Software Requirement Specification

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1. Introduction

1.1 Intention

This document describes the functional requirements and non-functional requirements of `A+Quant: a machine-learning based asset quantitative management system`.The development team's implementation and verification work toward our software system is based on this document.

Unless specially stated, all the requirements contained in this document are requirements with high priority.

1.2 Scope

The A+Quant system is a business system developed for individual investors. The goal of the system is to help the individual investor allocate his/her funds among the stock market, bond market and commodity market to get a desired income rate and a corresponding minimal risk rate.

Through the application of the A+Quant system, we expect to allocate assets for individual investors, make adjustments automatically, and help them to obtain a income rate more than the bank interest rate at the same period.

1.3 References

1.The IEEE standard

2.General Description

2.1 Commodity prospects

2.1.2 Background and Opportunity

First of all, the traditional one-on-one manual service, only for high-net-worth people, high investment threshold, high management rate and other characteristics, it is difficult to meet the rapidly changing customer groups and needs. Secondly, due to the above reasons, more and more financial institutions have introduced solutions called “smart investment”.

The A+Quant system is a smart investment system developed for the needs of individual investors and includes a web server. The web server stores all user data and a part of the financial data, and another part of the financial data is obtained through the online API. The user completes daily work through the desktop web server or the mobile phone PWA client, and the web end or the PWA client and the web server use real-time communication to complete data exchange.

2.3 Constraints

- CON1：The system is deployed on a Windows Server
- CON2：The system uses the web interface

2.4 Assumptions and Dependencies

- AE1： Users will accurately fill in the questionnaire about expected benefits and risks to give a suitable portfolio recommendation.
- AE2：The large-scale asset evaluation system and multi-factor evaluation system can appropriately evaluate the performance of each asset in a certain period of time.
- AE3：Other important assumptions corresponding to different asset allocation strategy models

3.External interface requirements

3.1 External interface requirements

3.1.1 UI (User Interface)

- References the interface prototype

3.1.2 CI (Communication Interface)

- CI：http

3.2 Cases and functional requirements

3.2.1 Registration and filling in the questionnaire.

- **Feature description**：Unregistered users must register, fill in and log in to start using the system.
- **Priority**：High
- **Functional demand and stimulus-response sequence**：

  SR1-1: SignUp

  Stimulus: User input has not registered our system username, mailbox and two times consistent passwords.

  Response: The system prompts the user to enter the verification code in the authentication mail.

  SR1-2: SignUp.Input.Invalid

  Stimulus: Users enter user names, mailboxes and passwords that have been registered on our system.

  Response: System prompts users to enter errors.

  SR1-3: SignUp.Email.Valid

  Stimulus: The user correctly entered the verification code in the authentication mail.

  Response: the system prompts the user to authenticate successfully.

  SR1-4: SignUp.Email.Invalid

  Stimulus: The user did not enter the authentication code in the authenticated mail correctly.

  Response: The system prompts the user for failed authentication.

  SR1-5: SignUp.Questionnaire

  Stimulus: Users fill out risk assessment questionnaire .

  Response: The system hint risk assessment success.

3.2.2 Login

- **Feature description**： Registered users must log in to start using the system.

- **Priority：** High
- **Functional demand and stimulus-response sequence：**

  SR2-1: Signin.Valid

  Stimulus: The user enters the correct combination of user name and password.

  Response: The system jumps to the users' home page.

  SR2-2: Signin.Invalid

  Stimulus: The user enters the wrong combination of user name and password.

  Response: The user is prompted for error of user name and password.

  SR2-3: Signin.Forget.Mail

  Stimulus: The user clicks the button of forgetting password.

  Response: The system sends a message to reset password to the mail reserved for the user.

  SR2-4: Signin.Forget.Reset

  Stimulus: The user clicks on the link in the email to reset password.

  Response: The system opens a page that resets the password.

  SR2-5: Signin.Forget.Valid

  Stimulus: The user repeats the input of the same new password twice.

  Response: The user is prompted to reset the password successfully and jump to the login page.

