

Research Article

The Default Risk of Bank Customers Based on Embedded Microprocessor Wireless Communication under the Internet Finance Background

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Internet finance refers to a new financial business model in which traditional financial institutions and Internet enterprises use Internet technology and information and communication technology to achieve capital financing, payment, investment, and information intermediary services. Embedded microprocessors have more than 32-bit processors with high performance. And it is small in size, light in weight, and low in cost. This article aims to explore the default risk of bank customers based on embedded microprocessor wireless communication under the background of Internet finance and how to control the credit risk of bank customers and help to clarify the development direction of Internet finance. Based on multimedia technology and orderly logistics model, this article designs a customer default credit risk management system. In order to test the performance of the bank customer credit risk management system, a small customer credit evaluation system was created. The experiment proves that the customer credit evaluation system can well realize risk evaluation and risk early warning and promote the sustainable development of the bank. At the same time, the system can be applied to most scenarios in the financial industry.

1. Introduction

With the reform of interest rate marketization, the traditional model relying on spreads and scale expansion to achieve high-profit growth faces serious challenges. Internet technology and the traditional financial industry began to integrate. The rapid development of Internet finance and the concept of continuous innovation have been driving traditional financial institutions to change their business models and service models. The issue of customer credit risk management is imminent. The development and use of embedded systems have enabled people to find a way to solve the problem. The characteristics of high portability and strong stability of embedded systems have made more and more people begin to invest in research. The pace of financial innovation has accelerated, and Internet finance represented by Internet payment, online loans, and crowdfunding has developed rapidly. As a representative of the traditional banking industry, commercial banks actively carry out

Internet business and services, and adopting a more distinctive and differentiated marketing strategy is an inevitable choice for the development of the times [1–3].

With the continuous integration of Internet technology and commercial banking, the risks faced by commercial banks are also increasing. In the context of Internet finance, commercial banks face this. Commercial banks use Internet technology to optimize the business functions, product functions, and service functions of online banking. For example, when using the Internet for intermediary business, you can use the Alibaba microfinance model to expand personal, small, and micro enterprise loans; banks should actively cooperate with relevant industries and market departments and realize foreign exchange products, gold products, capital products, and financial derivatives. For online sales, banks should also develop e-banking services, establish e-commerce platforms, promote online banking to external users, and integrate multiple functions to increase revenue from intermediary businesses.

In the 2015 government work report, it is clearly stated that it is necessary to promote the development of Internet finance, which means the development of Internet finance in China.

The risks include customer information security risk, payment system security risk, cash laundering risk, liquidity risk, market risk, interest rate risk, and credit risk of customer default [4, 5]. This article mainly studies the bank's Internet financial credit business—medium customer default credit risk.

Credit risk refers to the possibility that the debtor will not perform the contract or fail to fully perform the contract, resulting in the loss of the creditor. In the bank credit business, the credit risk refers to the possibility that the lender cannot return the loan on time according to the agreement reached with the bank or the loan amount is lower than the agreed amount, resulting in a certain loss of the bank. Compared with traditional commercial banks, the Internet faces a wider range of participants, including borrowers, Internet service providers, and network equipment vendors. In the absence of effective credit risk management, its default rate will be far greater than the commercial bank credit risk default rate [6].

The traditional commercial bank's credit risk management process for customers is divided into five steps: credit investigation, credit initial evaluation, credit review, credit recognition, and credit tracking adjustment. In the process of risk management, the mutual trust between the bank and the customer is not high, the customer risk management mechanism is not perfect, and the customer profile information is not updated in time, and continuous dynamic monitoring cannot be formed. With the advancement of the Internet, the bank's control over customer credit risk still has the following problems: first, the credit risk organization structure is not perfect, second, the credit risk information management system needs to be strengthened, and third, it fails to effectively prevent the infection of credit risks [7, 8]. In this context, this article proposes to use multimedia technology to build a customer credit risk management system to solve the current shortcomings of credit risk management.

As an important development direction of computer technology, multimedia has changed the insufficiency of traditional computers to deal with digital and text information alone, enabling computers to comprehensively process sound, text, and graphic information and with image, rich and convenient interactivity. The improved man-machine interface has changed how computers are used, opening the door for computers to enter the realm of human life and production and opening up a very broad market for the computer industry. In the long run, the bright future of multimedia technology has been widely accepted.

Multimedia technology has three distinct features: integration, interactivity, and comprehensiveness. Integrated multimedia technology can simultaneously process three media: sound, graphics, and text. Generally speaking, the interactivity of multimedia technology means that both users and computers can exchange information under the interaction. Each user is both a consumer of information and a provider of information. Comprehensive multimedia

technology integrates various media into an organic whole and cooperates with each other to express various actual information and changes in real time.

The application of multimedia technology is more and more extensive. For the current application, multimedia applications mainly appear in the following aspects: CAI teaching, games and entertainment, electronic publications, multimedia display, and information inquiry system. Far more than this, this article will study the application of multimedia technology in the bank customer credit risk information management system [9, 10].

The contribution of this article is to use multimedia technology to design and implement the bank customer default risk management system under the background of Internet finance and strictly control the default risk of customers in the process of developing commercial banking Internet financial services: in the early stage of financial business, through the prediction of customer default risk, customer screening, through information cross-matching to prevent fraud risks; in the business development process, through customer credit to prevent credit risk; in the final link, through risk monitoring to provide users with security, convenient and efficient Internet financial credit service. The design of the system is based on the ordered logistic model, designing relevant functions according to the needs of commercial banks, using the logistic model [11] structure, and using Apache Shiro [12], jQuery, and MyEclipse web development technology implementation system [13, 14].

1.1. The Theoretical Basis of Bank Customer Default Risk Management. Most credit risk management models summarize the characteristics of default customers and quality customers from historical data, summarize the influencing factors of credit risk, and then construct a model to quantitatively characterize customer credit risk. Specifically, the most widely used models include discriminant analysis [15], neural network model [16], and logistic regression model [11]. In this article, by comparing the above models, the advantages and disadvantages of each model are analyzed, and the applicability of the ordered logistic model is proposed.

1.2. Construction of Ordered Logistic Model. The most significant difference between the ordered logistic regression model and the traditional binary logistic model is that the number of dependent variables is increased from two to more, and the values of multiple dependent variable probabilities are hierarchical. The previous data processing steps are consistent with the binary logistic regression. The credit variable is unified into the WOE transformation of the original data, and the WOE (weight of evidence) value is generated from the original data for logistic regression. This method is most commonly used in the industry. Prior to this, factor analysis was performed on various types of amount variables that may have collinearity, and the common factors were extracted. The different classifications of each variable were transformed into a specific value and incorporated into a logistic regression, as shown in Figure 1.

