

Intelligent Door Locking System

B. Anubala, M. Rahini, T. Bavithra

3rd year, Department of Information Technology, Velammal College of Engineering and Technology, Madurai.

Abstract

In the present scenario, home safety is a major threat faced by every individual. There are lot of solutions available for this issue and complete solution for this problem is not yet discovered. Our project "Intelligent door locking system" provides freedom from mental and physical stress faced by individual while moving away from their home. Unauthorized access is prohibited by designing a lock that stores the fingerprints of one or more authorized users. Fingerprint is sensed by sensor and is validated for authentication. If the fingerprint matches, the door will be opened automatically otherwise the system captures the image of unauthorized person and the microcontroller sends the image as a multimedia message to the authenticated person's mobile number and the lock will remain in locked position. This system is highly efficient as it is built with open source hardware.

INDEX TERMS- Fingerprint, Sensor, Microcontroller, Multimedia message, Open source Hardware.

I. INTRODUCTION

Security problem is a major threat faced by every individual when away from home. Earlier system provides security manually which can easily break by intruders. Later, Password is mainly used for authentication but this method of authentication forces user to remember username/password combinations to access accounts. Password authentication also requires strong server security otherwise anyone can break into the database and read the passwords. Password authentication protocols fail when user doesn't address them seriously, at the same time constructing complex passwords and maintaining secrecy is a tiresome process. Fingerprint is basic method for authentication and it proves to be a unique identification for every individual. For their permanence and unique nature, they have been used for not only in identification but also in the field of security as criminal and forensic investigation for a long time.

II. EXISTING SYSTEM

Various attempts are made for providing security for all domiciles. Up to date, complete security is not discovered.

i. Lock and Key System:

First step towards security was Lock and key system. Security protocol followed in this system was "Single key for a single lock". Initially, this system was considered to provide utmost security. But this belief was soon proved wrong by the fact that multiple keys can be easily made for a single lock. Hence this system is an outdated system to provide security.

ii. Password Authentication:

Next level of Security used password as an authenticating tool. This system stores password of authenticated users for the purpose of validation. System using password authentication provides considerable security to the users as it acts as a secret of authorized users. This system also have a pitfall that password can be acquired by unauthorized user by continuously trying all the possible combinations. This is also one among the hundreds of attempt made for providing security.

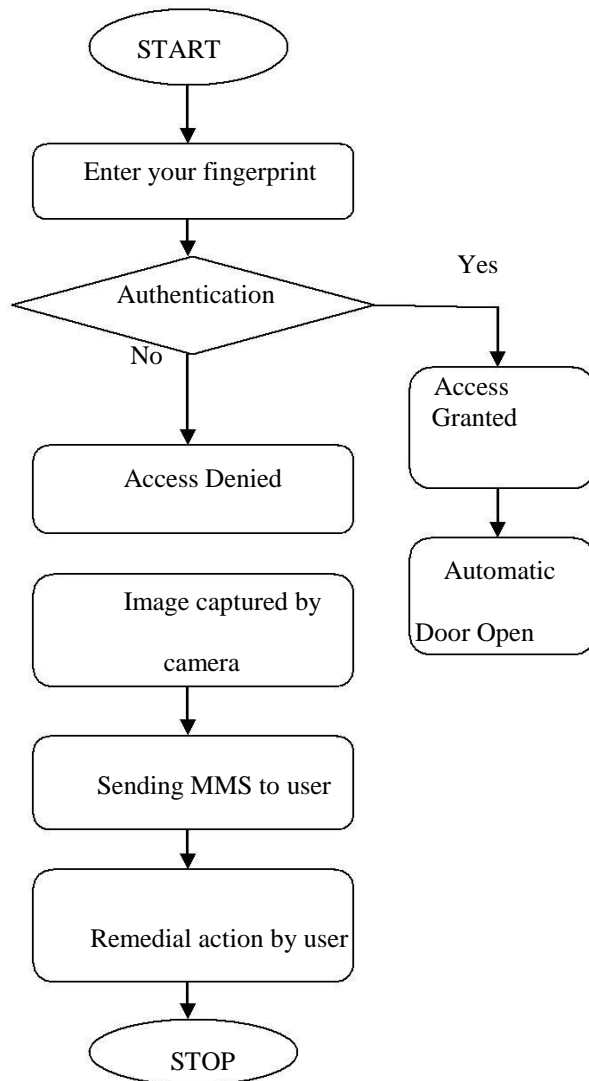
iii. Authentication by RFID card:

Next level of technological development for providing security was authentication by RFID card. This system enriched the level of security. Access is granted only for the user whose RFID code matches with the authorized code. This system also have disadvantage of duplication of RFID card and anyone who possess this card can unlock the door.

III. PROPOSED SYSTEM

Our proposed system overcomes all the security problems in existing system and provides high security and efficiency. This is a perfect/optimal solution for saving/protecting one from the hassle of stolen/lost key or an unauthorized entry. Fingerprint is a boon solution for these problems which provides high level of recognition accuracy. The skin on our palms and soles exhibits a flow like pattern of ridges called friction ridges^[3]. The pattern of friction ridges on each finger is unique and immutable. This makes fingerprint a unique identification for everyone. Fingerprint door lock incorporates the proven technology. Fingerprint scanner scans the fingerprints of users and used for ensuring authentication.

