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Fingerprint Door Unlock System

Prof. Vanita Buradkar[1], Sakshi Lahamge[2], Shreya Kudrapwar[3], Mahek Rafique Khan[4]
Department of Computer Science Engineering, Rajiv Gandhi College of Engineering Research and Technology, Chandrapur, Maharashtra, India

Abstract: ***Human detection and recognisation field is very significant and has undergone rapid changes with time. An important and very reliable human identification method is fingerprint identification. Fingerprint of every person. is unique. So this helps in identifying a person or in improving security of a system. Finger print of a person is read by a special type of sensor. Finger print sensor can be interfaced with a microcontroller. Through keypad we can add new user and delete the existing user, also identify the user by selecting corresponding option through keypad. In this project we use a fingerprint sensor to read ones identity to automatically operate the door of the car. For this, we use a microcontroller to enable the door opening or closing if the matching between scanned data and the already existing data is correct. Comparison is done inside the fingerprint module itself and its output is given to microcontroller. Result is displayed in a LCD display whether the user is authorized or not.LCD also helps to make troubleshooting easier. Alarming option is provided to warn about an unauthorized usage.***

Keywords: Fingerprint Sensor, LCD, Arduino UNO, Solenoid Lock, Relay.

I. INTRODUCTION

A fingerprint door unlock system revolutionizes traditional security measures by employing cutting-edge biometric technology. By harnessing the unique patterns of an individual's fingerprints, this system ensures secure access control while offering unparalleled convenience. This innovative solution not only heightens security but also streamlines entry processes, making it an ideal choice for homes, offices, and high-security environments. Its seamless integration of advanced biometrics marks a significant leap forward in modern access control, promising a safer and more efficient way to safeguard spaces.

A fingerprint door unlock system utilizes biometric technology to grant access based on unique fingerprints. It enhances security by eliminating the need for traditional keys or codes, offering a more secure and convenient way to control access to spaces. This system typically involves a fingerprint scanner that captures and analyzes the unique patterns of an individual's fingerprint, allowing authorized individuals to gain entry with a simple scan.

Lock systems have been around for centuries, and traditional lock systems are still being used today. However, these systems are no longer considered secure and convenient as they are prone to various vulnerabilities. The rise of technology has led to the development of advanced door lock systems that are more secure and convenient than traditional lock systems. Biometric door lock systems are one such technology that uses a person’s unique physical traits for authentication purposes. Fingerprint door lock systems are becoming increasingly popular due to their security and convenience. This thesis presents the design and implementation of a fingerprint door lock system using Arduino Uno microcontroller.

II. LITERATURE REVIEW

On fingerprint door unlock systems reveals a growing interest in biometric security. Studies highlight the reliability and uniqueness of fingerprints, emphasizing their effectiveness in access control. Researchers explore various algorithms for fingerprint recognition, such as minutiae-based and pattern-based approaches, analyzing their accuracy and robustness. Additionally, there's a focus on enhancing system security against spoofing attempts and addressing privacy concerns. Integration with smart home technology and the Internet of Things (IoT) is also a notable trend, showcasing the potential for seamless and secure access control in modern environments. Overall, the literature underscores the continuous evolution of fingerprint door unlock systems with advancements in technology and a commitment to improving security measures.

III. METHODOLOGY

The methodology section describes the design and implementation of the finger-print door lock system using Arduino Uno microcontroller. The system consists of hardware and software components. The hardware components include Arduino Uno, fingerprint sensors module, relay module, solenoid door lock, some jumper wires, and an adapter.

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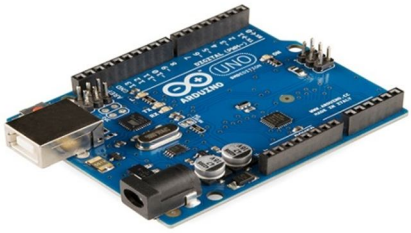
The software components include a program for interfacing the fingerprint sensor with Arduino. The system was designed and implemented using the Arduino software, and the programming language used was C.

IV. SYSTEM DESIGN

A. Arduino UNO

The Arduino UNO is the best board to get started with electronics and coding. In the beginning with the platform, this UNO is the most robust board that can be started playing with. The UNO is the most used and documented board of the whole Arduino family. This microcontroller is the central processing unit of the system. It controls all the and other components processes fingerprint data.



