

Biometric Start-Up System

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Abstract: The main effort of this work is to provide a concrete security to any computing device using biometric locks. The idea proposes the use of components and devices like Microcontrollers (e.g. Arduino), Fingerprint Sensor and Relay which are cost effective. They are easily available in Indian Market. The principle of flow of power supply has been extensively used to make sure that the motherboard of the system does not receive any power supply which delivers the system an extremely rigid security and provides a safety factor for the avoidance of being attacked. The system has been designed in such a way that the reliability is not compromised in any kind of fake authentication. The components are arranged in such a way that the circuit should work in the most efficient manner and provide optimum performance.

Keywords: Biometric, Fingerprint, Microcontroller, Reliability, Security.

I. Introduction

Biometric locks are revolutionary locking storage cases that open with just the touch of your finger. Jewelry, weapons, documents, and other valuable or potentially harmful items can be deposited securely by using such kind of products. These utilize fingerprint recognition technology to allow access to only those whose fingerprints you choose. It contains all the necessary electronics to allow you to store, delete, and verify fingerprints with just the touch of a button. Stored fingerprints are retained even in the event of complete power failure or battery drain.

In our proposed work the fingerprint module from Mixes Biometrics is recommended. It can store up to 750 finger prints in its memory. It can be controlled through its serial port. The micro controller interacts with the module to train and process the scanned fingerprints. We can add a fingerprint, delete a fingerprint and identify the fingerprint. To add a fingerprint, just show the finger on the module and press the ADD key. Now the micro controller will send the ADD command to the module and the module will add it into the memory.

To delete the fingerprint, follow the same as above. To identify the fingerprint, we need to press the Identify button and if the finger matches then the Relay is used.

II. Literature Review

A. Literature Survey

The Fingerprint serves to identify that the person authenticating is who he/she claims to be. Fingerprint identification is popular biometric technique due to easiness in acquiring [1]. Fingerprint matching has been successfully used by law enforcement for more than a century. The technology is now finding many other applications such as identity management and access control. [2]

Automatic Fingerprint Identification System (AFIS) [3], in fingerprint recognition is also helpful to access control system of automobiles. In another study, Delaunay Quadrangle method using topology code has been used for authentication [4].

Fingerprint authentications are also used in ATMs. Some fingerprint matching systems are also based on model-based designs. [5]

B. Components

The system consists of the components and devices which can be replaced by similar functioning components. The components we are going to use are strictly according to the market survey and information analysis of the current scenario. All the components are easily available in Indian market at a very reasonable cost. Following components and devices will be used for optimum working of the project.

- i. **Switched Mode Power Supply:** A SMPS or switched mode power supply is an electronic power supply that integrates a switching regulator to transform electrical power proficiently. Like other power supplies, an SMPS transfers power from a DC or AC source to DC loads, while changing voltage and current

characteristics. A SMPS provides most favorable power to the computer systems components like motherboards, HDD, DVD-ROM etc.

For minimizing the wastage of energy, a SMPS repeatedly switches between full-on and full-off states, low-dissipation and spends very little time in the high dissipation transitions. Ideally, no power is dissipated by a switched-mode power supply. The ratio of on-to-off time achieves voltage regulation which is quite variable. As the transformer is smaller in size, the SMPS is substantially smaller and lighter than the generic or linear mode power supply.

