



# Implementation of Real Time Embedded Security System for ATM Using Enhanced Finger Vein Recognition

Joshpinmary.S<sup>1</sup>, Manikandan.M<sup>2</sup>, Sangavi.S<sup>3</sup>, Aarthi.R<sup>4</sup>

UG Scholar, ECE Department, N.S.N College of Engineering & Technology, Karur, India<sup>1</sup>

UG Scholar, ECE Department, N.S.N College of Engineering & Technology, Karur, India<sup>2</sup>

UG Scholar, ECE Department, N.S.N College of Engineering & Technology, Karur, India<sup>3</sup>

Assistant professor, ECE, N.S.N College of Engineering & Technology, Karur, India.<sup>4</sup>

**Abstract**— The main objective of this system is to develop an embedded system, which is used for ATM security applications. In these systems, Bankers will collect the customer finger prints and mobile number while opening the accounts then customer only access ATM machine. The working of these ATM machine is when customer place finger on the finger print module when it access automatically generates every time different 4-digit code as a message to the mobile of the authorized customer through GSM modem connected to the microcontroller. The code received by the customer should be entered by pressing the keys on the touch screen. After entering it checks whether it is a valid one or not and allows the customer further access. Bankers will collect the customer finger prints and mobile number while opening the accounts then customer only access ATM machine. The working of these ATM machine is when customer place finger on the finger print module when it access automatically generates every time different 4-digit code as a message to the mobile of the authorized customer through GSM modem connected to the microcontroller. The code received by the customer should be entered by pressing the keys on the screen. After entering it checks whether it is a valid one or not and allows the customer further access.

**Index Terms**— finger vein module, Ardiuno board, Ardiuno IDE, GSM.

## I. INTRODUCTION

Biometrics is automated methods of recognizing a person based on a physiological or behavioral characteristic. Biometric-based solutions are able to provide for confidential financial transactions and personal data privacy. The various features used are face, fingerprints, hand geometry, handwriting, iris, retina, vein and voice. Fingerprinting or finger-scanning technologies are the oldest of the biometric sciences and utilize distinctive features of the fingerprint to identify or verify the identity of individuals. Finger-scan technology is the most commonly deployed biometric technology, used in a broad range of physical access and logical access applications. All fingerprints have unique characteristics and patterns. A normal fingerprint pattern is

made up of lines and spaces. These lines are called ridges while the spaces between the ridges are called valleys. It is through the pattern of these ridges and valleys that a unique fingerprint is matched for verification and authorization. These unique fingerprint traits are termed “minutiae” and comparisons are made based on these traits. On average, a typical live scan produces 40 “minutiae”. The Federal Bureau of Investigation (FBI) has reported that no more than 8 common minutiae can be shared by two individuals.

### A. Finger Scan Technology

There are five stages involved in finger-scan verification and identification. Fingerprint (FP) image acquisition, image processing, and location of distinctive characteristics, template creation and template matching. A scanner takes a mathematical snapshot of a user's unique biological traits. This snapshot is saved in a fingerprint database as a minutiae file. The first challenge facing a finger-scanning system is to acquire high-quality image of a fingerprint. The standard for forensic-quality fingerprinting is images of 500 dots per inch (DPI). Image acquisition can be a major challenge for finger-scan developers, since the quality of print differs from person to person and from finger to finger. Some populations are more likely than others to have faint or difficult-to-acquire fingerprints, whether due to wear or tear or physiological traits. Taking an image in the cold weather also can have an effect. Oils in the finger help produce a better print. In cold weather, these oils naturally dry up. Pressing harder on the platen (the surface on which the finger is placed, also known as a scanner) can help in this case. Finger vein is a blood vessel network under finger skin. The network pattern is unique for each individual, unaffected by aging, and it is internal, i.e. inside human skin which can always guarantee high security authentication. How a days, finger vein has become one of the major interest in biometric