B. Fingerprint Sensor Module

Fingerprint sensor was used in this thesis project. It can be easily inte- grated into various biometric projects. It is compatible with Arduino development boards and can be used to implement secure access control systems, attendance management systems, and other biometric applications. The sensor module is equipped with a high-resolution optical scanner that can capture fingerprints with high accuracy and speed.

The fingerprint sensor module has a compact design and is easy to install. It communicates with Arduino boards via a serial interface. The module also features a built-in LED indicator and buzzer that provide real-time feedback during finger- print scanning.

Overall is a versatile and reliable fingerprint sensor module that can be used in a variety of biometric projects. Its ease of use and compatibility with Ar- duino boards make it an ideal choice for hobbyists and professionals alike.

C. Solenoid Door Lock

The Solenoid Lock is a compact and powerful locking mechanism de- signed for various applications that require secure access control. It operates at 12V DC and consumes 18W of power, making it suitable for a range of electronic locking systems. This solenoid lock is known for its reliability, durability, and efficient performance. It features a solenoid coil that, when energized, generates a magnetic field, allow- ing the lock to engage or disengage. The lock mechanism is designed to securely hold or release a latch or bolt, providing a reliable locking and unlocking mecha- nism.

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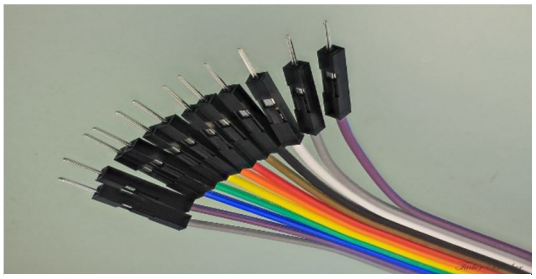
D. Relay Module

The module is used to control the electronic door lock. It is activated by the Ar- duino Uno if the fingerprint data matches one in the database. The latching relay module is an electronic module that uses a latching relay to control the switching of an electrical circuit. The module is compact and easy to use, making it a popular choice for various applications that require remote control of electrical circuits. The module typically consists of a latching relay, a control circuit, and an interface for connecting to an external control device, such as a microcontroller or a switch. It operates on a low input voltage and provides a high output voltage, making it ideal for use in battery-operated devices.

E. Jumper Wire

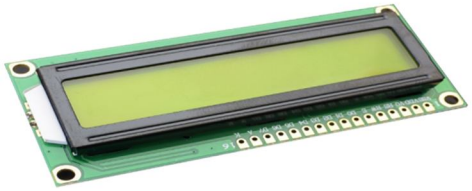
A jump wire is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

The overall design of the system is explained through the block diagram shown below. It describes all the components needed to implement a system. Figure 1 shows the block diagram of Obstacle avoiding Voice controlled system.



F. LCD Display

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome, LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as present words, digits, and seven-segment displays, as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the colour of the backlight, and a character negative LCD will have a black background with the letters being of the same colour as the backlight. Optical filters are added to white on blue LCDs to give them their characteristic appearance.



G. Buzzer

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board.

V. WORKING

Fingerprint locks operate by scanning and converting your fingerprint data into a numerical template.

Once you place your finger onto the scanner for the first time the conversion into numerical data takes place, and the fingerprint template is saved. This process is then repeated every time you want to grant someone access. The next time someone places his/her finger on the sensor, it matches the data obtained through the finger with the pre-saved values. If a match is found, access is granted and the door opens. On the other hand, if its someone else trying to get through, access is not allowed and the door remains locked. Simple, no?

Now, matching the algorithm is the most important process here. This is usually achieved by the Minutia matching process. In this, several minutia points are located on your fingers pads, along with their position and direction when you register for the first time. This information is stored in the memory. While matching, the already stored fingerprint template is compared to the received input. If there is a match, a green LED usually signals it and the door is opened. The process is very quick and is completed in a fraction of a second. In case you are wondering, two instances of friction ridge skin impressions together constitute a minutia

VI. CONCLUSION

Fingerprint door unlocking systems offer a secure and convenient access control solution. Their reliance on unique biometric identifiers enhances security, reducing the risk of unauthorized access. However, potential drawbacks include cost, technological limitations, and privacy concerns. Careful implementation and consideration of these factors are crucial for the successful integration of fingerprint-based door unlocking systems.