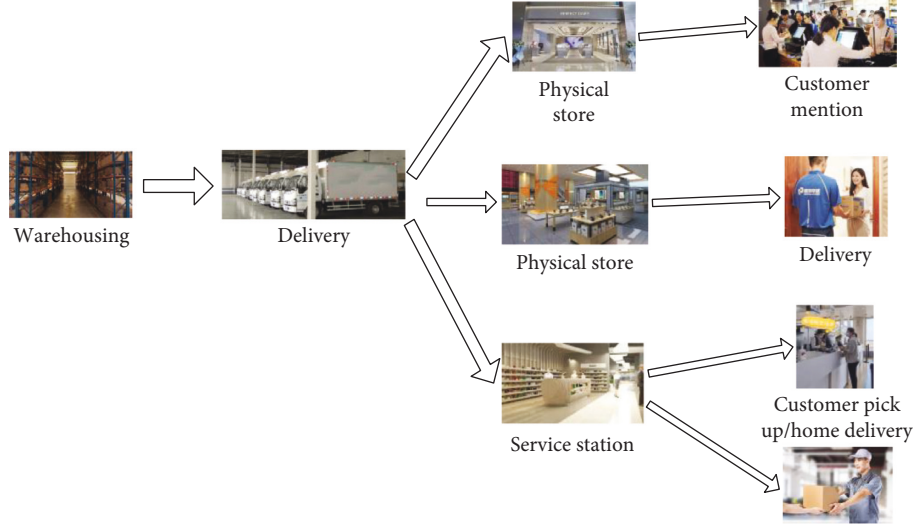


FIGURE 1: Orderly logistics distribution.

For category i of a nominal variable, or a segment of a continuous variable, WOE can be defined as follows:

$$WOE_i = LN(B/G). \quad (1)$$

Logistic regression is performed by replacing the original variable with the value of WOE. The larger the WOE value, the higher the ratio of the dependent variable to 1 in the data interval. The traditional binary regression equation after fitting is as follows:

$$\log(\text{odds}) = a + \sum_{i=1}^n \beta_i \times \text{woe}_i. \quad (2)$$

An ordered multiclassification model can be used as an appropriate estimation model when the explanatory variables are more than only the two states of default and nondefault, and the classification is as follows:

$$\ln \left\{ \frac{p(y \leq i|x)}{[1 - p(y \leq i|x)]} \right\} = u_i - \left(a + \sum_{j=1}^j \beta_j X_j \right). \quad (3)$$

The ordered logistic model, also known as the “cumulative classification” regression model, can predict the cumulative formula:

$$p(y \leq i|x) = p(y \leq u_i|x) = \frac{e^{u_i - (a + \sum_{j=1}^j \beta_j X_j)}}{e^{u_i - (a + \sum_{j=1}^j \beta_j X_j)} + 1}. \quad (4)$$

Once the cumulative probability is calculated, the probability of belonging to a particular category can be calculated:

$$\begin{aligned} p(y = 1) &= p(y \leq 1), \\ p(y = 2) &= p(y \leq 2) - p(y \leq 1), \\ p(y = i) &= 1 - p(y \leq i - 1), \\ p(y = 1) + p(y = 2) + \dots + p(y = i) &= 1. \end{aligned} \quad (5)$$

There are order relationships in different categories of default probabilities (that is, the probability of default is increased in turn). It is suitable to use the ordered multiclass logistic model for regression analysis of data. The model contains three ordered classification functions:

$$\begin{aligned} \ln \left(\frac{p_1}{p_2 + p_3 + p_4} \right) &= \beta_1 - \sum_{j=1}^j \beta_j X_j, \\ \ln \left(\frac{p_1 + p_2}{p_3 + p_4} \right) &= \beta_2 - \sum_{j=1}^j \beta_j X_j, \\ \ln \left(\frac{p_1 + p_2 + p_3}{p_4} \right) &= \beta_3 - \sum_{j=1}^j \beta_j X_j. \end{aligned} \quad (6)$$

In formula (6), p_1, p_2, p_3, p_4 indicates the may settle in advance, normal, suspicious, and loss. When there are K categories of dependent variables recorded as $N_1, N_2 \dots N_4$, the ordered multiclass regression results will have K-1 thresholds, denoted as $U_1, U_2 \dots U_{K-1}$. If $U_{i-1} < Y' \leq U_i$, then $Y = N_i$.

1.3. The Architecture and Verification Method of Wireless Communication for High-Confidence Embedded System. In the functioning of society, trust is often the overall expectation that the words, promises, and statements of others can be trusted. The belief that one dares to trust because one believes sustains the shared values and stability of society. This thinking also applies in the computer world, where failure to function properly can occur if trust is broken. A trusted computing base (TCB) is the sum of hardware, firmware, and software required to perform key functions or security protection mechanisms in a computer system. Once any component in the trusted computing base fails or has a security breach, it may cause harm to the safe operation of the entire system. In traditional embedded systems, because application tasks, kernels, and system software run in the

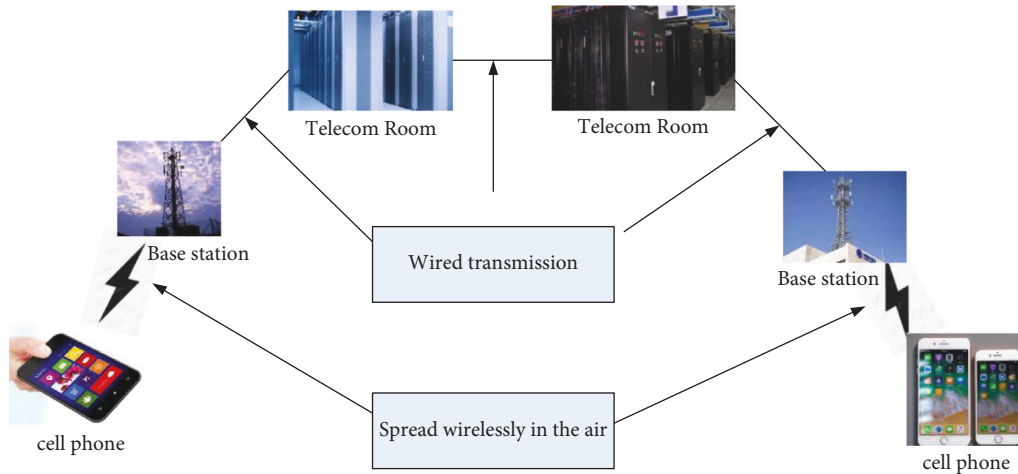


FIGURE 2: Common wireless propagation process.