research for automated system due to its attributes in high security and reliability. Accordingly, a lot of new devices and technologies which are related to finger vein recognition have emerged in the worldwide market. Finger vein recognition that have been proposed have similarities on the fundamental algorithm which include finger vein pattern extraction in the pre-processing stage. However, when the vein pattern is not clear, pattern extraction might become inconvenient and prone to extract inaccurate vein pattern. To overcome this problem, recently, researchers have developed an efficient matching technique using the phase component of two-dimensional discrete Fourier Transform (2D-DFT) of an image [6]. This matching technique is also known as Phase Only Correlation (POC). It has become a current emerging matching technique in biometric application such as fingerprint [6] and iris [7] recognition, and finger-knuckle-print verification. This matching technique is claimed reliable, robust and doing less job in pattern extraction. Correspond to the benefit of using finger vein image as a biometric trait and the performance of POC matching technique, this work proposes an efficient finger vein recognition algorithm using POC function. A pre-processing and matching algorithm have been developed using POC function for a set of finger vein images which have been captured using a low cost finger vein image acquisition device. To summarize, our Finger vein is a blood vessel network under finger skin. The network pattern is unique for each individual [1], unaffected by aging, and it is internal, i.e. inside human skin which can always guarantee high security authentication. Nowadays, finger vein has become one of the major interest in biometric research for automated system due to its attributes in high security and reliability. Accordingly, a lot of new devices and technologies which are related to finger vein recognition have emerged in the worldwide market. Finger vein recognition that have been proposed have similarities on the fundamental algorithm which include finger vein pattern extraction in the pre-processing stage. However, when the vein pattern is not clear, pattern extraction might become inconvenient and prone to extract inaccurate vein pattern [5]. To overcome this problem, recently, researchers have developed an efficient matching technique using the phase component of two-dimensional discrete Fourier Transform (2D-DFT) of an image. This matching technique is also known as Phase Only Correlation (POC). It has become a current emerging matching technique in biometric application such as fingerprint [6] and iris [7] recognition, and finger-knuckle-print verification [8]. This matching technique is claimed reliable, robust and doing less job in pattern extraction. Correspond to the benefit of using

finger vein image as a biometric trait and the performance of POC matching technique, this work proposes an efficient finger vein recognition algorithm using POC function. A pre-processing and matching algorithm have been developed using POC function for a set of finger vein images which have been captured using a low cost finger vein image acquisition device.

## II. EXISTING SYSTEM

In this paper, we review the prior work on finger vein biometric security systems over various applications. David et al introduced preliminary process to enhance the image quality that worsen by light effect and produces noise by the web camera, and then segmented the vein pattern by using adaptive threshold method and matched them using improved template matching. The result shows that even the image quality is not good and as long as the veins are clear with some appropriate process can be used for personal identification.

Wenming et al proposed a structured personal identification approach using finger vein Location and Direction Coding (LDC). Initially finger vein imaging device is designed using near infrared (NIR) Light source, by which a database for finger vein images is established. The brightness difference in finger vein image is used to extract the vein pattern. The finger vein LDC creates a structure feature image for each finger vein. The structured image is utilized to conduct the personal identification with image database for finger vein, which includes 440 vein images from 220 different fingers.

Finger vein recognition (FVR) is very effective when compared with pin number based authentication and other types of Biometric security methods like finger print security, palm print security, image scanning and some recognition techniques. Finger-vein being hidden inside the human body is difficult to be duplicated. Also, it is very convenient for the end user due to non-intrusive nature of acquisition. FVR system uses the vein scanning. As it is related to the biological factor, it is very difficult to change the vein information of a user. So, this system can provide more security than any other security level. In this FVR system, we are focusing on high security with RFID technology. Initially each and every user will be given with one RFID secret card. This will make an effective initial communication between the user and the device. This technique will make the device to extract the user information from its memory. In FVR system, the RFID module is used to collect the user database. With this system, a unique code will be generated for each and every user for



