iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** V **Month of publication:** May 2023

DOI: https://doi.org/10.22214/ijraset.2023.53047

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue V May 2023- Available at www.ijraset.com

Biometric based Fingerprint Identification for Bank Locker Security System

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Abstract: ***This paper presents the human detection and recognition 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 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 fingerprint we can add new user and delete the existing user. In this project we use a fingerprint sensor to read one's identity to automatically operate the door of the locker. 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 an LCD display whether the user is authorized or not. The aim of our project is to design finger print based bank locker security system, which uses candidate's fingerprint to decide the authenticity of candidate.***
Keywords: ***Finger print sensor, LCD, Arduino UNO ATMEGA328, Servo Motor, I2C module.***

I. INTRODUCTION

A. Background of Study and Motivation

The fingerprint-based bank locker system is an enhancement to the traditional bank locker system that uses keys. The fingerprinted authenticated bank locker system is safe as well as easy to use and maintain. No key handling no need to worry about key getting lost. The system uses fingerprint sensing to read fingerprints and first store registered fingerprints against the bank locker record. Now next time a person scans finger the sensor reads it and compares it with past records. Now if match is found with existing prints, it sends the match signal to the microcontroller and the controller displays this data on the LCD display. Also, the controller drives the driver motor to open the bank locker door and opens it for authorized customers. The door of locker wants open for authorized customers.

B. Project Objectives

The goal of this project is to research and analyse a suitable collection of components for developing a smart door lock using Arduino that provides excellent security and quick access. The aim of our project is to design finger print based bank locker security system, which uses candidate's fingerprint to decide the authenticity of candidate.

II. LITERATURE REVIEW

There are just a few digital approaches for door security locks in the current system. This contemporary smart locking system takes the place of the classic lock and key locking method. Modern living is largely reliant on technological advancements, such as opening doors, managing the air conditioning, and regulating the curtains. People want to feel safe in their own homes, offices, and stores. The primary motivation for the development of smart locks is to meet the needs of people. Some of these systems will be discussed in this section.

A. Fingerprint Locking System

Fingerprint locking system is a locking system that uses a fingerprint sensor module to secure the user's fingerprint. The fingerprint sensor module uses an Arduino to operate. In the proposed system, there is a three-level security. Any two levels of security users have to face to unlock the system. This is the ideal option for avoiding the hassles of a stolen or lost key or illegal access. The authorized user must register his or her fingerprint in the system. The registered person's mobile number is then added to GSM, and a permanent image password is assigned to this user. As a first step, the unauthorized individual must choose unauthorized as the user type. The admin receives a random picture. The person must properly choose the random image. Otherwise, the system will go back to the first page.

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B. Knock-Pattern Using Arduino

This system, which consists of Arduino, Servo Motor, and other components, employs a 'Secret Knocking Pattern' that is only known by the owner of the safe, luggage, or other property or item on which the device is mounted. For the lock to open, the knocking pattern must be used only at a certain location, which is only known by the owner. The secret pattern can only be changed after the secret knock has been unlocked. Because there is no key to be copied, this approach fully eliminates the worry of duplication.

C. Keyless Entry System Based on Arduino Board

A keyless entry system that focuses on the use of an Arduino circuit board and the C programming language to provide access to a closed door. The suggested solution, which uses an Arduino Uno board to unlock the door without a key, is described. The internet connection allows the system to unlock the door from any place, unlike traditional systems, which have a limited range.

III. METHODOLOGY

In this project, we implemented a Fingerprint Based Security System Using Arduino & Fingerprint sensor. Thefts are increasing day by day security is becoming a major concern nowadays. So, a fingerprint lock can secure our bank locker easily. It will open your door only when the right person is entered. Only authorized people are allowed access to the restricted sections due to a fingerprint-based door lock mechanism. The Arduino is responsible for the entire project's operation. The desired fingerprint can be entered using fingerprint sensor R305.