Fingerprint scanning is more accurate and cost effective method and duplication is virtually impossible. A Fingerprint recognition system can easily perform verification. In verification, the system compares an input fingerprint to the enrolled fingerprint of a specific user to determine if they are from the same finger. Now the security of our home/office is literally in our hands or rather on our fingertips. The following flow graph describes the sequence of operations performed in the system,



1.1 Flow Chart

IV. SYSTEM MODEL

A. Arduino Microcontroller

Arduino acts as the core for the system which performs all the operations and controls all the other devices. Arduino is a single board microcontroller which has the capability of controlling variety of sensors, motors and other physical outputs. Here we have used Arduino Uno (8-bit) for controlling the Fingerprint sensor and the

Standard Analog Servo. The program is written and it is uploaded into the microcontroller memory. Hence every time when the power supply is given to the Arduino board the program gets executed automatically. The main advantages of using Arduino microcontroller is that it is low cost open source extensible hardware and it consumes only less power of maximum 12V.

B. Fingerprint Sensor

Fingerprint Sensor is the one which obtain the finger print of the user and compare it with the previously stored ones. The Sensor module we have used here is capable of storing 120 fingerprints into its flash memory. It is with TTL-UART interface and the user can configure it in 1:1 or 1: N mode for identifying the person. This can be directly interfaced with Arduino microcontroller.

C. Servo Motor

The servo we have used here is the HK15138 Standard Analog Servo. The servo locks at approximately 90 degrees, at which it is tightly wrapped around the door's lock and the servo horn gets a really tight grip with the lock. When the finger print gets validated the Arduino will make the servo to rotate to unlock the door. It has the torque of 4.3kg with the power supply of 6V.

D. GSM Modem

GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. The modem can be directly connected to Arduino which enables the Arduino board to do most of the operations that can be done with a GSM phone like sending messages, placing voice calls and connect to the internet over a GPRS network. It transfers data from serial port to the GSM network. Here in case of failure of the fingerprint authentication the GSM modem gets the image taken by the camera through Arduino and sends it as a multimedia message to the registered mobile number.

E. Camera

The camera used in our system is RS485 TTL Serial Camera Module. It uses an Omni Vision CMOS OV7725 sensor along with a JPEG compression chip that provides a low cost and low powered camera system (5V). Its on-board Serial interface is suitable for a direct connection with the Arduino microcontroller. The image captured by the camera is sent to the owner's mobile through GSM Modem.

V. ARCHITECTURE

Arduino microcontroller centrally controls all the devices connected to it. The program has to be

fed into the Arduino board and connected to the power supply.

The devices are triggered according to the flow of the code. Firstly the fingerprints of the authorized users have to be stored inside the Fingerprint sensor. Upon entering the finger print the door is either locked or unlocked. For opening the door the user will enter their finger print in the Fingerprint sensor and any one of the following scenario will occur,

i. For Authorized user:

If the user is authorized and the finger print is validated successfully by the sensor, the Arduino will start the servo to rotate and unlocks the door.

ii. For Unauthorized user:

If the user who tries to enter the door is found as unauthorized and if the validation fails, the Arduino will start the camera and the image obtained from the camera will be sent to the owner's mobile through the GSM Modem. The GSM Modem has a SIM which is used to send multimedia message more like a normal mobile phone.



1.2 General Architecture

VI. COMPARISON WITH OTHER SYSTEMS

Many Systems have been developed in the past with the objective to improve the security in home, offices, banks and in other living areas. Hence different systems are compared based on the three following factors

Factors	Lock and Key System	Password Authentication	Authentication by RFID card	Intelligent door lock system
Security	Low	Medium	High	Very high
cost	Low	High	High	Medium
Usability	High	Medium	Medium	High

i. Security:

Security is of main concern in any locking system. When lock and Key system is concerned, security is very poor compared to other improved security systems as any key can be duplicated at any time. Password authentication system provides pretty good security compared to lock and key system but there are chances for intruders to hack the database of passwords and break the system. FID card provides good authentication compared to above system. This card can be misused when caught into the hands of intruders. On the other hand, intelligent door locking system provides complete security as finger print is an unique identification for each user. It is impossible for finger print duplication. Hence this system provides optimal security compared to other systems.

ii. Cost:

When a new system launched in the market, it is considered only when it cost effective than other existing systems. Lock and key system is of less cost than all other systems and is available to all users. Both password and RFID authentication is more costly and also provides considerable security than lock and key system. On the other hand our system offers extreme security for optimum cost.

iii. Usability:

Success in the system lies on the comfort of using it. Users are mode adapted to the usage of lock and key system. On the other hand password authentication system requires the user to remember the complex passwords created by the user. FID system requires the user to maintain the RFID card safely without any damage. On the other hand intelligent door locking system is comfortable to use as it uses fingerprint for authenticating the user .Hence this system is user friendly compared to all other systems.

VII. FUTURE WORK

In future, alarm will be introduced. When intruder tries to break the door, the vibration is sensed by sensor which makes an alarm. This will inform the neighbors about intruders and this will help to take further action to prevent intruder from entering.

VIII. CONCLUSION

Hence the biometric finger print system provides good solution to the home safety problem. Our proposed system is designed in such a way that it overcomes all the defects of previously available systems. User friendliness is given much importance in our system which makes it more comfortable to use than any other existing systems. Also it is built with open source hardware which makes it cheaper.

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