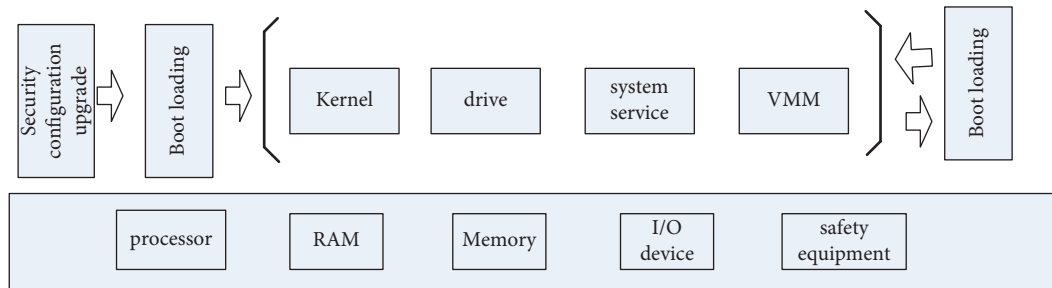


FIGURE 3: Schematic diagram of safety requirements for embedded systems.

same address space, tasks can access any function and data in the system. Therefore, the entire software and hardware platform is regarded as a trusted computing base for the secure and reliable execution of embedded systems. Although the greater the coverage of the trusted computing base, the higher the possibility of system security problems, this is acceptable for traditional embedded platforms because relatively fixed functions and closed execution environments make all application tasks and systems. Modules can be treated or verified as trusted components. The process of wireless communication is shown in Figure 2.

1.3.1. Safety Requirements. The core of high-confidence embedded software security requirements is to protect the correct execution of critical tasks without the leakage of security-critical information. In a system where there may be untrusted components (as shown in Figure 3), the security requirements can be decomposed into the following aspects.

Ensure the isolation between applications and between applications and systems. Component isolation is the basis for achieving higher-level system security strategies, and it is also an effective way to reduce damage caused by application failures. If there is no isolation between the application and the system, malicious or invalid application tasks can damage the kernel or prevent the implementation of security services in the kernel. If there is no isolation between applications, the code or data that performs critical tasks may

be modified or stolen by out-of-control tasks. The realization of the isolation method requires the help of hardware facilities and corresponding software technology.

1.3.2. Software Verification Method Based on Abstraction Layer. The verification research in this article is based on the verification framework of the abstraction layer because based on the above verification system, it adds the following features: it models the registers, memory, and corresponding assembly instructions that need to be used in the x86 hardware platform and has the ability to express system software verification.

The framework can abstract the data and prove the data refinement relationship between the protocols. In Figure 4, it is proved that in the forward simulation process of the program and the protocol, the initial/end state types corresponding to the program and the protocol are the same, and if the modeled system is more complex, the protocol often needs to describe the data more abstract than the data manipulated by the implementation code.

On the other hand, when verifying the attributes that the module satisfies, it can be directly deduced on its protocol without the need to expand the implementation of the module, as shown in Figure 5 for its functional correctness proof diagram. Since the module's protocol has covered all its behaviors, when proving security attributes such as isolation and confidentiality, it can be done directly on the

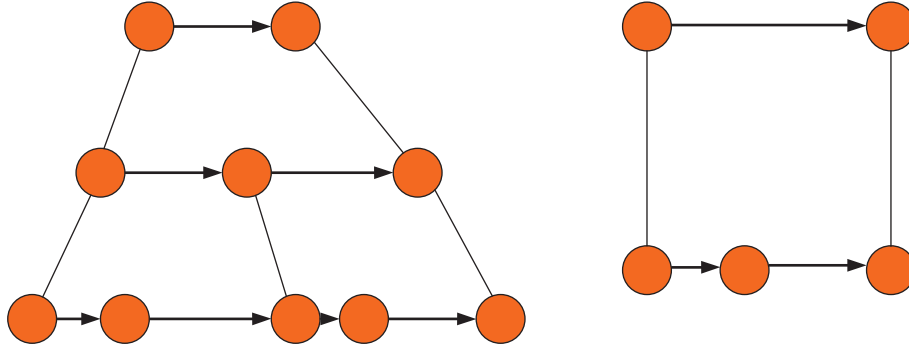


FIGURE 4: Proof of equivalence and proof of data refinement.

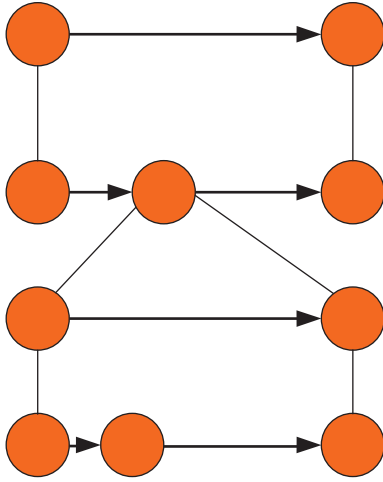


FIGURE 5: Context-dependent functional correctness proof.

abstract protocol, which reduces the workload of attribute proof.

1.3.3. Abstraction Layer Interface. The abstract layer interface L is a staged abstract machine model formed by the program verification process. The formal definition is as follows:

$$L = \varphi | i \mapsto \sigma | i \mapsto s | L_1 \oplus L_2. \quad (7)$$

In addition to primitives and abstract states, the abstraction layer interface also maintains a set of invariants INV to ensure that all primitives at the abstraction layer meet the constraints of INV .

$$\forall s, s'. INV(s) \wedge \sigma(s, s') \longrightarrow INV(s'). \quad (8)$$

Access the required abstract state by calling the primitives provided by L . Its formal definition is as follows:

$$M = \varphi | i \mapsto k | i \mapsto v | M_1 \oplus M_2, \quad (9)$$

$$L_1 \mapsto i \mapsto k: i \mapsto \sigma.$$

It is defined as a tuple containing an abstract list, namely,

$$d ::= (\text{cons_buf} : \text{list } Z). \quad (10)$$

The formal specifications of the three are shown in formulas (11) to (15):

$$\frac{d' = d[\text{cons_buf} \leftarrow \text{nil}]}{cb_init(d) = d'}. \quad (11)$$

Not empty:

$$\frac{c :: tl = d.\text{cons_buf} \cdot d' = d[\text{cons_buf} \leftarrow tl]}{cb_read(d) = (d', c)}. \quad (12)$$

Empty:

$$\frac{\text{nil} = d.\text{cons_buf}}{cb_read(d) = (d', CB_EMPTY)}. \quad (13)$$

Normal write:

$$\frac{\text{length} < CB_SIZE}{cb_write(d, c) = d'}. \quad (14)$$

Overflow coverage:

$$x :: l = d.\text{cons_buf}, \quad (15)$$

$$\text{length} = CB_SIZE, \quad (16)$$

$$\frac{d' = d[\text{cons_buf} \leftarrow l + + [c]]}{cb_write(d, c) = d'}. \quad (17)$$

The status and migration relationship of the command list is shown in Figure 6.