Working Principle: The purpose of this experiment is to implement a door-locking mechanism that opens or closes the lock on the door automatically with a fingerprint sensor. There are two work processes for this experiment which are:

A. Process of Work

1) *Case 1:* The lock will open: A finger print sensor will input data allowing us to compare the data with the stored record. When inputting a fingerprint comprising of fingerprint with the help of the past stored record, if the data matches the fingerprint which already fixed, the fingerprint will send a signal to the display and the "Code Accepted" message will be shown. If the code is accepted, the Arduino will send a signal to Servo Motor. The Motor will then rotate 90° and open the lock, allowing the door to be unlocked.
2) *Case 2:* The lock will not open: If the fingerprint inserted in the fingerprint sensor does not match the fixed data in stored record, the fingerprint will send a signal to the Display to show the "Wrong Code" message. inserting the wrong data in the fingerprint sensor will automatically instruct the user to start again from the beginning. If the "Wrong Code" message is shown, the Servo Motor will not rotate and the lock will not open allowing the door to remain locked.

B. Important Components

1) Hardware:

a) Fingerprint sensor module – R305
b) 1602(16*2) LCD display with I2C/IIC interface
c) Arduino UNO R3 SMD ATMEGA328 board
d) Tower Pro SG90 Servo- 9gms mini/micro–Servo motor

2) Software

a) Arduino IDE

C. Block Diagram



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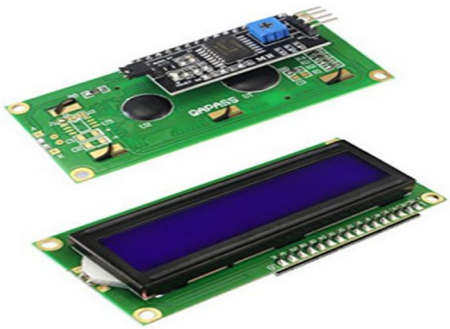
D. Fingerprint sensor module – R305

R305 Fingerprint Module consists of optical fingerprint sensor, high-speed DSP processor, high-performance fingerprint alignment algorithm, high-capacity FLASH chips and other hardware and software composition, stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.



*E. 1602(16*2) LCD display with I2C/IIC interface:*

This is LCD 1602 Parallel LCD Display that provides a simple and cost-effective solution for adding a 16×2 White on Liquid Crystal Display into your project. The display is 16 characters by 2-line display has a very clear and high contrast white text upon a blue background/backlight. This is great blue backlight LCD display. It is fantastic for Arduino based project. This LCD1602 LCD Display is very easy to interface with Arduino or Other Microcontrollers. This display overcomes the drawback of LCD 1602 Parallel LCD Display in which you'll waste about 8 Pins on your Arduino for the display to get working. Luckily in this product, an I2C adapter is directly soldered right onto the pins of the display. So, all you need to connect are the I2C pins, which shows a good library and little of coding.

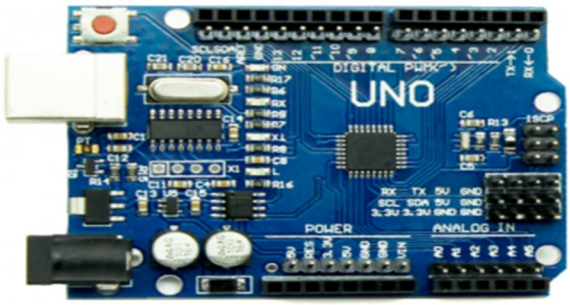


F. Arduino UNO R3 SMD ATMEGA328 Board

Arduino UNO R3 SMD is the open-source Embedded Development board based on Atmega328 SMD Package Microcontroller. Because Atmel is moving more and more of their production capacity to surface mount ICs, the DIP packaged ATmega is becoming more and more difficult to get. To keep up with demand, we now offer the Uno R3 with an SMD ATmega. The board is identical to the PTH version of the Uno, but you won't be able to remove the ATmega without some hot-air. This change shouldn't affect most users.