  SR2-6: Signin.Forget.Invalid

  Stimulus: The user repeats the new password twice, but it is inconsistent.

  Response: The system prompts the user to enter inconsistency twice, please re-enter.

3.2.3 Modification of personal information

- **Feature description：** Users who are already logged in can modify their personal information.
- **Priority：** High
- **Relevant functional needs and stimulus/ corresponding sequences:**

Stimulus: Purchasing staff requests to develop a bill of entry.

Response: System automatically generates the number for the incoming bill.

3.2.4 Management of asset account lists

- **Feature description：** After the user logs in, the user can manage the list of purchased asset accounts.
- **Priority：** High
- **Functional demand and stimulus-response sequence：**

  SR4-1: Account.Show

  Stimulus: The user views asset account list.

  Response: The system displays asset accounts purchased by users, asset accounts recommended by the system, and buttons for creating asset accounts

  SR4-2: Account.Create.Input

  Stimulus: The user clicks to create a new asset account.

  Response: The system prompts the user to enter the investment amount, the investment period, the investment return rate and the investment risk. The return on investment and investment risk have been filled in the default value according to the previous user questionnaire.

  SR4-3: Account.Create.Confirm

  Stimulus: The user clicks to create a new asset account.

  Response: The system prompts the user to enter the investment amount, the investment period, the investment return rate and the investment risk. The return on investment and investment risk have been filled in the default value according to the previous user questionnaire.

  SR4-4: Account.Remove.Warn

  Stimulus: The user deletes an unpurchased asset account.

  Response: The system prompts the user whether to delete.

  SR4-5: Account.Remove.Success

  Stimulus: The user confirms deletion of an unpurchased asset account.

  Response: The system prompts the user to delete successfully.

3.2.5 Purchase and redemption of asset accounts by users

- **Characteristics description：** After the user logs in, the user can buy the asset account not bought from the list of asset accounts and the recommended asset account, and can redeem the purchased asset account.
- **Priority：** High
- **Functional demand and stimulus-response sequence:**

  SR5-1: Account.Purchase.Warn

  Stimulus: An initial transaction is made when a user preview an unpurchased asset account or a recommended asset account.

  Response: The system shows the liability clause and prompts the user whether to continue.

  SR5-2: Account.Purchase.Call

  Stimulus: The user chooses to proceed with the initial transaction.

  Response: The system calls Citigroup API to transfer the principal set up by the user from the bank card of Citibank bound by the user to the investment bank account dedicated to the system, and the handling fee is borne by the user.

  SR5-3: Account.Purchase.Fail

  Stimulus: Citi API prompts for failed transfer from the user to the system.

  Response: The system prompts the user to fail to buy

  SR5-4: Account.Purchase.Success

  Stimulus: Citi API prompts successful transfer from user to system .

  Response: The system prompts user to buy successfully.

  SR5-5: Account.Redeem.Warn

  Stimulus: The user chooses to redeem the asset account when it is set up.

  Response: The system shows the liability clause and prompts the user whether to continue.

  SR5-6: Account.Redeem.Call

  Stimulus: The user chooses to proceed with the initial transaction.

  Response: the system calls Citi API to transfer the principal and income of the user from the investment bank account dedicated to the system to the bank card of Citibank, which is bound by the

user, and the handling fee is deducted from this part of the fund

SR5-7: Account.Redeem.Fail

Stimulus: Citi API prompts fail to transfer from the system to the user.

Response: System prompts user to fail to redeem.

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**SR5-8: Account.Redeem.Success**
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Stimulus: Citibank API prompts for successful transfer from the user to the system.

```
Response: System prompts user to success to redeem.
```

3.2.6 Users view the overall performance of asset accounts

- **Feature description:**After the user logs in, the user can view the overall performance of the asset account not purchased in the asset account list and the recommended asset account.
- **Priority**：High
- **Functional demand and stimulus-response sequence:**

  SR6-1: Account.Overview.Unpurchased

  Stimulus: Click on an unpurchased asset account or a recommended asset account.