Correspondingly, the abstraction layer primitive is defined as the operation of the module function in the abstract state, as shown in equations 18 to 22.

Buf is not empty:

$$i = d.\text{rpos } i \neq d.\text{wpos } c = d.\text{cons_buf_concrete}[i], \quad (18)$$

$$\frac{d' = d[\text{rpos} \leftarrow (i + 1) \bmod CB_SIZE]}{cb_read(d) = (d', c)}. \quad (19)$$

It is empty:

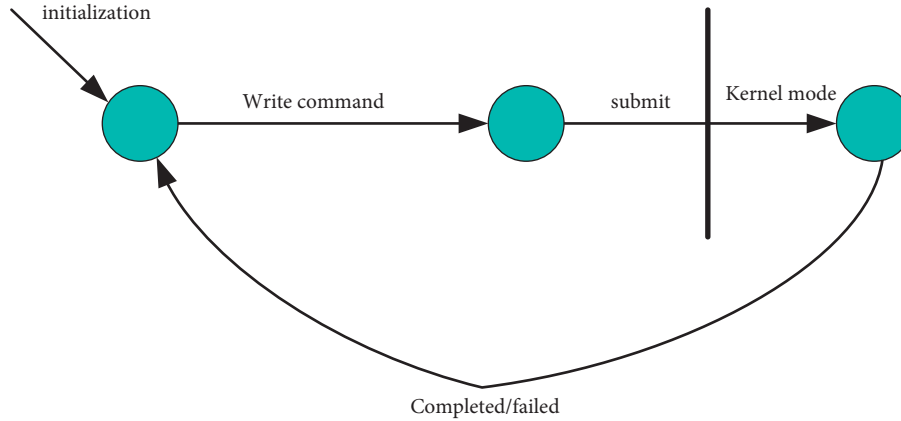


FIGURE 6: Command list status and migration relationship.

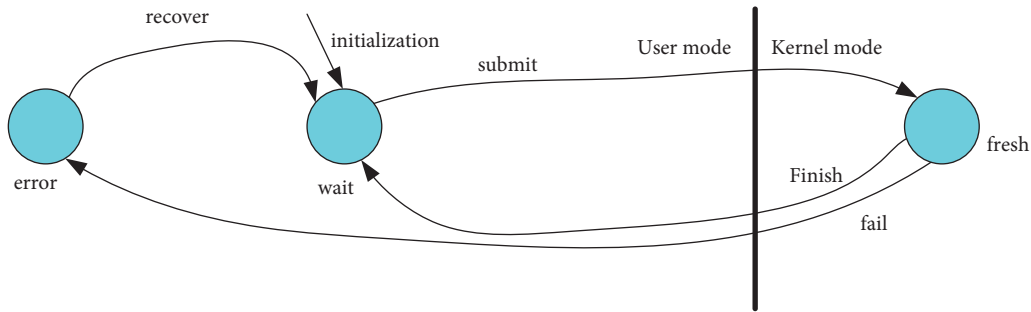


FIGURE 7: Status and its migration relationship in the status list.

$$\frac{d.wpos = d.rpos}{cb_read(d) = (d', CB_EMPTY)} \quad (20)$$

$$i = d.wpos \ i' = (i + 1) \bmod CB_SIZE \ d.rpos \neq i'. \quad (21)$$

$$\begin{aligned} b &= d.cons_buf_concrete[i \rightarrow c], \\ \frac{d' = d[cons_buf_concrete \leftarrow b][wpos \leftarrow i']}{cb_write(d, c) = d'} \end{aligned} \quad (22)$$

Among them, for the mapping m , $m[i]$ is used to represent the reference to the i element as the key. The state in the state list and its migration relationship are shown in Figure 7.

1.4. Indicator Design. The bank customer default risk evaluation system based on multimedia technology is mainly to evaluate the credit risk of bank customers. According to China's current index system related to personal credit, customer information can be summarized into four aspects, namely, basic information, occupational status, economic status, and credit status [17]. Each aspect can be further subdivided into a total of four first-level indicators and nine second-level indicators. The specific evaluation indicators are shown in Table 1.

(1) Basic Information

Through the application form submitted by the customer, after verification, the customer's personal basic information is confirmed, and the bank

TABLE 1: Customer credit evaluation indicators.

Primary indicator	Secondary indicator
Basic information	Age
	Gender
	Area
	Marital status
Occupational situation	Education
	Career status
Economic situation	Monthly income
	Real estate
Credit status	Historical credit history

provides indirect information for understanding the customer's repayment ability and willingness to repay. The basic information reflects the most basic personal situation of the customer and is characterized by easy access and easy verification, including age, gender, region, marital status, and education.

Age: it is segmented according to age group, including 23 years old, 24–30 years old, 31–40 years old, 41–50 years old, and 50 years old and above.

Gender: there are two types of men and women.

Region: according to economic conditions and regional characteristics, Hangzhou, Jiaxing, Jinhua, Shaoxing, and Huzhou in Zhejiang Province are in the first category, Wenzhou, Taizhou, and Yiwu are in the second category, and Cuisine, Lishui, and Zhoushan are in the third category.

TABLE 2: Virtual credit evaluation indicators.

Serial number	Virtual evaluation index	Meaning and remarks
1	Age	Whether age ≤ 23 (1: Yes; 0: No)
2		Whether age is 24~30 (1: Yes; 0: No)
3		Whether age 31~40 (1: Yes; 0: No)
4		Whether age 41~50 (1: Yes; 0: No)
5		Whether age ≥ 51 (1: Yes; 0: No)
6	Gender	Gender(1: Male; 0: Female)
7	Area	Whether it belongs to the first category (1: Yes; 0: No)
8		Whether it belongs to the second category (1: Yes; 0: No)
9	Marital status	Whether you are married and have children (1: Yes; 0: No)
10		Whether married or without children (1: Yes; 0: No)
11		Whether it is unmarried (1: Yes; 0: No)

Marital status: there are four types of children: married, children, married, unmarried, and others.

Education status: it is divided into graduate students and above, universities, junior colleges, technical secondary schools, and high schools, and other five categories.

- (2) Occupational situation: personal occupational indicators can directly show the customer's income level and the industry and occupational stability of the work they are doing. It is an important indicator to examine the credit level of customers, including the nature of the unit, position, title, and working years.
- (3) Economic situation: the personal income status of the customer, the housing situation, the assets, and the debt situation and the personal economic status indicators are the most direct indicators reflecting the customer's repayment ability, including monthly income, whether there is real estate, and personal total assets.

At present, there is no channel for measuring the total assets of individuals in China. This article only considers the monthly income and whether there are two indicators of real estate.

