"Fingerprint based License System using Arduino"

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Abstract: Driving license system is a very difficult task for the government to monitor. In this project, all the citizens' images will be scanned and recorded. Whenever a citizen crosses the traffic rules, the police can scan his image and can collect penalty/fine from the defaulter. Using this method, the police can track the history of the driver. This biometric based driving license monitoring system is very easy and convenient to monitor. According to ancient Greek scripts BIOMETRICS means study of life. Biometrics studies commonly include fingerprint, face, iris, voice, signature, and hand geometry recognition and verification. Many other modalities are in various stages of development and assessment. Among these available biometric traits Finger Print proves to be one of the best traits providing good mismatch ratio and also reliable.

The goal of our project is to design and assemble a biometric access control system that uses fingerprint scanning and recognition to authenticate the user. The fingerprint scanning device utilizes serial communication. Upon successful authentication, the user will be allowed to access all the driving related documents safely.

Keywords: Biometrics, Arduino, fingerprint

I.INTRODUCTION

Recently while discussing about Biometrics we are concentrating on Fingerprint scanning. For this we are using FIM 3030N high voltage module as a scanner. This module has in-built EEPROM and RAM. In this we can store up to 'n' no of users fingerprints. This module can operate in 2 modes they are Master mode and User mode. We will be using Master mode to register the fingerprints which will be stored in the ROM present on the scanner with a unique id. When this module is interfaced to the Arduino, we will be using it in user mode. In this mode we will be verifying the scanned images with the stored images. When coming to our application the images of the citizens will be stored in the module with a unique id. Citizens have to scan their image on demand by police, which is then verified with the image present in fingerprint module and their record will be updated. This scanner is interfaced to Arduino through enabling serial communication. By using this controller we will be controlling the scanning process. After the scanning has been completed the result is stored in the controller. By simply pressing a switch we can get the details of the person.

This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of230/12V step down transformer.

Fingerprint has distinct feature that don't change for whole life and they are easy to use, cheap and most suitable for miniaturization.

II.METHODOLOGY

In current scenario the vehicles have to stop and wait for long time to get verification from the traffic police. If their documents are clear then no problem arises. Suppose if their documents are not in a clear manner, this system provides lots of disadvantages like
 1. Time consumption
 2. Environmental pollution

❖   PROPOSED METHOD:

To implement the fingerprint based license checking system, a biometric module along with Arduino UNO, 16x2LCD, serial monitor and keypad will be required. The block diagram shows the overall perception of the system where Fingerprint scanner and keypad will be connected to ARDUINO UNO as microcontroller which will be connected with

16x2LCD display, serial monitor LED and Buzzer which operates according to the response received from the output of Arduino.
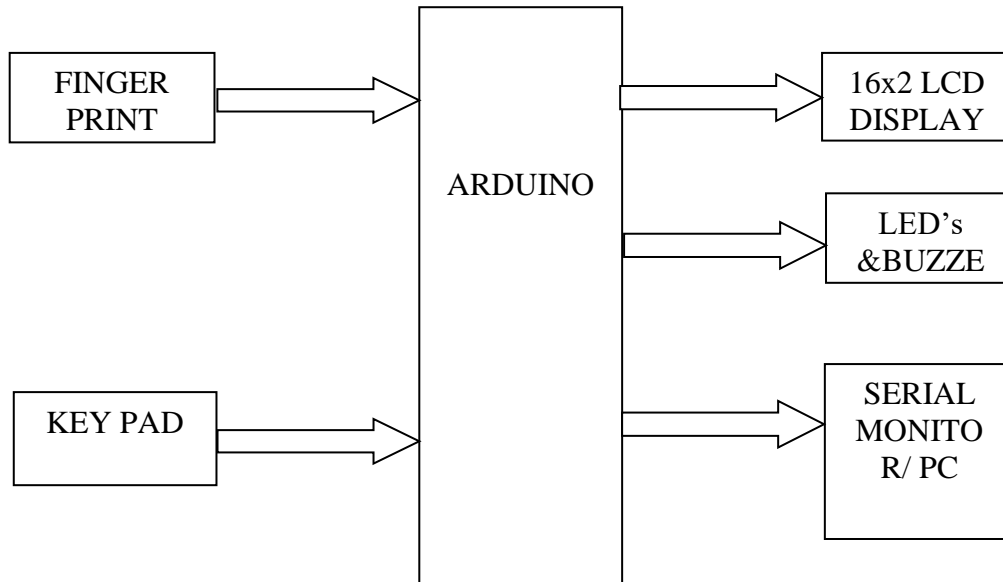
1. BLOCK DIAGRAM

