FINGERPRINT DOOR UNLOCK SYSTEM

1. INTRODUCTION

1.1 ABSTRACT

In this project, the simple fingerprint door unlock system using Arduino can be very useful for door security, forensics, crime investigation, personal identification, attendance system and much more. In the future, there could be many more applications like fingerprint-based driving licences, bank accounts operation.

1.2 RESEARCH

The whole system works under a simple algorithm called matching algorithm, which is used to compare previously-stored templates of fingerprints against users' fingerprints for authentication purposes.

A key is normally used for traditional door opening, but it provides very poor security. In this fingerprint door unlock project, only when an authorized person places a finger on the sensor, the door unlocks and the LCD displays a welcome message along with that person's name.

1.3 FEATURES OF THE SYSTEM

1. Fingerprint based driving licence.

2. fingerprint-based bank system.

3. fingerprint based attendance system.

1.4 SYSTEM DESCRIPTION

In this project, the circuit operates using a 12V power supply. An Arduino microcontroller (MCU) requires only 5V but the solenoid electric lock requires 12V. As Arduino Uno has an inbuilt 5V voltage regulator, a common 12V supply can be used for the whole system.

The brain of the circuit is Arduino Uno MCU board (BOARD1). It is based on ATmega328/ATmega328P and has 14 digital input/output (I/O) pins, six analogue inputs, 32k flash memory, 16MHz crystal oscillator, a USB connection, power jack, ICSP header and reset button, among others. It can be programmed using Arduino IDE software.

Fingerprint sensor module R305 (connected across CON2) has UART interface with direct connections to the MCU or to the PC through max232/USB serial adaptor. The user can store fingerprint data in the module and configure it in 1:1 or 1: N mode for identification. Pins TX and RX of R305 sensor are connected to Arduino digital pins 2 and 3, which are used for serial communication.

The LCD display (LCD1) is used to display messages during action. Here, a 16×2 display is used; each character is made of 5×7 dot-matrix. Pins 3, 4, 5 and 6 of the LCD are the control lines connected to pre-set (PR1) output, pin 12 (Arduino), GND and pin 11 (Arduino). Pins 11, 12, 13 and 14 are data pins of the LCD that are connected to pins 7, 6, 5 and 4 of Arduino, respectively. Pre-set PR1 is used to adjust the contrast of the LCD display.

An electronic door-lock solenoid (connected across connector CON3) is basically an electromagnet made of a big coil of copper wire with an armature (slug of metal) in the middle. When the coil is energised, the slug is pulled into the centre of the coil. This allows the solenoid to move to one end.

The solenoid lock requires more current than what Arduino can provide. Therefore, to operate the lock, a 5V relay (RL1) is used. CON3 is connected between normally open (N/O) contacts of RL1 and GND. The sequence of messages on the LCD.