Monthly income: it includes less than 2,000 yuan, 2000–5000 yuan, 5000–10000 yuan, and more than 10,000 yuan, a total of four files.

- (4) Credit status: the customer's personal credit loan records in the bank and the customer's loan record indicators reflect the customer's credit ethics in past credit loans. The credit status is mainly reflected in the historical credit record, which can be channeled by the People's Bank of China.

Historical credit records can be divided into two categories: good historical credit records and bad historical credit records.

Since a large number of evaluation indicators are qualitative indicators, this article adopts a large number of virtual evaluation indicators when setting evaluation indicators, and a total of 26 interpretation evaluation indicators are set for 9 secondary evaluation indicators [18]. See Tables 2 and 3 for details.

2. Design of Bank Customer Default Risk Management System under the Background of Internet Finance

2.1. Functional Requirements Analysis. The bank credit risk management system constructed in this article measures credit risk by guiding the customer's basic information, occupational status, economic status, and credit status and guiding the mode of credit risk management, starting from its own actual and business management needs, and in commercial bank credit. On the basis of the management system, the customer has been resegmented and improved. The risk management system needs to have the following three functions:

- (1) *Risk Measurement Function.* The risk management system divides customers into different categories based on different customer conditions. According to different customer categories, the risk indicators of financial business are calculated. The specific risk indicators include default probability, default loss rate, and expected loss rate. By comparing the calculated values of risk indicators in different dimensions, the managers are instructed in different organizations and customers. The product or industry conducts scientific and reasonable loan placement, reduces loan risk indicators, and optimizes loan quality.
- (2) *Query Function.* After the bank manager maintains the credit information through the electronic banking financial service maintenance page, the system can realize customer information, loan information, personal relationship, default record, bad record, loan recovery details, interest rates, and bank acceptance bills. The information of "ten small pieces," such as discount information and customer contribution, has wide coverage and a large amount of information.
- (3) *Risk Warning Function.* The key to risk management is to detect and identify the source of risk, risk range, risk level and risk trend early, and issue corresponding risk warning signals. The purpose is to take precautionary measures against potential risks in

TABLE 3: Basic information of virtual credit individuals.

Serial number	Virtual evaluation index	Meaning and remarks
1	Education	Whether graduate or above (1: Yes; 0: No)
2		Whether university (1: Yes; 0: No)
3		Whether junior college (1: Yes; 0: No)
4		Whether secondary or high school (1: Yes; 0: No)
5		Whether junior high school and below (1: Yes; 0: No)
6	Income	Whether the monthly income is less than 2,000 yuan (1: Yes; 0: No)
7		Whether the monthly income is 2~5 thousand yuan (1: Yes; 0: No)
8		Whether the monthly income is 0.5~10,000 (1: Yes; 0: No)
9		Whether the monthly income is 10,000 yuan or more (1: Yes; 0: No)
10	Real estate	Whether the house has its own property rights (1: Yes; 0: No)
11		Is there a housing mortgage (1: Yes; 0: No)
12		Whether living with parents (1: Yes; 0: No)
13		Whether to rent a house (1: Yes; 0: No)
14		Whether the unit is allocated (1: Yes; 0: No)
15	Credit status	Credit bureau records (1: Bad; 0: No)

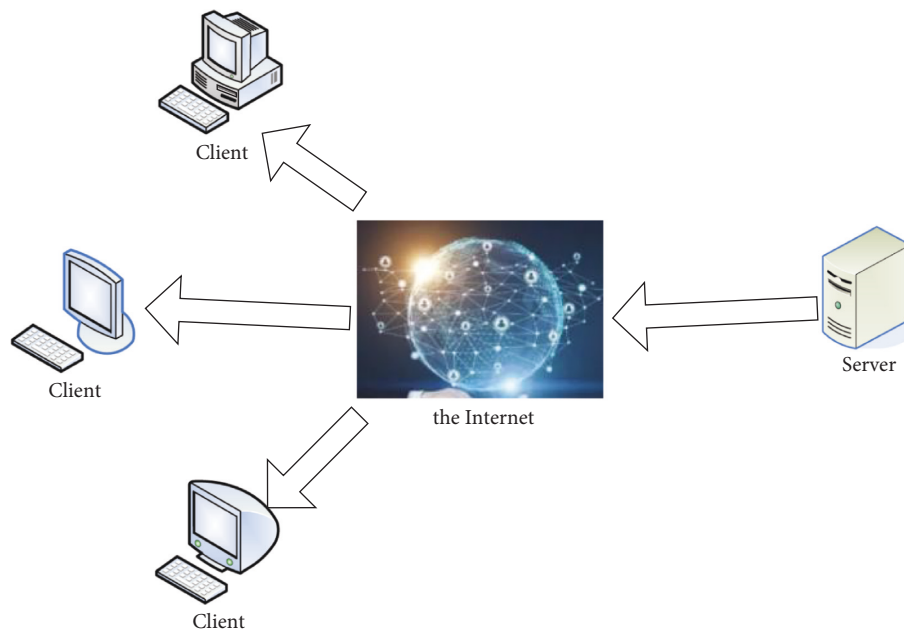


FIGURE 8: Schematic diagram of B/S structure.

advance according to the risk warning signals provided by the risk warning system so as to eliminate them in the bud. The system has set up three major early warning rules: large loan monitoring, macro early warning, and micro early warning. When the customer or loan information reaches the early warning condition, the system will give the loan manager an early warning prompt. The micro-warning needs to be managed by the administrator to select the “early warning disposal” method. After the early warning is processed, the early warning information is no longer displayed. This function moves the risk threshold forward and gives early warning of the loan-related risks, which is beneficial to the loan

manager to take measures in advance, resolve risks, and ensure the safety of loans.

2.2. System Features

- (1) The system adopts B/S mode, the interface is clear, the information query is accurate, flexible, convenient, and fast, and the data storage is safe and reliable. The structure of the B/S mode is shown in Figure 8.
- (2) manages system user roles.
- (3) ability to maintain a database and statistics of data through the network.
- (4) Set different permission levels and open the corresponding permissions for the permission level.

- (5) The system maximizes ease of installation, ease of maintenance, and ease of operation.
- (6) The system is stable and reliable.
- (7) System compatibility is good, and it will not affect the display effect when used under different browsers.

3. Realization of Bank Customer Default Risk Management System under the Background of Internet Finance

3.1. System Architecture Design. The full name of the B/S architecture is browser/server, which is the browser/server architecture. Its characteristics only realize a very small number of transaction logic in the front end, and the main transaction logic is implemented on the server side. The browser client, the network application server, and the database end constitute a three-tier architecture of view, control, and data access. MVC exists in the desktop program at the beginning, *M* refers to the business model, *V* refers to the user interface, and *C* refers to the controller. The purpose of using MVC is to separate the implementation code of *M* and *V* so that the same program can use different representations. The B/S architecture does not require an additional installation package, just a web browser.