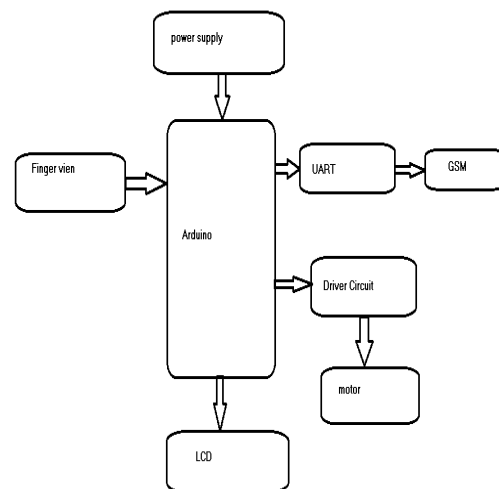
storing the finger vein details in the server. Here an active RFID technology is used for creating the secret signal. The encoded signal will be continuously transmitted by the card if it is in on state. This RFID will reduce the complexity of the image acquisition module. As the RFID have an unique signal it can store only one vein information. So authentication and identification will become soon. Because of these features the FVRS will be a faster recognition system. In this section, RF receiver module is attached with the embedded control unit. This unit receives the secret digital data from the card and it will be given to the controller. In the FVRS recognition unit, vein images will be stored in the image acquisition module. If RF receiver receives any digital code, then automatically code verification will be done inside the embedded control unit. If the code is matched then an asynchronous command will be given to the image acquisition module. Then the vein image comparison will be done inside the processor. If the image is matched then automatically the device will go to its working state. To this ECU further a GSM module is interfaced. With this module a password system can be developed. During every successful access, automatically intimation will be given to the controlling authority. The unit will send a password with this intimation. It will make a very effective security to the user. This password will be working for one time. It will play an effective authentication process. This mobile GSM communication module will not only send the intimation for authorize but also for unauthorized.

### III. PROPOSED METHOD

The main aim of the project is whenever the user enters puts his finger on to the Finger vein Module where we kept our embedded board attached with the reader along with PC. The input is nothing but finger vein image captured by CCD camera from the Infrared LED rays which have been emerged through the finger of the person. This can be extracted by the Finger vein extractor and it will convert the image in to the fine manner. The stored image and obtained image will be compared in the PC connected and which is connected to the Microcontroller. The MAX232 connector will be used to transfer data from the MAX232 (16-pin) port of a PC to the input line converter. The connector will be a 90-degree flat mount design that will allow the pins of a serial connection to be transferred to data lines in a board. The serial interface on the transmitter will accept a data line from the MAX 232 connector and transfer it to standard logic level. The signal will then be sent on a data line to the Encoder/Buffer. The serial interface on the receiver will accept a data from the Decoder/Buffer and transfer it to standard logic level. The signal will then be sent on a data line to the MAX232

Connector. The Microcontroller does the process and matched then microcontroller runs the motor otherwise the microcontroller gives alert and it will be remain in locked position, This system is more secure than other systems because perfect match of finger veins are needed for authentication . Here in this project we are using DC Motor and Driver unit for opening and closing the Locker. The DC Motor operates at 12V, but our Controller operates at 3.3V, in order to drive more voltage we are using driver L293D.

