

# Fingerprint Based Security System

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**Abstract:** Fingerprint-based security systems can be used in a variety of settings, including industries, offices, and colleges, as well as in our own homes. This project combines "Biometrics technology" and "Embedded system technology" in a unique way. The fingerprint sensor is the most important component of this system. It detects fingerprints using a biometric sensor. It is also known as a biometric sensor. The fingerprint sensor employs a variety of techniques, including ultrasonic, optical, and thermal methods. We used an optical fingerprint sensor in this project.

This project's main components are a microcontroller, a fingerprint module, a buzzer, a relay, a keypad, an LCD display, and a motor. The user must place his or her finger on the fingerprint module's optical sensor. We've seen RFID-based security systems and password-based security systems. The main characteristic or specialty of a fingerprint is its uniqueness. It provides greater security for this project than other security systems. Fingerprint identification has long been used for person recognition. The most common application is in criminal cases.

**Keywords:** Security, System, Fingerprint, Sensor, Lock, Door, Access, Message, Fingerprint Based Security System

## I. INTRODUCTION

Security is regarded as one of the most common sources of concern for humans. We are all looking for practical solutions and suggestions to keep our belongings and privacy safe from intruders. Home security and possessions are among the most important challenges that individuals, corporate organisations, and nations face. This critical problem of property security and intrusion into premises dates back to the dawn of humanity.

Building security can now be easily achieved through the use of door security controls. It restricts access to unauthorised individuals and collects information and records on all those who pass through it [1].

Fingerprint-based security systems can be used in a variety of settings, including industries, offices, and colleges, as well as at home. The fingerprint sensor is the most important component of this system. It is also known as a biometric sensor. The user must place his or her finger on the optical sensor portion of the fingerprint module. We've seen RFID-based security systems and password-based security systems.

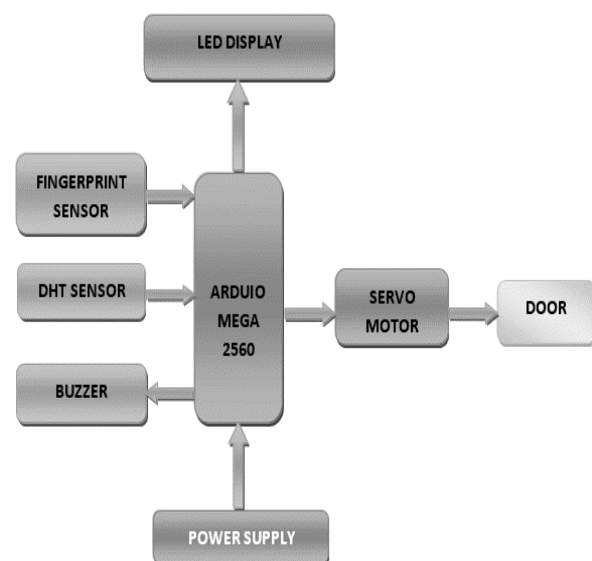
The main characteristic or specialty of a fingerprint is its uniqueness. It provides greater security for this project than other security systems. To run this project, we must first enter data into the database of the finger print sensor, which requires us to take fingerprint impressions of those people to whom we want to grant access to our security system.

This can be done once or whenever a new entry in the system is required. The project must then be used in search mode. The system compares the fingerprint input received at its optical plate with the previously stored fingerprint from its flash memory in this mode. If the entry matches

the memory, it sends an OK signal along with the person's identity number.

However, if the entry does not match the memory, an error signal is generated. The microcontroller receives the fingerprint sensor's output. The output data is then compared by the microcontroller. The function of a microcontroller is to turn on the appropriate device based on the input received. When the fingerprint module sends an OK signal, the microcontroller activates a relay and a motor. If the error output is received, the Buzzer [2] is activated.

## II. BLOCK DIAGRAM



**Figure 1: Block diagram**

**Block Diagram Description:****Following are the important blocks of this system**

1) Fingerprint sensor: The R305 Finger Print Sensor was used. It is equipped with an optical biometric fingerprint reader. It also has flash memory built in. It performs image processing and outputs data via its output pin.

2) Microcontroller: This is our project's CPU (central processing unit). We'll be using an 8051 family microcontroller.

The following are some of the functions of a microcontroller:

- i. Reading different digital input signals from a fingerprint sensor
- ii. Sending this data to an LCD so that the person in charge of this project understands the status.
- iii. Sending the appropriate signal to the various output devices. Valid access is controlled by a relay and a DC motor, while invalid access is controlled by a buzzer.
- iv. Using a serial port to send data to a computer. This information includes the status of valid or invalid access.

3) LCD: We used a 16x2 alphanumeric Liquid Crystal Display (LCD) that can display alphabets and numbers on two lines of 16 characters each.

4) Buzzer: We will use a buzzer to indicate the invalid access in order to open the door.