PRINCIPLE OF THE SYSTEM

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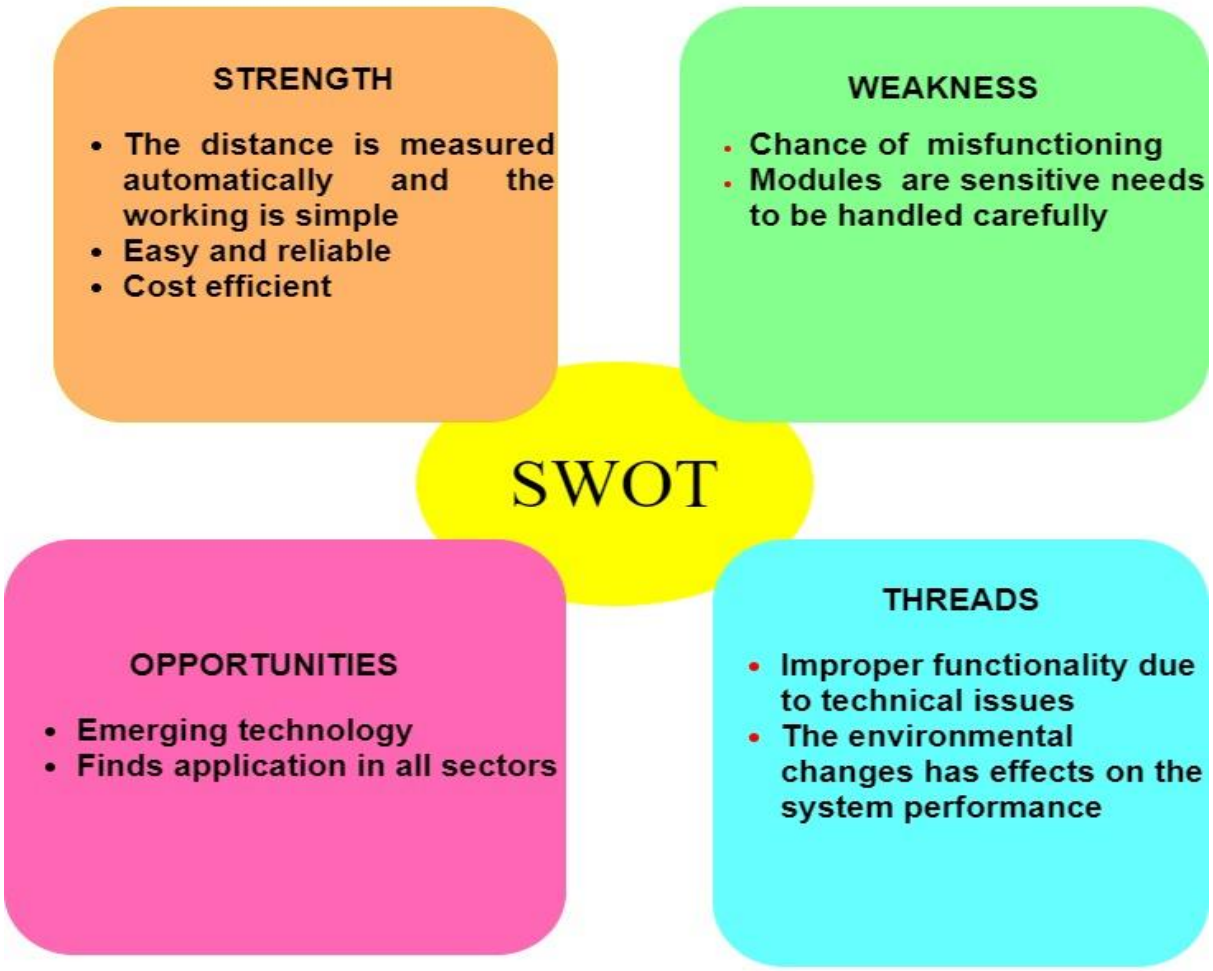
Programs named enrol and fingerprint use different functions like getFingerprintEnroll(int, id), Adafruit_Fingerprint(&my Serial) and getFingerprintEnroll(id). These functions are defined inside the library and pass arguments when called.

After uploading enrol in the Arduino, open serial monitors from Arduino IDE from Tools→Serial monitor options. Change baud rate below the serial

monitor window to 38400. Choose Newline option from the same place. Then, follow the instructions on the serial monitor. Place the finger on the fingerprint module. Type any whole number as the ID number. Press Send tab to send the ID number from the serial monitor to Arduino. This fingerprint gets converted into digital data and gets store inside R305 module database.

More than 200 fingerprints can be stored on this system. Make sure that each fingerprint has a unique ID number. This ID number will be used in the next program to identify the authenticated person’s name. The serial monitor will guide the user as to when he or she should place the finger and when to remove it.

For debugging without an LCD display, make the same settings for the serial monitor after uploading Fingerprint program. This is used to compare the fingerprint in the sensor with stored prints. The serial monitors guides here also. The fingerprint program should be edited to change the name and ID numbers according to how users want.



1.5 SWOT ANALYSIS

1.6 4W & 1H

WHAT

The fingerprint sensor module is used to find the registered fingerprint all when it find the match the door unlock with an welcome note in the led display.

WHERE

FINGERPRINT DOOR UNLOCK SYSTEM can be used in every place and due to emerging new technologies, it can be even used in houses

WHEN

It can be used even to access the bank accounts or even for driving licence

WHY

This method can be used or upgraded as it will ensure security and its more effective than any other system

HOW

By using the Arduino uno we can upgraded our fingerprint system and it can be used

2. REQUIREMENTS

2.1 HIGH LEVEL REQUIREMENTS

HLR ID	DESCRIPTION	CATEGORY	STATUS
HLR1	System shall detect the fingerprint of the registered person	Technical	Implemented
HLR2	System shall check any other mismatches	Technical	Implemented
HLR3	System shall have user interface	Technical	Implemented