In the B/S architecture, the web browser is only responsible for the display logic, and the transaction logic is placed on the web application server side, thus avoiding the huge fat client and reducing the pressure on the client. Because the client contains very little logic, it is also known as the thin client [19, 20].

Advantages of B/S mode software are as follows:

- (1) It can be operated in any place where there is a computer with Internet access without installing special software.
- (2) The B/S architecture can be directly placed on the local area network or the Internet, and the purpose of multiclient access is achieved through certain permission control, and the interaction is strong.
- (3) B/S architecture does not need to upgrade multiple clients or upgrade the server

Combined with the many advantages and practical needs of the B/S structure design, the bank credit risk management system is designed to adapt to the B/S mode. B/S model includes a user presentation layer, business logic layer, and data access layer. The three-tier architecture is described in detail as follows:

The user presentation layer: the program interface that the user sees runs on the client computer and completes the information released through the browser. The user sends a service request to the server by operating the service menu and displays the return result of the server, and the user presentation layer does not perform actual data processing and communicates only the user's instructions to the business logic layer.

Business logic layer: after receiving the processing instruction of the presentation layer, the business logic layer transfers the program file to complete the business processing, generates a data processing request to the data access layer, generates a user interface for the data returned by the database, and feeds the data back to the user computer browser.

Data access layer: the database management system and the database file are deployed on the database server. The data access layer responds to the data processing request sent by the program file, completes the operation of writing, reading, and deleting data to the database, and feeds back the data processing result. Give the business logic layer.

3.2. Related Technology Introduction

3.2.1. Apache Shiro Technology. Apache Shiro is a powerful and easy-to-use Java security framework that provides authentication, authorization, encryption, and session management [21]. In addition to the above features, Shiro also offers a lot of extensions:

- (1) Web Support: it provides some common functions for web applications.
- (2) Caching: cache can make the application run more efficiently.
- (3) Concurrency: it includes multithread-related functions.
- (4) Testing: it helps us to test related functions.
- (5) Run As: it allows the user to assume another user identity (if allowed), sometimes useful in managing scripts.

3.2.2. jQuery Technology. jQuery, as its name suggests, is JavaScript and Query, which is a library for assisting JavaScript development. It is a lightweight JS library that is compatible with CSS3 and is compatible with a variety of browsers (IE6.0+, FF1.5+, Safari2.0+, Opera 9.0+). jQuery makes it easier for users to work with HTML (an application under the standard universal markup language), implement animation effects, and provide AJAX interaction for websites. The jQuery documentation is also very comprehensive, and it is very detailed for various applications, and there are many mature plug-ins to choose from. jQuery can keep the user's HTML content and HTML page code separated, thus greatly improving the user experience.

jQuery is a free, open source and uses the MIT license. Developers can use jQuery's syntax design to make it easier to create animation effects, manipulate document objects, use AJAX, and more. jQuery also provides an API for developers to write plug-ins. Developers use modular methods to easily develop powerful static or dynamic web pages [22, 23].

3.2.3. MyEclipse Technology. MyEclipse is a software development platform that is currently used more. It is a powerful enterprise-level integrated development environment developed on the basis of Eclipse and its own plug-in.

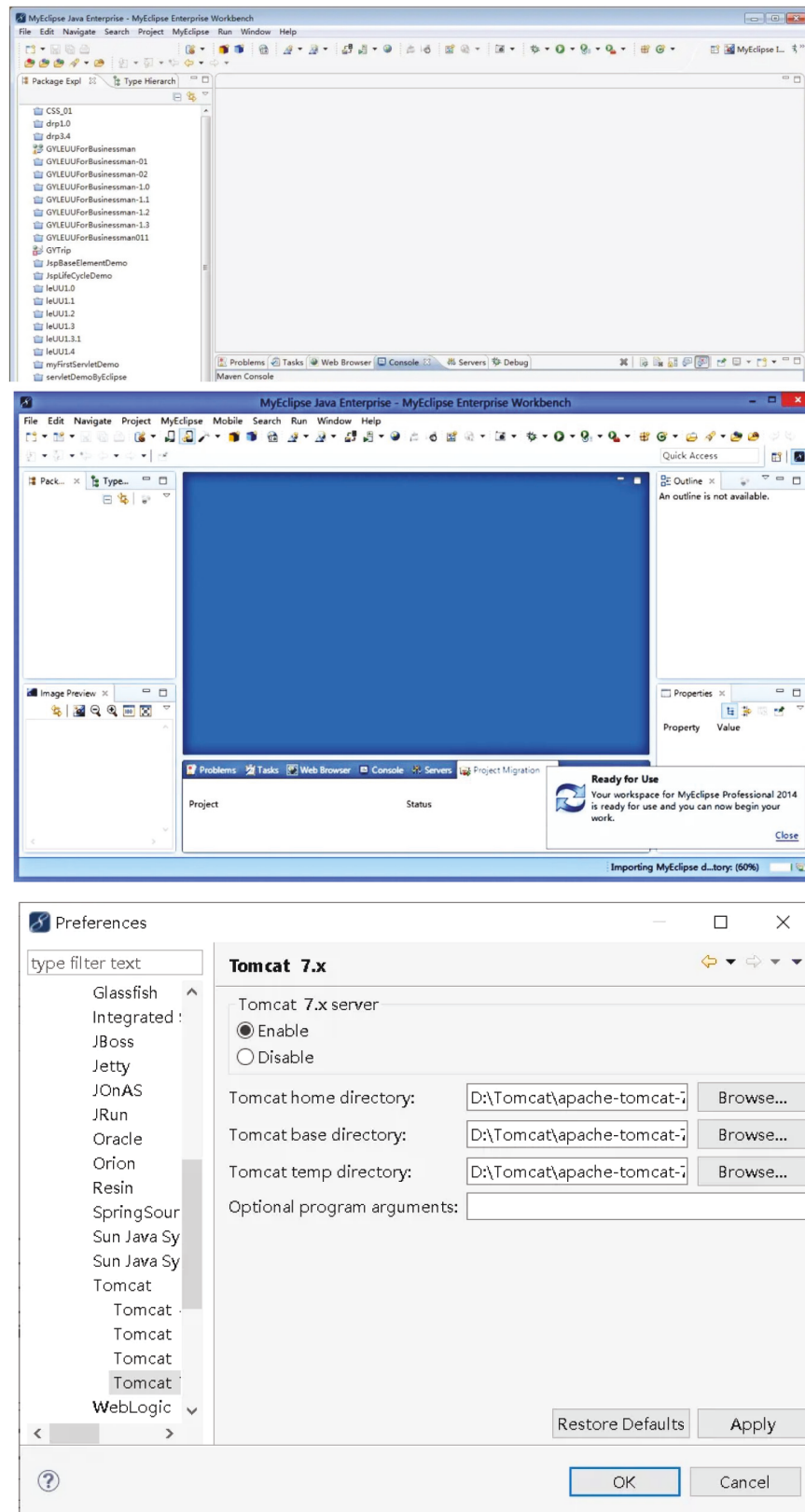


FIGURE 9: Several operation interfaces of MyEclipse (<http://alturl.com/juviv> and <http://alturl.com/4ktif>, <http://alturl.com/o9kjh>).