  Response: The system displays the expected annualized yield, expected volatility, historical two-year return curve, stock bond and commodity market matching preview and matching details of the asset account allocation scheme. A list of initial transactions and buttons prompt the user for the initial transaction.

  SR6-2: Account.Overview.Purchased

  Stimulus: User clicks on purchased asset account.

  Response: The system shows the cumulative income of the asset account allocation scheme, the expected annualized rate of return, the rate of return today, the initial time, the initial investment, the return curve from the beginning to the present, stock, bond and commodity market matching preview and matching details. The system also shows each adjustment ratio of the stack histogram and adjustment history.

3.2.7 Users view the performance of asset accounts in the stock market

- **Feature description: **After the user logs in, the user can view the performance of purchased asset accounts in the asset account list on the stock market.

- **Priority：** High
- **Functional demand and stimulus-response sequence:**

  SR7-1: Account.Stock

  Stimulus: Users check stock market performance of purchased asset accounts.

  Response: The system shows the initial time of the asset account allocation scheme in the stock market, the ratio of the total value to the asset account, the current position list, and the latest trading list.

  SR7-2: Account.Stock.Performance

  Stimulus: Users check the stock market revenue performance of purchased asset accounts.

  Response: The system shows the excess dynamic retreat and excess yield of the asset account allocation scheme in the stock market.

  SR7-3: Account.Stock.Attribution

  Stimulus: Users check the attribution analysis of stock market of purchased asset accounts.

  Response: The system shows the style profile of the asset account allocation scheme in the stock market. The chart shows the style timing and the contribution of style stock selection to the income.

  SR7-4: Account.Stock.Scenario

  Stimulus: Users check the stock market scenario analysis of purchased asset accounts.

  Response: The market segmentation and factor sensitivity analysis chart of the asset account allocation scheme in the stock market are presented by the system. The market segmentation chart shows the market has risen significantly, market has risen volatility, markets have fallen significantly, and market has fallen volatility and its cycles, weekly yield ranges and scenario earnings account for the proportion. Factor sensitivity analysis chart shows the standardized rate of return of different volatility factors under linear fitting and curve fitting.

3.2.8 Users view the performance of asset accounts in the bond market

- **Characteristic description：** After the user logs in, the user can view the bond market performance of the purchased asset account in the asset account list.
- **Priority：** High
- **Functional demand and stimulus-response sequence：**

  SR8-1: Account.Bond

Stimulus: The user looks at the bond market performance of the asset account purchased.

Response: The system shows the initial time, duration, current yield, current total value, current total value relative to assets account and current position list of the asset account allocation plan in the investment of credit and interest rate debt.

SR8-2: Account.Bond.Credit

Stimulus: Users view in-depth credit analysis of the bond market for purchased asset accounts.

Response: The system shows the credit debt valuation table and credit debt risk index table of the asset account configuration scheme. The valuation table gives the monthly valuation of the credit debt, the risk indicator table gives the quarterly valuation correction, the asset-liability ratio, the cash flow ratio and the credit rating.

SR8-3: Account.Bond.Rate

Stimulus: Users view in-depth analysis of interest rate debt in the bond market for asset accounts purchased.

Response: The system shows the interest rate debt valuation form of the asset account allocation plan and the interest rate debt valuation modified duration form. The valuation form gives the monthly valuation of the credit debt, and the valuation correction form gives the change of the duration of the interest rate debt valuation with the quarter.

3.2.9 Users look at the performance of the asset account in the commodity

- **Characteristic description：** After the user logs in, Users can view the performance of purchased asset accounts in the commodity market on the asset account list.
- **Priority：** High
- **Functional demand and stimulus-response sequence:**

  SR9-1: Account.Product

  Stimulus: The user looks at the performance of the purchased asset accounts in the commodity market.

  Response: The system shows the initial time, current rate of return, current total value, current total value relative to assets account and current position list of the asset account allocation plan in crude oil futures and crude oil spot investment.

