Security for ATM Terminal Using Various Recognition Systems

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Abstract: For the traditional ATM terminal customer recognition systems rely only on bank cards, passwords, and such identity verification methods which measures are not perfect and functions are too single. For solving the bugs of traditional ones, the author designs a new ATM terminal recognition systems to verify the finger print of the Acc holder at outside of the gate. Finger Print Recognition System, Face Recognition System, IRIS Recognition System & Global System for Mobile communications are used to verify the Acc no., password, IRIS and fingerprint of the Acc holder. The chip LPC 2148 is used for the core of microprocessor in arm7, furthermore an improved enhancement algorithm of fingerprint image increases the security that customer use the ATM machine.

Keywords: ARM Controller, GSM MODEM, FPRS, IRIS and FRS.

I. INTRODUCTION

With the development of computer network technology and e-commerce, the self-service banking system has got extensive popularization with the characteristic offering high quality 24hrs service for customer. Nowadays, using the ATM (automatic teller machine) which provides customers with the convenient banknote trading is very common. However, the financial crime case rises repeatedly in recent years; a lot of criminals tamper with the atm terminal and steel uses credit card and password by illegal means. once uses bankcard is lost and password is stolen, the criminal will draw all cash this shortest time, which will bring enormous financial losses to customer how to carry valid identity to the customer becomes the focus in current financial circle. Traditional atm systems authenticate generally by using the credit card and the password, the method has some defects. using credit card and password cannot verify the clients identity exactly. in recent years the algorithm that the fingerprint recognition continuously updated which has offered new verification means for us, the original password authentication method combined with the bio-metric identification technology verify the clients identity better and achieve the purpose that use of ATM machine improve the safety effectively.

II. METHODOLOGY

A. The Characteristic of the System Design

The embedded ATM client authentication system is based on finger print recognition which is based on after analyze existed ATM systems the LPC2148 chip is used as the core this embedded system which is associated with the technologies of fingerprint recognition and current high-speed network communication. The primary function is shown as follows:

- **IRIS recognition**: it is used to scan the eye recognition and certify the security for ATM systems.
- **Finger print recognition**: the master’s fingerprint information was used as the standards of identification. It must certify the feature of the human fingerprint before using ATM systems.
- **Remote authentication**: System can compare current client’s fingerprint in information with remote fingerprint data server.
- **Message sending**: The message can be used to the relevant staff’s mobile phone without any noise, in order to carry on emergency processing.
- **Police network connection**: The system can send message the police via the police network.
- **Two discriminate analysis methods**: Besides the fingerprint recognition, the mode of password recognition can be also used for the system.

B. Software Design and Hardware Design

Design of entire system consisted of two part which are hardware and software. Embedded system and the steps of software consisted of three parts.

C. Hardware Design: The LPC2148 chip is used as the core of entire hardware. Furthermore, the modules of LCD, keyboard, alarm, fingerprint recognition and IRIS recognition. These are connected with the main chip (LPC 2148). The SRAM and FLASH are also embedded system there are some modules consisted in the system as follows.

Fig.1 Hardware Block Diagram
**LCD module:** The JDH162A is used in this module as a LCD controller; it displays the info of the system. It displays 16x2B character.

**Keypad module:** It can be used for inputting passwords.

**SMS module:** SIM 300 module is based on GSM technology implement which can send message to the credit card owner and send message to relevant staff without any sound.

**SRAM and FLASH:** The 32-bit 512MB of FLASH chip and the 32-bit 40kB of SRAM chip are connected with the main chip. Their functions are storing the running code, the information of fingerprint and the algorithm.

**Fingerprint recognition module:** KY-M8I be used as a fingerprint recognition. The other function of fingerprints is a total coincidence. Like everything in the human body, these ridges form through a combination of genetic and environmental factors. The genetic code in DNA gives general orders on the way skin should form in a developing fetus, but the specific way it forms is a result of random events. The exact position of the fetus in the womb at a particular moment and the exact composition and density of surrounding amniotic fluid decides how every individual ridge will form. Before using the ATM terminal, the client’s fingerprint feature will be connected to the remote fingerprint data server to match fingerprint data with the master’s, if the result is not correct, the system will send SMS to the credit card owner.