Fig 1: Block Diagram of Finger Print Based Licence System

2. WORKING

Working of this Finger print based licence system using Arduino is a little bit complex for beginners. First of all, user needs to enrol finger with the help of push buttons/keys. To do this user need to press ENROLL key and then LCD asks for entering location/ID where finger will be a store. So now user needs to enter ID (Location) by using UP/DOWN keys. After selecting Location/ID user needs to press an OK key (DEL key). Now LCD will ask for placing finger over the finger print module. Now user needs to put his finger over finger print module. Then LCD will ask to remove the finger from finger print module and again ask for placing the finger. Now user needs to put his finger again over finger print module. Now finger print module takes an image and converts it into templates and stores it by selected ID in to the finger print module's memory. Now User will be registered and he/she can access. By same method all the users can be registered into the system.

The block diagram of this Fingerprint Based licence system is very simple which contains Arduino for controlling whole the process of the project, push button for enrolling, deleting, selecting IDs and accessing purpose, a buzzer for alert, LEDs for indication and 16x2 LCD for instruct users and showing the result as well. Yellow LED indicates that fingerprint module is ready to take an image of the finger and Green LED indicates that system is ready to take a access or see licence validity.

In a program, we have used Adafruit Fingerprint Sensor Library for interfacing fingerprint module with Arduino board. You can check the complete Code below. Here we are explaining main functions of the Arduino Program.

In setup function, we have given directions to defined pins and have initiated the LCD and Fingerprint module.

III.HARDWARE AND SOFTWARE DESCRIPTION

HARDWARE COMPONENTS

1.   Arduino

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer

releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

Fig 2: Arduino

Arduino specification:

Microcontroller	ATmega328P
Operating Voltage	5v
Input voltage	7-12v
Input voltage limit	6-20v
Digital I/O Pins	6
Analogue input Pins	6
DC current per I/O pins	20 Ma
DC current for 3.3v Pin	50 Ma
Flash Memory	Of which o.5KB is used
SRAM	2 KB
EEPROM	1KB
Clock Speed	16MHz
Length	68.6mm
Width	53.4nm
Weight	25g

Table no: 1

Arduino programming:
The Arduino/Genuino Uno can be programmed with the (Arduino Software (IDE)).Select "Arduino/Genuino Uno from the Tools>Board menu (according to the microcontroller on your board). The ATmega328 on the Arduino/Genuino Uno comes preprogrammed with a boot loader that allows us to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, Cheaderfiles).
We can also bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:
- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

2.   Fingerprint Scanner

A fingerprint is an impression left by the friction ridges of a human finger. Friction ridge a raised portion of the skin on the fingers.

Fingerprint matching consists of the comparison of several features of the print pattern, which include: patterns, which are aggregate characteristics of ridges. Minutia points, which are unique features found within the patterns.

Fig 3: Finger Print Sensor

Fingerprint scanner is used to provide security for the device or any other security applications. Every fingerprint is different from one another and people have different patterns of ridges on their hands. So the fingerprint cannot be changed or removed and that are unique for each and every person because there are countless combination and are used for security identification.

Working flow of fingerprint sensor: Adafruit fingerprint sensor is an optical sensor, which it analyses the photo of an image and then renders the image, make some calculation and searches in its memory for the fingerprint of the same characteristics. The performance comparison of Biometric technologies based on FAR

(False Acceptance Rate), FRR (False Rejection Rate), EER (Equal Error Rate) is given below:

Equal Error Rate –Rate at which both acceptance and rejection errors are equal. Lower the EER, system is more accurate.

False Acceptance Rate – Rate at which system incorrectly matches the input patterns to non-matching template in the database.

False Rejection Rate – Rate at which system fails to detect match between input pattern and matching template in the database.
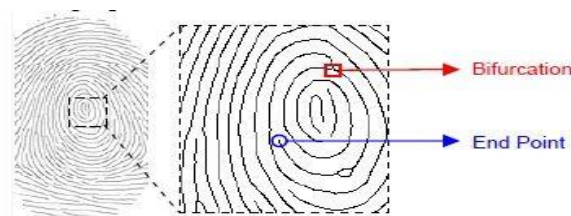
Fig 4: Fingerprint Detection

3. Buzzers

It is an audio device. It can be either electro mechanical, mechanical or piezoelectric. It is like an indicator which will generate an alarm sound if any of the documents gets mismatched or absent. It is like an indicator which will generate an alarm sound if any of the documents gets mismatched or absent.