2.2 LOW LEVEL REQUIREMENTS

LLR ID	HLR ID	DESCRIPTION	CATEGORY	STATUS
LLR1	HLR1	System shall have a fingerprint sensor module	Technical	Implemented
LLR2	HLR2	System shall have a Arduino uno	Technical	Implemented
LLR2	HLR2	System shall have led display to welcome note	Technical	Implemented
LLR3	HLR3	System shall have a solenoid lock to open /close door	Technical	Implemented

2.3 COMPONENTS REQUIRED

1. ARDINO UNO
2. FINGERPRINT SENSOR MODULE
3. 16*2 LCD Display
4. SOLINOID LOCK

ARUDINO UNO

The Arduino Uno MCU board. The brain of the circuit is Arduino Uno MCU board (BOARD1). It is based on ATmega328/ATmega328P and has 14 digital input/output (I/O) pins, six analogue inputs, 32k flash memory, 16MHz crystal oscillator, a USB connection, power jack, ICSP header and reset button, among others.

FINGERPRINT SENSOR MODULE

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16x2 LCD Module

16x2 LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability, programmer friendly and available educational resources.

1.Operating Voltage is 4.7V to 5.3V

2.Current consumption is 1mA without backlight

3.Alphanumeric LCD display module, meaning can display alphabets and numbers

4.Consists of two rows and each row can print 16 characters

5.Each character is build by a 5×8 pixel box

6.Can work on both 8-bit and 4-bit mode

7.It can also display any custom generated characters 8.Available in Green and Blue Backlight

P.No	PIN NAME	PIN DESCRIPTION
1	Vss (Ground)	Ground pin connected to system ground
2	Vdd (+5 Volt)	Powers the LCD with +5V (4.7V – 5.3V)
3	VE (Contrast V)	Decides the contrast level of display. Grounded to get maximum contrast.
4	Register Select	Connected to Microcontroller to shift between command/data register
5	Read/Write	Used to read or write data. Normally grounded to write data to LCD
6	Enable	Connected to Microcontroller Pin and toggled between 1 and 0 for data acknowledgement
7	Data Pin 0	
8	Data Pin 1	
9	Data Pin 2	
10	Data Pin 3	
11	Data Pin 4	

P.No	PIN NAME	PIN DESCRIPTION
12	Data Pin 5	
13	Data Pin 6	
14	Data Pin 7	
15	LED Positive	Backlight LED pin positive terminal
16	LED Negative	Backlight LED pin negative terminal