Microcontroller: ATmega328 SMD.
Operating Voltage: 5V.
Supply Voltage recommended: 7-12V DC.
Digital I/O Pins: 14 (of which 6 provide PWM output).
Analog Input Pins: 6.
DC Current per I/O Pin: 40 mA.
DC Current for 3.3V Pin: 50 mA.
Flash Memory: 32 KB (ATmega328) of which 0.5 KB used by bootloader.
SRAM: 2 KB (ATmega328).
EEPROM: 1 KB (ATmega328).
Clock Speed: 16 MHz

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G. Tower Pro SG90 Servo- 9gms mini/micro–Servo motor

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

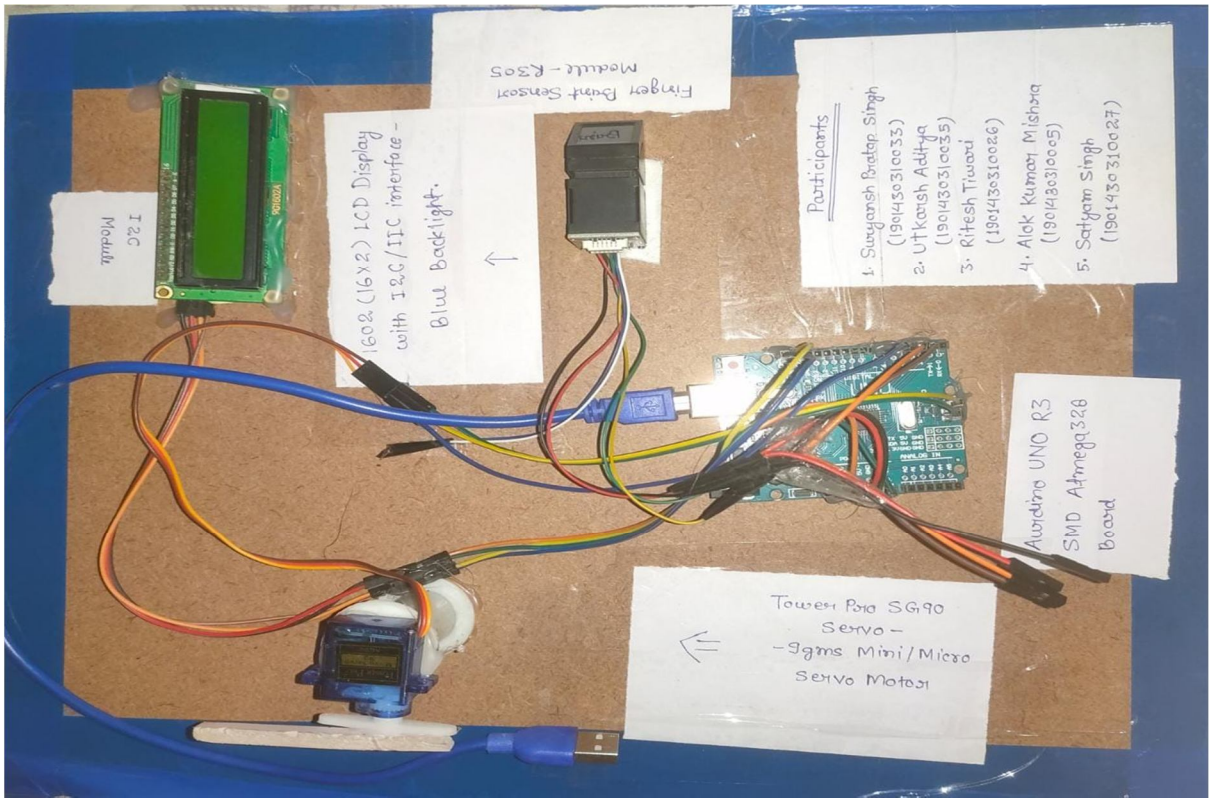


IV. RESULT & DISCUSSION

First of all, user is asked to enrol his fingerprint. After enrolment the user's identification is done. If the person is authorised, the door automatically opens and after access done, the door automatically closes. The door automatically closes. This system focuses on the use of fingerprints for door opening and closing. The fingerprint recognition software enables fingerprints of valid users to be enrolled in a database. Before any user can use the locker his/her fingerprint image is matched against the fingerprints in the database while users with no match in the database are prevented from using. The microcontroller stores the data equivalent of fingerprint of the master user. Compare between this enrolled fingerprint and the fingerprint of the person who is about to use the locker is done by the microcontroller. If both the fingerprints are identical control circuitry of the microcontroller sends appropriate signals to the motor relays operating the door of the locker.