Fig 5: Buzzer

4. Serial Monitor

It is part of the Arduino IDE software. Is used to allow you to both send message from your computer to an Arduino board and also to receive messages from the Arduino.

5. 16x2 LCD DISPLAY (Liquid Crystal Display)

High peak intensity produces very bright images. Best for brightly lit environments Scans are perfectly flat. Consume little electricity and produce little heat. LCD screen is an electronic presentation module. LCD TEMP has a wide scope of utilization. A 16x2 LCD show is all around ordinarily utilized in different gadgets and circuits. A 16x2 LCD show modules are favoured more than 7 portions and other multi-fragment LEDs since LCD are prudent and it are effectively programmable and have no constraint of showing unique and even custom characters, liveliness, etc.

A 16x2 LCD can show 16 characters for each line and there are 2 such lines. In this each character is shown in 5x7 pixel framework and it has two registers which are Direction and Information registers where order register stores the order guidelines given to that and information register stores the information to be shown on the LCD. A portion of the direction guidelines is instating, clearing the screen, setting the cursor position, controlling presentation, and so on. Information is the ASCII estimation of the character to be shown on it.

Pin Configuration

Pin 1	GND
Pin 2	+5v
Pin 3	Potentiometer for brightness control
Pin 4	Register Selection
Pin 5	Read/Write
Pin 6	Enable
Pin 7-14	DB0-DB7
Pin 15	+4.2v - 5v
Pin 16	GND

Table no: 2

Fig 6: LCD interfacing with Arduino mega

SOFTWARE COMPONENTS:

Arduino IDE

- The Arduino IDE (Integrated Development Environment) is used to write and upload programs to Arduino compatible board.
- The Arduino IDE supplies software library from the Wiring project, which provide many common input and output procedures.
- The Arduino IDE (Integrated Development Environment) is an open source. It is easy to write the code and upload it to the board. It runs on different platforms like Windows, Mac OS X and Linux. It also supports languages like C and C++.
- The basic Arduino sketch consists of two functions
- Void setup () {
- …………………….
- }
- Void loop () {
- …………………….
- }

EMBEDDED C

➤ It is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

➤ C language is a designed with different keywords, data types, variables, constants, etc. If C programming language is associated with any particular hardware architecture, then it is called as Embedded C. it is an extension to the C language with some additional header files.

➤ The embedded system programmers must have knowledge about the hardware architecture to write and implement programs.

The Structure of an Embedded C Program

```
Main () function
{
Local variables
        Statements
        …………..
…………..
}
Fun ()
{
Local variables
Statements
…………..
…………..
}
```

When designing software for a smaller embedded system with the 801, it is a very common place to develop the entire product using assembly code. With many projects, this is a feasible approach since the amount of code that must be generated is typically less than 8 kilobytes and is relatively simple in nature. If a hardware engineer is tasked with designing both the hardware and the software, he or she will frequently be tempted to write the software in assembly language. The trouble with projects done with assembly code is that they can be difficult to read and maintain, especially if they are not well commented. Additionally, the amount of code reusable from typical assembly language project is usually very low. Use of a higher-level language like C can directly address here issues. A program written in C is easier to read than an assembly program.

Since a C program possesses greater structure, it is easier to understand and maintain. Because of its modularity, a C program can better lend itself to reuse of code from project to project. The division of code into functions will force better structure of the software and lead to functions that can be taken from one project and used in another, thus reducing the overall development time. A high order language such as C allows a developer to write code, which resembles a human's thought process more closely than does the equivalent assembly code. This will greatly reduce development time and lower debugging time since the code is more understandable. All of this not to say assembly language does not have its place. In fact, many embedded systems (particularly real time systems) have a combination of C and assembly code. For time critical operations, assembly code is frequently the only way to go. One of the great things about the C language is that it allows you to perform low-level manipulations of the hardware if need be, yet provides you the functionality and abstraction of a higher order language.

IV. EXPERIMENTAL RESULT

Fig 7: Output

V.CONCLUSION

The fingerprint will continue to be the dominant biometric trait, and many identity management and access control applications will continue to rely on fingerprint recognition because of its proven performance, the existence of large legacy databases, and the availability of compact and cheap fingerprint readers. Further, fingerprint evidence is acceptable in courts of law to convict criminals. In this project we have proposed method for reducing usage and carrying bulk number of cards, which is well secured through key and fingerprint. The system seems to be an effective way of preventing card usage and is also a channel to expand our reach to rural and illiterate masses. The security can be further increased using some modern technologies like advanced sensors, e.g. Retina Sensors, but these increases the cost of the project.

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