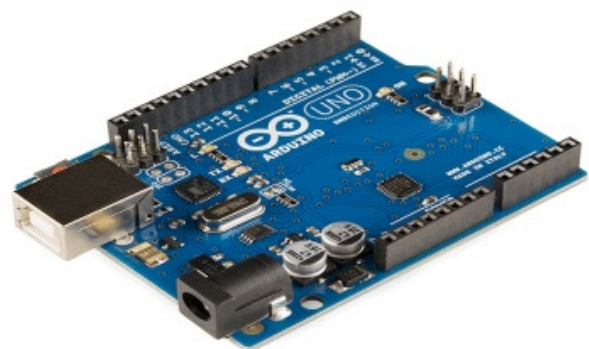
### Block diagram



### 3.1. HARDWARE DESIGN:

- MICROCONTROLLER CIRCUIT
- DRIVER CIRCUIT
- GEAR MOTOR
- FINGER VEIN
- POWER SUPPLY DESIGN

#### 3.1.1. MICROCONTROLLER:



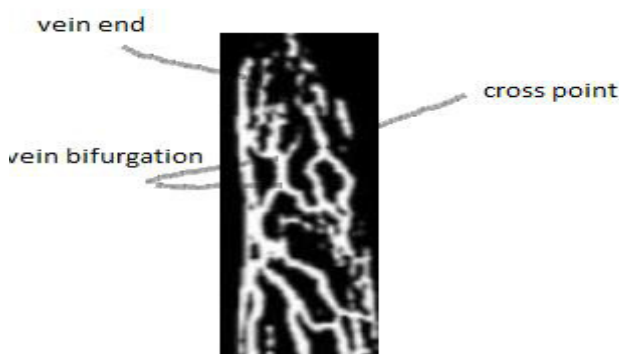


- The Uno is a microcontroller board based on the atmega328p.
- It has 14 digital input/output pins,
- 6 analog inputs
- 16 MHz quartz crystal,
- USB connection, a power jack, an
- ICSP header and a reset button.
- It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a 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.

### 3.1.2. FINGER VEIN:

The finger vein sensor is combination of R305 FP+P8051 MCU board that can read different fingerprints and store in its own flash memory. The sensor can perform three functions namely Add(Enroll) , Empty Database or Search Database and return the ID in LCD display , While in search Mode When the Finger matches it Indicates in LCD finger match Found and P0.0 Goes High to Low , The response is either error or ok which is indicated by onboard LCD. We have provided indicating LCD and function switch already so it's ready to use when you receive it. Just give power and start using the sensor using onboard switches. Then you can move on making external application using these functions.



## IV. SOFTWARE DESIGN

### 4.1. ARDUINO IDE:

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in Java. It originated from the IDE for the Processing programming language project and the Wiring project. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It

includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism for compiling and loading programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch".

### 4.2. PROGRAMMING LANGUAGE:

#### EMBEDDED C LANGUAGE

Arduino programs may be written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino IDE supports the C and C++ programming languages using special rules of code organization. The Arduino IDE supplies a software library called "Wiring" from the Wiring project, which provides many common input and output procedures. A typical Arduino C/C++ sketch consists of two functions that are compiled and linked with a program stub *main ()* into an executable cyclic executive program:

- *Setup ()*: a function that runs once at the start of a program and that can initialize settings.

*Loop ()*: a function called repeatedly until the board powers off.

## V. WORKING PRINCIPLE

Finger vein verification of ATM (Automatic Teller Machine) security system using the biometric with hybridization. The fingerprint trait is chosen, because of its availability, reliability and high accuracy. The fingerprint based biometric system can be implemented easily for secure the ATM machine. Bankers will collect the customer finger prints and mobile number while opening the accounts then customer only access ATM machine. The working of these ATM machine is when customer place finger on the finger print module when it access automatically generates every time different 4-digit code as a message to the mobile of the authorized customer through GSM modem connected to the microcontroller. The code received by the customer should be entered by pressing the keys on the touch screen.

ATM machine is when customer place finger on the finger print module when it access automatically generates every time different 4-digit code as a message to the mobile of the authorized customer through GSM modem connected to the microcontroller

## VI. CONCLUSION

The Proposed a finger-vein recognition system and vein image extraction is implemented on a Embedded System. The proposed system includes a device for capturing finger-vein images and a proposed algorithm to extract finger-vein





images by considering various parameters like vein width, position, length, pixels and intersection of veins. Our system is suitable for mobile device because of its low computational complexity and low power consumption. The advantage of this proposed system is more secured and confidential. For any kind of personal devices like mobile safe locks personal chambers bank lockers this system can be installed which gives a unique security for the users.

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