**D. Software Design:** The design of software is very important for this embedded system. The design was component of three parts included the design of main program flowchart, the initializing ones, and the algorithm of fingerprint recognition flowchart. This system of software is implemented by the steps as follows:

1. The OS and the file system are loaded into the main chip. The system is initialized to implement specific task, such as checking ATM system, GSM communication and so on, and then each module reset for ready to run commands. First entering into the ATM terminal fingerprint is required. If fingerprint is correct, we will enter into the ATM terminal before using ATM terminal, the password and fingerprint is required. First need to enter owner’s password, if password is successful. Then the system requires the owner’s fingerprint, Face and scans the eye recognition. If all the recognition is right, the system would enter into the waiting status. In addition, the number of times that recognition of fingerprint and password are restricted to 3. If more than 3 times, the system will send message to the police through police network, send message to the owner and send message to relevant staff. Then lock the owner’s credit card.

2. He process of inputting fingerprint, the KY-M8I which is a linear sensor that captures fingerprint images by sweeping the finger over the sensing area, will used for acquiring the image of fingerprint. This product embeds true hardware based 8-way navigation and click functions.

**Fig.2 Flow Chart for Software Design**

The fingerprint information will be temporarily stored in SRAM and upload to the remote finger data to compare through bank network. The result of process will be controlled by main chip (LPC2148). The initializing process means that set the hardware and software and then starts the multiple mission modules, each module will be started according to the priority processes. At first, initialize the system clock, and execute the codes of open interrupt and the open interrupt task. The system would judge and enter process of module. Finally, the system would start to attempt multiple tasks.

**E. The design of fingerprint recognition algorithm.**

The design of algorithm based on fingerprint recognition is vital for the whole system. We would approach two steps to process the images of fingerprint. The detail of fingerprint recognition process

The first step was the acquisition of fingerprint image by above device mentioned in the algorithm, and the results could be sent to the following process. Pre-processing the images acquired. After obtain the fingerprint image, it must be pre-processing.

Generally, pre-processing of ones is filtering, histogram computing, image enhancement and image finalization. Lastly, the characteristic value was extracted,
and the results of the above measures would be compared with the information of owner’s fingerprint in the database so as to verify whether the character is matched, and then the system returned the results matched or not.

1. The design of fingerprint image enhancement

   Fingerprint recognition module is an extremely important part of the system, the high quality images was the major factors of influencing the performance in the system. There is a lot of noise in fingerprint image; the image enhancement was the precondition for recognition of fingerprint characteristics. The algorithm of fingerprint recognition based on the algorithm of Gabor and direction filter was used. Fingerprint enhancement algorithm based on Gabor filter could be better to remove noise, strengthen the definition between the ridge and valley, it could significantly improve the image enhancement processing capacity, but this algorithm was slow in dealing with the high capacity requirements. Fingerprint enhancement algorithm based on direction filter has faster processing capabilities, but it was not good to handling the large noise areas. so combination of these two algorithms could obtain better effects. This algorithm based on direction filter was used in the clear area, and based on Gabor filter was used in the recoverable region. The Gabor filter algorithms

   a) The Gabor filter algorithms

      For each point, according to its frequency, direction calculates the Gabor filter coefficients, calculate the filter values of each point and then, move to the next point, repeat the process above.

   b) The direction filter algorithms

   $G(u,v)$ is normalized after the fingerprint image, $g(u,v)$ as a template filter coefficient. Proposed image block average M, the calculation using image block average grey level range, if mean was small, the variance was small, that is not to restore area, if the moderate, have the great variance, the smaller the ratio of mean and variance, it could be regard as the clear area, if the mean moderate variance and they were smaller than the ratio of non-recovery area. It could be regard as confusion region. Image block average calculated as follows: the fingerprint image was divided into $W \times W$ area. And the statistics is greater than the number of M, marked as $M$ and less than the number of M, marked as $N$.

III. CONCLUSION

   The design of ATM terminal system based on fingerprint recognition took advantages of the stability and reliability of fingerprint characteristics, a new biological technology based on the image enhancement algorithm of Gabor and direction filter. Additionally, the system also contains the original verifying methods which were inputting owner’s password. The security features were enhanced largely for the stability and reliability for the owner recognition. The whole system is built on the technology of embedded system which makes the system more safe, reliable and easy to use.

IV. FUTURE ENHANCEMENT

   The future enhancement of this paper is to implement with more efficient voice recognition system. Voice recognition or speech recognition is a type of behavioral biometric technology, which is used to identify a user, with the help of pre-stored voice templates in the biometric device. Every individual has a distinct voice structure, which is based upon a number of characteristics. With the help of voice recognition technology, a number of devices have been manufactured to provide security at ATM. It is impossible for intruders to tamper with this technology and thus, you can rely upon voice recognition systems for maintaining high-level security.

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