5) Keypad: The keypad will be used by the user to enter various commands. The following are some keypad keys:

- i. Add a fingerprint entry
- ii. Search for a fingerprint
- iii. Empty the fingerprint module's database

**Hardware Specifications:**

- Fingerprint module
- LCD Display
- Door
- Power Supply
- Rectifier
- Regulator
- Atmega 328 Microcontroller
- Push Buttons

**Software Specifications:**

- Arduino Compiler
- MC Programming Language: C

**Fingerprint Module:** This is a fingerprint sensor module with a TTL UART interface for connecting directly to a microcontroller UART or to a PC via a MAX232 / USB-Serial adapter. The user can save the finger print data in the

module and configure it to identify the person in 1:1 or 1:N mode. The FP module can communicate directly with a 3v3 or 5v microcontroller. Interfacing with a PC serial port necessitates the use of a level converter (such as MAX232). Optical biometric fingerprint reader with excellent features that can be embedded in a wide range of end products, including access control, attendance, safety deposit boxes, and car door locks.

**Features:**

- Fingerprint reader can conduct secondary development and can be embedded in a variety of end products due to its integrated image collecting and algorithm chip.
- Professional optical technology, precise module manufacturing techniques • Low power consumption, low cost, small size, excellent performance
- Capable of capturing images with a resolution of up to 500 dpi thanks to strong image processing capabilities.

**Objectives:**

1. Research a fingerprint-based security system.
2. Microcontroller block diagram implementation.
3. Fingerprint-based security system analysis.

**III. REVIEW OF LITERATURE**

Prior to 2006, Fernandez et al. proposed a comparative study of FQA in which they classified FQA algorithms into three categories: local feature-based approaches, global feature-based methods, and solutions with classifiers. These quality metrics can be simply summarised as follows: quality metrics based on fingerprint pattern orientation; algorithms based on Gabor response variation; frequency domain approaches; measurements based on pixel information; and quality indexes based on multi-feature classification. Furthermore, that study examined quality metrics primarily in terms of their linearity. [3]

The second category discusses quality metrics that rely on a single feature that can be applied to an image locally or globally. Ratha et al., for example, proposed using the cumulative energy of several sub-bands of the compressed image in the wavelet domain. Lee et al. examined three fingerprint image-based approaches: local standard deviation, directional contrast of local block, and the Gabor feature. They proposed a feature based on the fingerprint image's Fourier spectrum. Their quality metric is based on the pixels of the Fourier spectrum image, which is a floating measure for various image settings. [4-7]

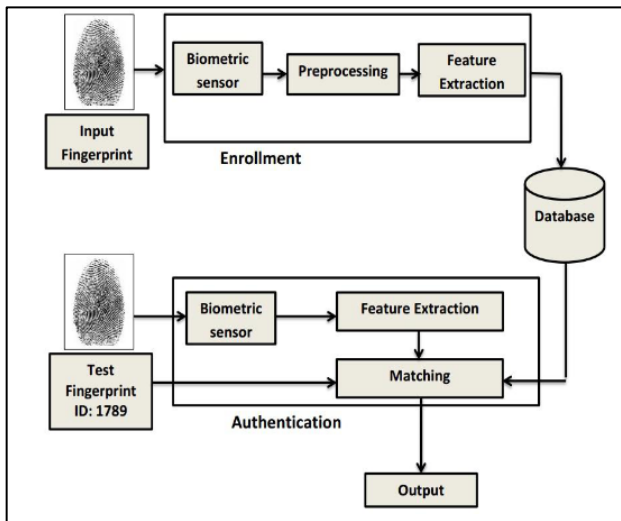
**IV. RESEARCH METHODOLOGY**

Books, educational and development journals, government papers, and print and online reference resources were just a few of the secondary sources we used to learn about the composition, application, and impact of Fingerprint Based

Security System. The performance analysis for fingerprint biometrics was presented in this paper. It clearly outperforms password and token-based security. In terms of usability, size, privacy, and operational temperature range, it can be concluded that automatic fingerprint recognition is a biometric technology that can be used for security. The proposed security system can help to reduce vehicle theft while also allowing the owner to identify the intruder.

**V. RESULT AND DISCUSSION**

The operation of a fingerprint-based system begins with adding fingerprints features of authorised persons to our system’s database. By placing the finger on the fingerprint optical scanner, some features are extracted from the finger surface and stored to the database with a specific ID and the person’s name can be added, as shown in figure [1].



**Figure 2: The process of Extracting features from the finger surface and storing them in a database.**

We investigate some representative FQA literature to illustrate the solutions proposed thus far. The biometric quality of a fingerprint sample is not always the same as it is estimated by subjective criteria. The biometric definition should be linked to the expected matching performance of the qualified fingerprint samples. This issue can be easily illustrated by some examples, as shown in Figure 2. [8-9].



**Figure 3: Typical View of finger surface pattern**

Figure 3 depicts several genuine fingerprint samples that differ visually, with the leftmost one being relatively clear and complete, followed by an image with a little bit translation, a fragment print, and a scattered-looking image.

**VI. CONCLUSION**

The proposed security system was tested in a real-world setting, and its performance was deemed satisfactory. The system's security features, such as GSM technology, a password system, and a web cam, distinguish it and make it competitive. The future scope of this work is very broad, and many other security tools, such as iris scanners for a person's visual identification, fire sensors linked to alerting alarms, and the system can be enhanced using artificial intelligence techniques to speed up and facilitate the process of identifying a person by using face recognition technique with a database of popular burglars, can be added to the system to provide more security.

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