  SR9-2: Account.Product.Analysis

  Stimulus: The user looks at the depth of the commodity market for the asset account purchased

Response：The system shows the daily rate of return chart, combination rate of return chart, total rate of return chart, scene analysis data table, comparison chart with market benchmark, factor sensitivity analysis chart and residual analysis chart of the asset account configuration scheme. The daily yield charts display of crude oil futures, spot and its combination of yield trend with time, the combination yields charts and total yield charts show portfolio yield and total yield respectively, along with the change of date scene analysis data table shows the current week sharpe ratio, Calmar ratio, maximum yield, minimum weekly return, volatility and maximum retracement. The comparison chart with the market benchmark shows the change of the south China crude oil market benchmark, south China index market benchmark and portfolio yield with the date. The factor sensitivity analysis graph shows the standardized rate of return of different volatility factors under linear fitting and curve fitting. The residuals analysis chart shows how residuals change with the date.

3.2.10 Users look at the transaction record of the asset account

- **Characteristic description**：After the user logs in, users can view the transaction records of purchased asset accounts in the asset account list.
- **Priority**：High
- **Functional demand and stimulus-response sequence:**

  SR10-1: Account.Transaction

  Stimulus: The user looks at the transaction records of the purchased asset accounts.

  Response: The system displays daily transaction records, each row of which includes time, type, contract code, buy or sell, volume, price and volume.

3.2.11 Users check positions in asset accounts

- **Characteristic description**：After log in, users can check the position of the asset that has been purchased in the asset account list.
- **Priority**：High
- **Functional demand and stimulus-response sequence:**

  SR11-1: Account.Position.Daily

  Stimulus：Users check daily positions of purchased asset accounts.

  Response：The system displays the daily position sheet, each row of which includes date, contract code, current price, holdings, total, profit or loss and cost.

  SR11-2: Account.Reallocation

Stimulus：Users check the convertible position records of the purchased asset account.

Response：The system displays the daily convertible position records, each row of which includes time of the position adjustment, stock allocation ratio, fund allocation ratio and commodity market allocation ratio in this change.

SR11-3: Account.Reallocation.Detail

Stimulus：Users check details of the convertible position records of the purchased asset account.

Response：The system shows the proportions of the stock market, bond market and commodity market to the whole asset account in the previous and current period, as well as the pie chart of the previous allocation and current allocation.

SR11-4: Account.Reallocation.Detail.Transaction

Stimulus：Users check the details of the purchase asset account.

Response：The system displays daily transaction records in stock market, bond market and commodity market, each row of which includes time, category, contract code, buy or sell, volume, price and turnover.

3.2.12 Users set the asset account

- **Characteristic description：：** After logging in, users can set purchased asset accounts in the asset account list to satisfy diversified automated transactions.
- **Priority：** High
- **Functional demand and stimulus-response sequence:**

  SR12-1: Account.Setting.Plan Stimulus: Users add automatic transaction time, reminding time, automatic transaction threshold and default operations when manually confirming are omitted of the asset account and save it.

  Response：System saves automatically.

3.2.13 System adjusting warehouse

- **Characteristic description：** Daily market conditions fluctuate, exceeding the threshold set by the system and the system adjusts its position to obtain the appropriate return.
- **Priority：** High
- **Functional demand and stimulus-response sequence:**

  SR12-1: Account.Reallocate

Stimulus：Daily market conditions fluctuate beyond the threshold set by the system.

Response：The system adjusts the warehouse to the user.

3.3 Non-Functional Requirements

3.3.1 Security

- Safety1:the system should only allow access to verified and authorized user accounts.
- Safety2:the system uses OAuth2.0 to bind a user account to a Citi card.

3.3.2 Maintainability

3.3.3 Ease of use

- Usability1：the system shall inform users of the planned transaction on the platform and by email before the planned transaction.

3.3.4 Reliability

3.3.5 Business Rules

3.3.6 Constraints

- CON1：The system is deployed on a Windows Server
- CON2：The system uses a Web interface.

3.4 Data Requirements

3.4.1 Default Data

- Default asset account automatic trading setup
  - Trading time：15:00 UTC+8
  - Advance notice time：1h
  - Manually confirm the transaction amount threshold：20,000 RMB
  - Default operation wait time：2h
  - Default operation：confirm transaction