VII. RESULT

The fingerprint door unlock system's success relies on its accurate identification of authorized fingerprints, providing a secure and convenient access method. However, potential challenges may include false positives or negatives, depending on the system's technology and quality. Regular maintenance, updates, and adherence to security best practices contribute to the system's overall reliability and effectiveness in real-world applications.

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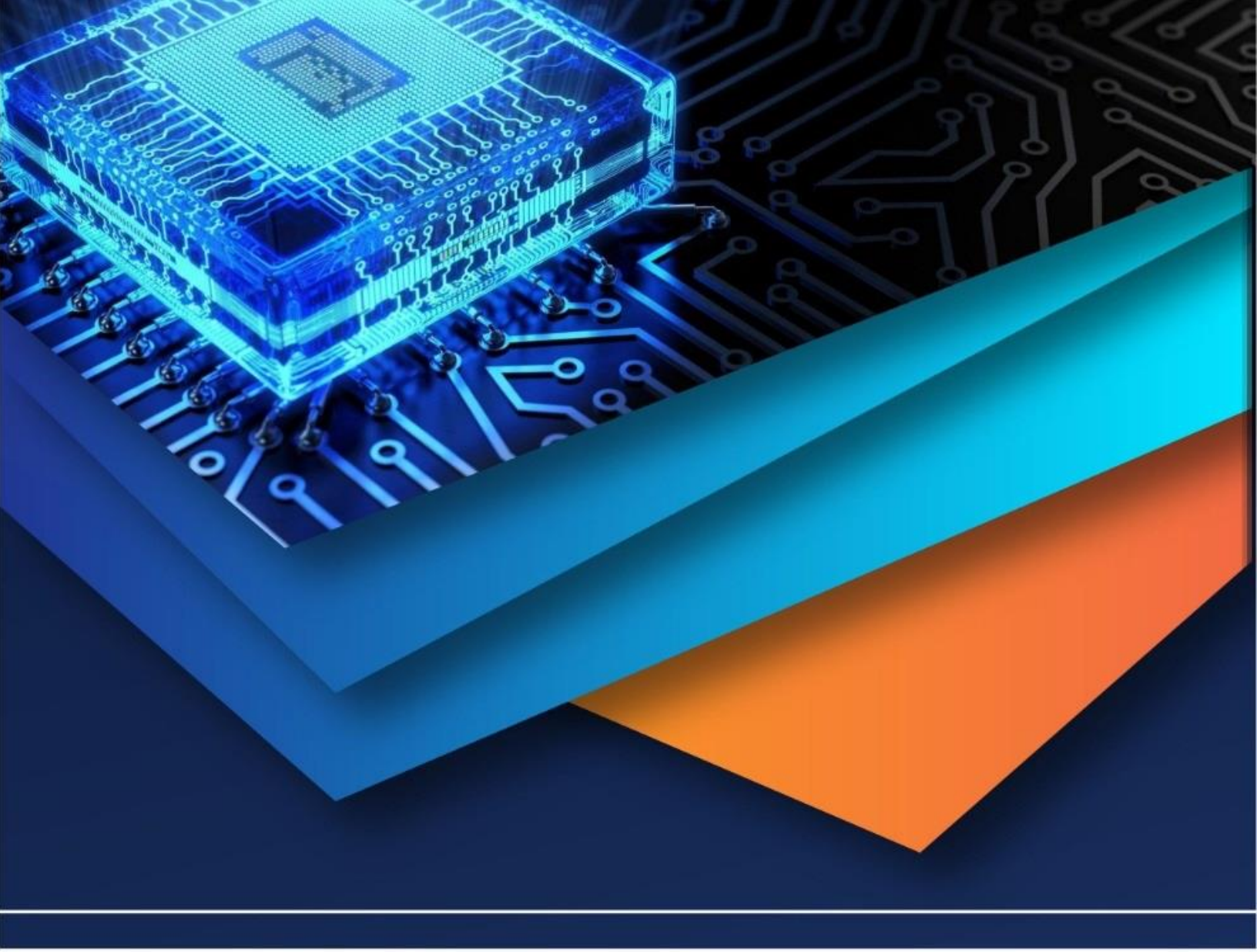

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