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A. Hardware Representation



(Figure 1.0 Biometric Based Fingerprint Identification For Bank Locker Security System)

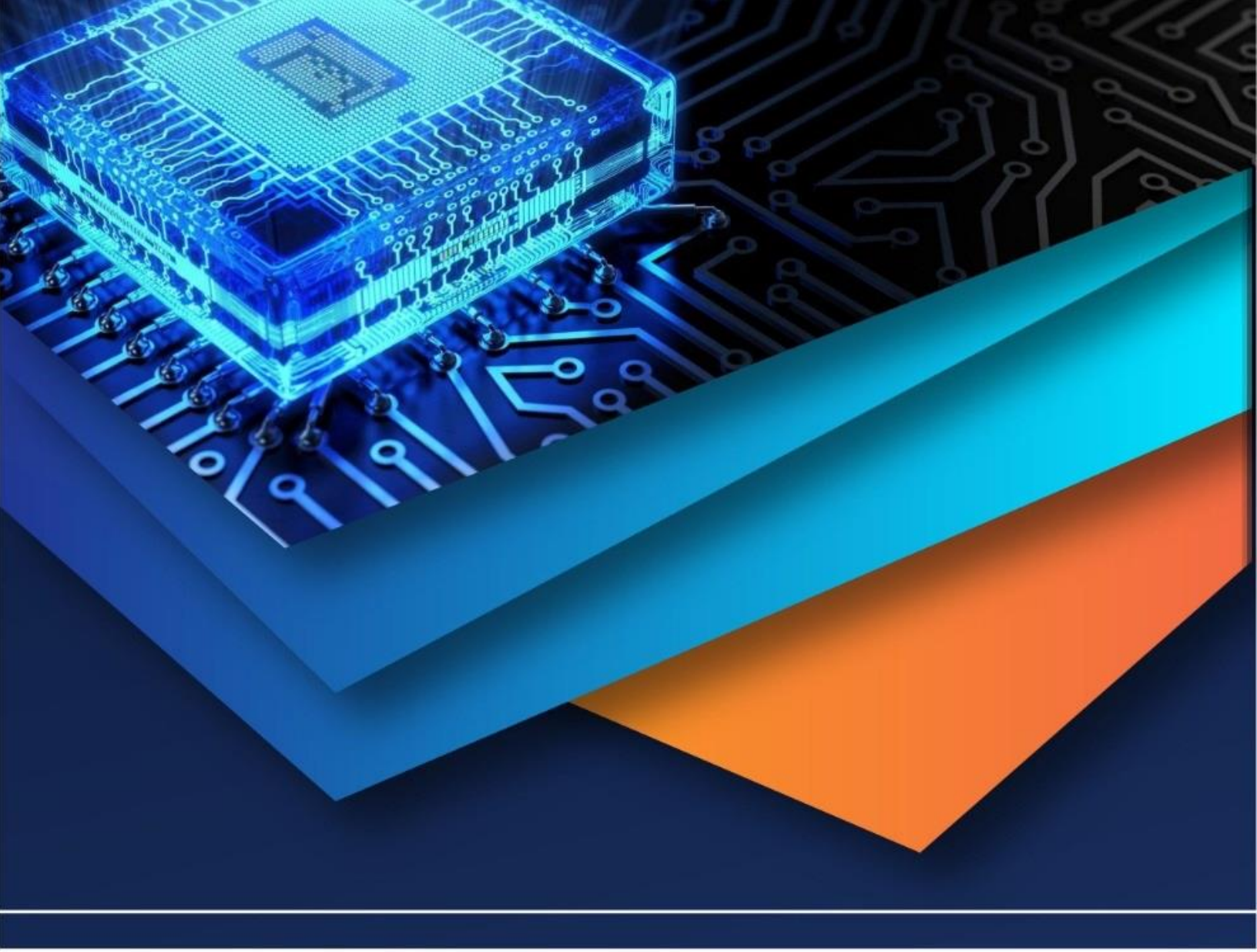
V. CONCLUSION

Fingerprint identification enhances the security of a locker and makes it possible only for some authorized people to use the locker. Thus, by implementing this relatively cheap and easily available system on a locker, one can ensure much greater security and exclusivity than that offered by a conventional lock and key. It can be deduced that the use of biometric security systems offers a much better and fool proof means of restricting the use of locker by unauthorized users. The developed prototype serves as an impetus to drive future research, geared towards developing a more robust and embedded real-time fingerprint based automatic door lock systems in bank locker.

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