SOLINOID LOCK

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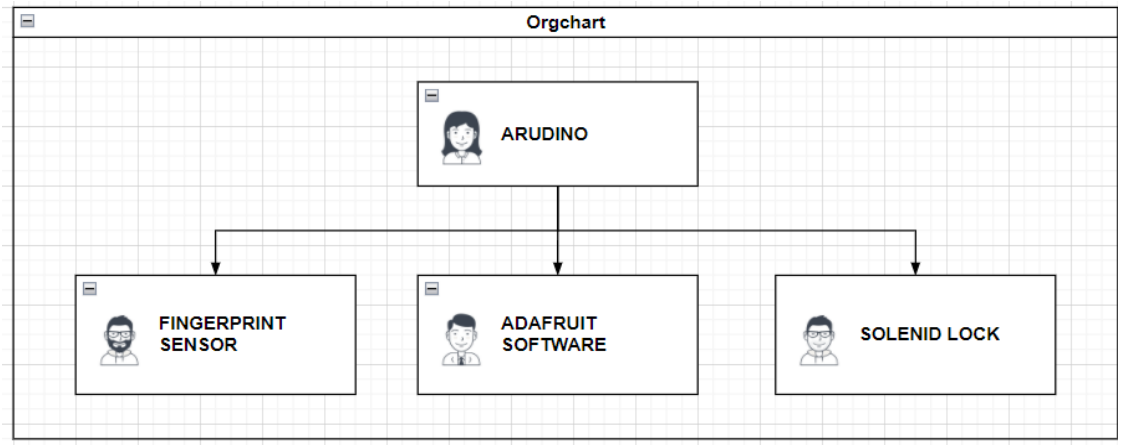
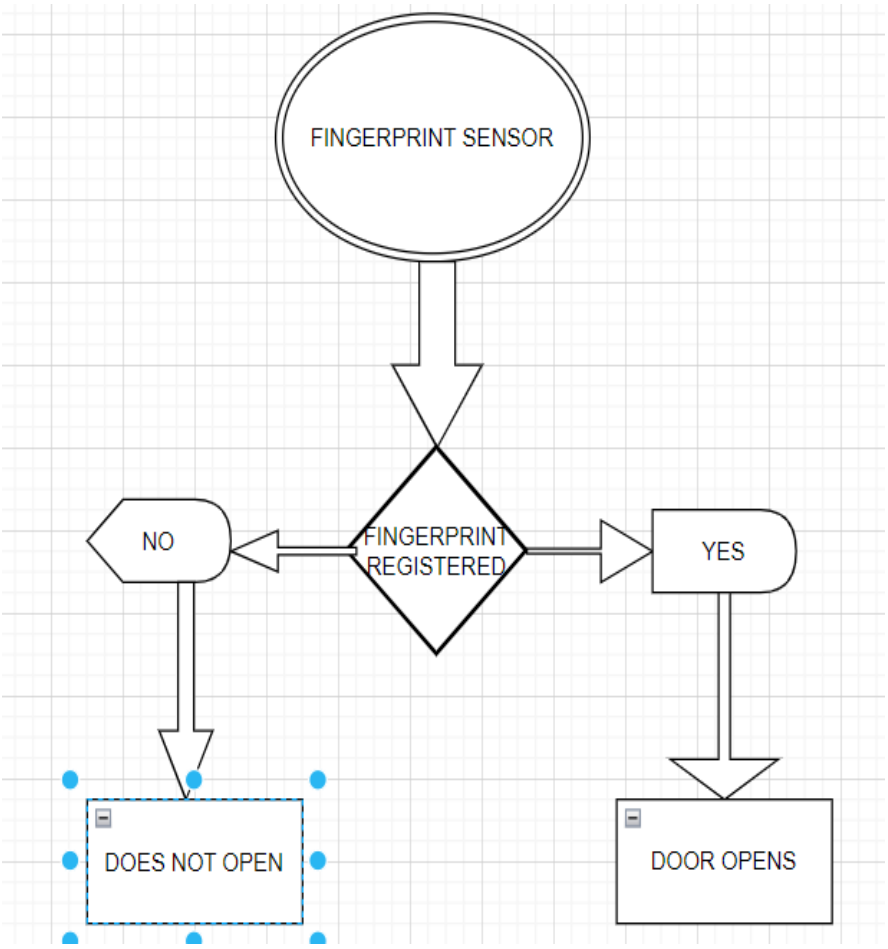
BEHAVIORAL DIAGRAM

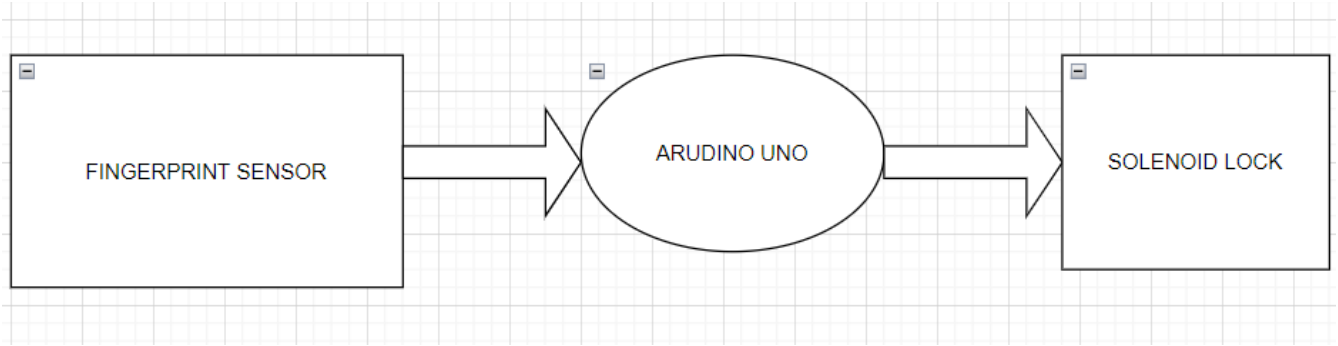
LOW LEVEL DAGRAM



HIGH LEVEL DIAGRAM



BLOCK DIAGRAM



STRUCTURAL DIAGRAM