TABLE 4: Customer basic information table.

Name	Primary key	Field name	Data type	Length
Name	Yes	Customer name	VARCHAR	8
Gender	No	Gender	VARCHAR	8
Age	No	Age	InB	50
Education	No	Education	VARCHAR	50
Employer	No	Company	VARCHAR	20
Level	No	Customer level	VARCHAR	10

TABLE 5: Transaction information table.

Name	Primary key	Field name	Data type	Length
Transaction flow number	Yes	Exchanged	VARCHAR	50
Account number	No	Account number	VARCHAR	50
Transaction content	No	Exchange content	VARCHAR	50
Transaction hour	No	Exchange time	Date time	8
The transaction amount	No	Exchange amount	Float	8
Trading status	No	Exchange status	VARCHAR	50

TABLE 6: Customer credit record form.

Name	Primary key	Field name	Data type	Length
Customer number	Yes	CUSTID	VARCHAR2	20
Bad record subject	No	SUBJECT	VARCHAR2	2
Bad record date	No	RECORDDATE	VARCHAR2	10
Bad record description	No	BADDESCRIPTION	VARCHAR2	400
City code	No	INSTCITYCODE	VARCHAR2	6
Business number	No	BMNO	VARCHAR2	20
Reason for breach of contract	No	REASON	VARCHAR2	3
Default start date	No	STR_DATE	VARCHAR2	8
Default end date	No	END_DATE	VARCHAR2	8

It is mainly used for the development of Java, JavaEE, and mobile applications. Several common MyEclipse operation interfaces are shown in Figure 9.

MyEclipse includes complete code writing, code debugging, and other functions, which can perfectly support many programming languages, supported for language and framework development, such as PHP, Python, Vue, Angular, React, Java, and JavaEE. It is a widely used development platform.

3.3. Database Design. The system uses a database to integrate customer information and can strongly support customer credit in commercial banking.

Risk management is the customer credit risk management system through the database to correlate and screen the various data, thereby forming a measure of the customer's basic profile, customer credit records, and credit risk. The database is the foundation of the customer's credit risk management system.

Through the analysis and design of the customer credit risk management system, the data in Tables 4–6 in the system is obtained:

The customer risk management system monitors the customer information by querying and setting parameters according to the collected basic information of the customer, business information, and credit records and compares the

calculated values of the risk indicators of different dimensions and forms risk warning information to guide the banking network business. The account manager conducts scientific and rational financial operations for different clients, reduces network credit risk indicators, and optimizes credit quality.

3.4. Management System Implementation Renderings. Style consistency should be maintained in the interface design. Consistency includes the use of standard controls, as well as the consistency of the color and font of the visual elements in the interface, and the consistency of the informational content.

After entering the bank customer credit management system website, the login interface is displayed first. The login interface designed in this article is shown in Figure 10. If the customer enters the system for the first time, they need to complete the registration before they can log in. When logging in, the customer needs to fill in the username and password to enter the system.

After logging in to the system, you will be taken to the home page interface. The homepage interface is shown in Figure 11. As can be seen from the figure, the credit management system of this article includes the workbench subsystem, credit evaluation subsystem, customer data query subsystem, and risk early warning subsystem. The

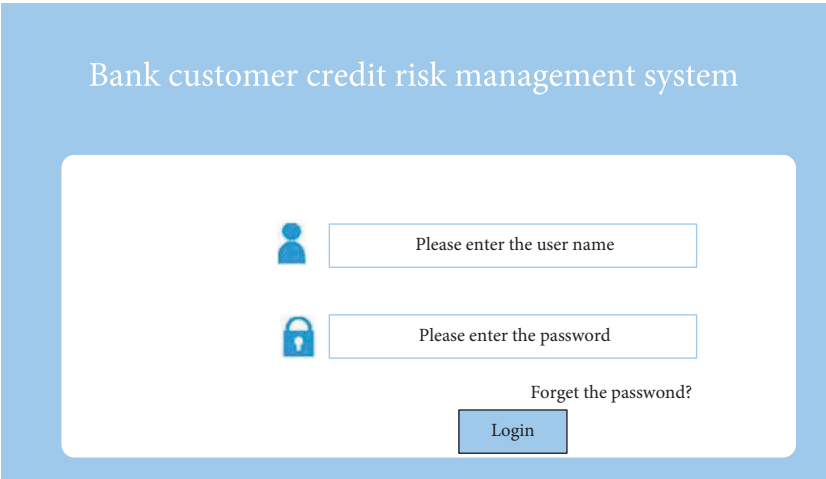


FIGURE 10: User login interface.

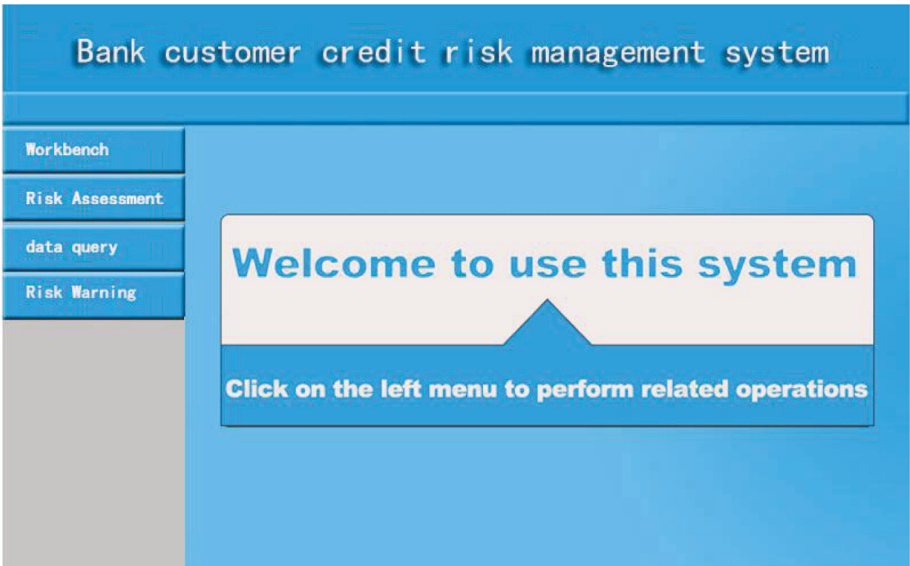


FIGURE 11: Home page interface.

