (Error Dialog Box)

Function name	Search owned stocks
Users' input	Click the search button
General output	Information of owned stocks

Function name	Search stock information
Users' input	Stock number (stock name)
General output	The highest and lowest price of the stock so far, in one month, one week and one day. Important notes of the stock.

Function name	Cancel orders	
Users' input	Click the cancel button	
General output	Success(show the order number)	Failed(Error Dialog Box)

Function name	Exit system
Users' input	Click the exit button
General output	Close the function interface

Function name	Search all the orders in one day
Users' input	None
General output	Show information of all the orders in one day

Function name	Search capital information
Users' input	None
General output	Total capital, usable capital, frozen capital

10 Error Handling Design

Errors	Cases	Outputs	Handling
Information input error	1. Users input wrong account number or wrong password. 2. Users input wrong stock name or wrong stock number.	A dialog box will remind users about the error.	By remind users the reasons
Information flaw	1. Users forget to input the account number or password. 2. Users click the search button but haven't input stock name or stock number.	A dialog box will remind users about the error.	By remind users the reasons
The information does not tally with the reality	The price of predetermined stocks is more than usable capital.	A dialog box will remind users about the error.	By remind users the reasons
Program error	To deal with too much information at the same time may cause the system collapse	The data will be saved, then exit the system Automatically.	By program design
Other error	One account can't login the system twice at the same time.	A dialog box will remind users about the error.	By remind users the reasons

11 Appendix

11.1 Group List

Name	Student Number	Telephone	E-mail
高石	3062211074	13656648835	06rjgcgs@st.zju.edu.cn
金立	3062211079	13656655870	06rjgcjl@st.zju.edu.cn
甘锡云	3062211081	13857162301	06rjcggxy@st.zju.edu.cn
徐德超	3062211071	15988487336	xdcs@zju.edu.cn

11.2 Version and Changes

Version	Date	Brief summary of changes
1.0	2008-10-12	This is the first version of Software Design Document.
1.1	2008-10-26	Update the Architecture Context Diagram. Update the Activity Diagrams. Update the interface requirements. Update the user interface
1.2	2008-10-31	Update the detail design Update the class diagram Update the activity diagrams