Bank customer credit risk management system			
First level index	Second level index	Standard score	Score
Basic information	age	7	
	Gender	10	
	Area	7	
	Education	10	
Economic situation	monthly income	6	
	Real estate	9	
credit status	Bad record	10	
	Default record	10	

FIGURE 12: Credit risk assessment subsystem interface.

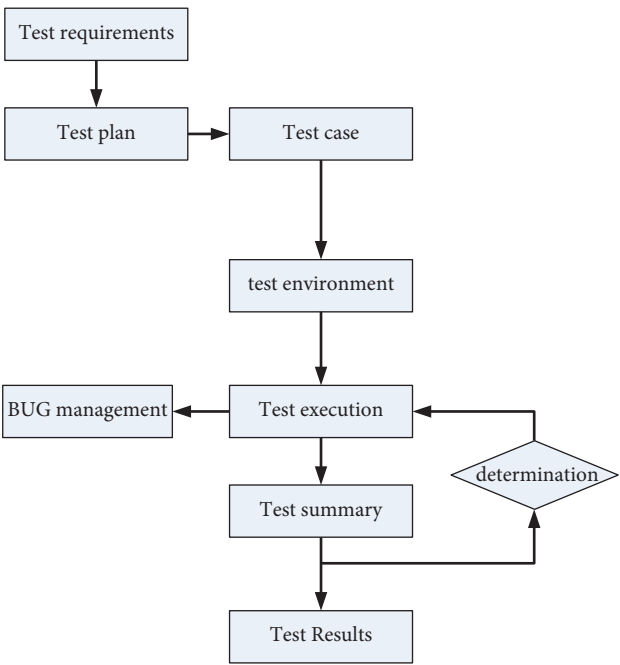


FIGURE 13: Test process diagram.

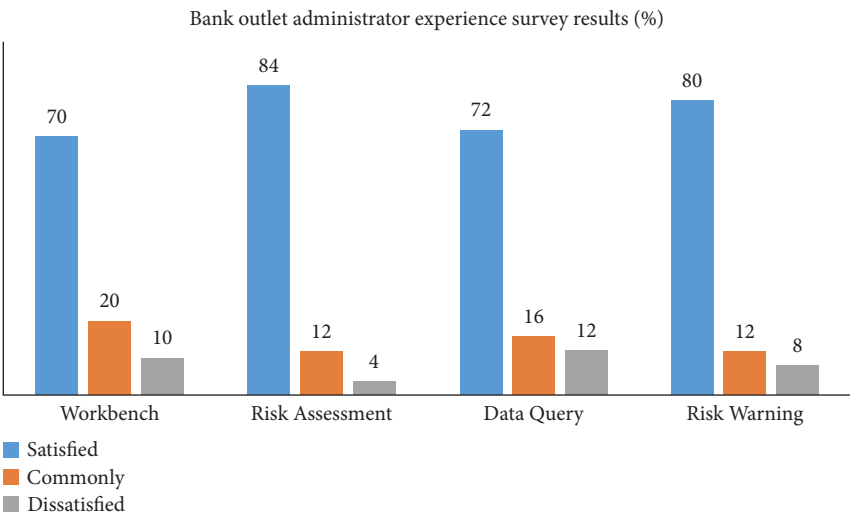


FIGURE 14: Bank outlet administrator experience survey results.

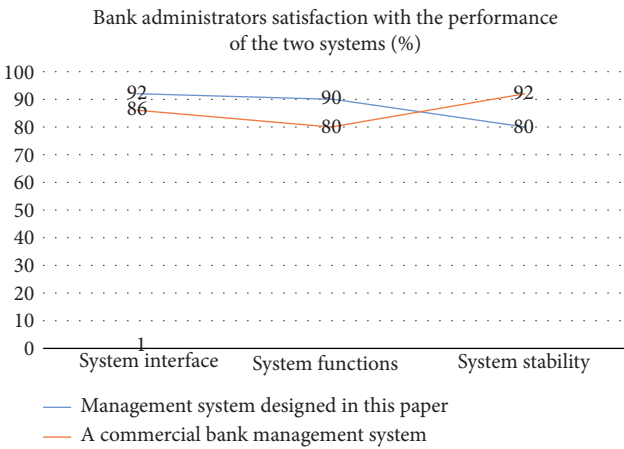


FIGURE 15: Bank administrators' satisfaction with the performance of the two systems.

workbench subsystem covers customer basic information and customer financial business information; the credit evaluation subsystem can conduct customer default risk evaluation according to customer evaluation indicators; the customer data query subsystem facilitates account managers to query customer bad records and default records—risk warning. The system performs a warning of poor default according to the risk evaluation parameters.

This article introduces the credit risk assessment subsystem. In the evaluation subsystem, the customer default risk can be evaluated. As shown in Figure 12, the figure shows the first-level indicator and the second-level indicator. The bank administrator can score the indicator. After the completion, the system can calculate the risk evaluation results and save the evaluation results.

4. System Testing and Analysis

In order to test the function of the designed bank customer credit risk management system, this article builds a small test system. The purpose is to verify whether the risk assessment index design is reasonable, whether the designated function is implemented, whether it can automatically list the customers beyond the warning risk threshold, and whether it can get the correct results for various query conditions. Through testing to find out whether the expected function is achieved, the advantages of this article credit management system are analyzed. The test process is shown in Figure 13.

In the process of system experience survey for bank administrators, 50 bank administrators compare their satisfaction with the performance of the two management systems. The test indicators are the interface, function, and stability of the management system. The comparison results are shown in Figures 14 and 15. According to the analysis of the comparison results, the test version of the credit management system designed in this article is more satisfactory than the credit management system of a commercial bank in terms of system interface and system function, but the satisfaction of the stability of the system is slightly lower. Because the system is a test version, the system stability module should be strengthened in the subsequent debugging.

5. Conclusions

With the rapid development of Internet technology, commercial banks have rapidly integrated with Internet technology, forming Internet finance represented by new products and services such as e-banking, mobile banking, and e-commerce. Internet finance has certain risks. The purpose of this article is to explore the risk of bank customer default based on embedded microprocessor wireless communication in the context of Internet finance. We expect to solve the problem of data management in the development of the embedded module, which is more convenient for customer credit management. Although the bank customer default risk under Internet finance is explored in this article, there are still shortcomings: the distribution of objects in the

experiment of the article is narrower and still does not represent a broad scope despite the classification.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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