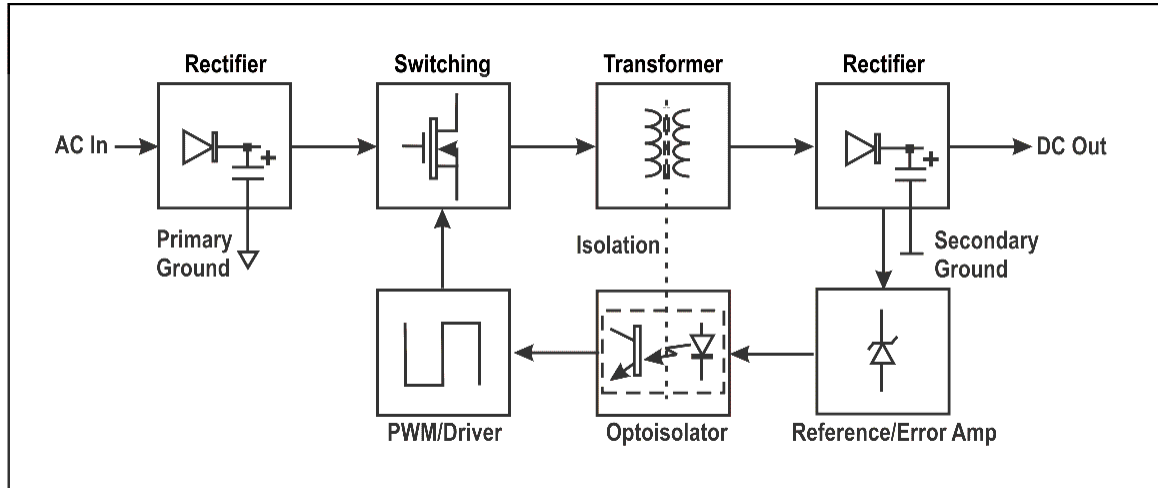


Fig. 2.1 Block Diagram for SMPS

- ii. **Microcontroller:** A microcontroller is an assembly of all the mandatory components which are used in a computer on a single integrated circuit containing a processor core, memory, and programmable input/output peripherals. The circuit includes program memory in the form of Ferroelectric RAM, NOR flash or OTP ROM. Typically, it also consists of a small amount of RAM.

Embedded applications use Microcontrollers which are designed suitably. In various automatically controlled products and devices, such as automobile engine control systems, implantable medicinal devices, distant controls, office machineries, appliances, power tools and other embedded systems. A microcontroller is very cost-effective as it avoids the cost of a separate microprocessor, memory, and input/output devices. Microcontrollers make it inexpensive to digitally control even more devices and processes.

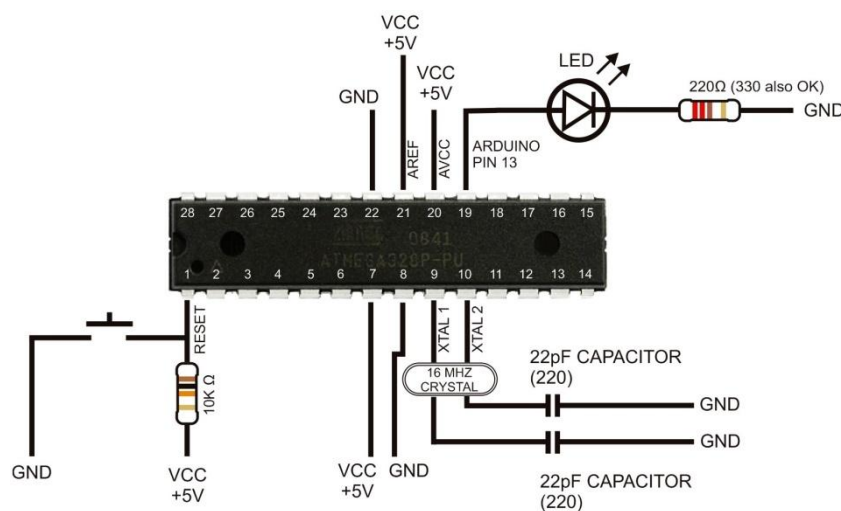


Fig. 2.2 Basic Microcontroller (ATmega328)

- iii. **Scanner module info:** Fingerprint scanners are security systems of biometrics. They are now used in police stations, security industries and most recently, on computers. Everyone has marks on their fingers. They cannot be removed or changed. These marks have a pattern and this pattern is called the fingerprint. Every

fingerprint is special, and different from any other in the world. Because there are countless combinations, fingerprints have become an ideal means of identification

There are four types of fingerprint scanners: the optical scanner, the capacitance scanner, the 'ultrasonic scanner' and the thermal scanners. The basic function of these three types of scanners is to get an image of a person's fingerprint and find a match for this print in the database. The capacitance scanner is better, because the images are more exact and precise. Scanners are used for scanning.

- a. Optical scanners take a visual image of the fingerprint using a digital camera.
- b. Capacitive or CMOS scanners use capacitors and thus electrical current to form an image of the fingerprint.
- c. Ultrasound fingerprint scanners use high frequency sound waves to penetrate the epidermal (outer) layer of the skin.
- d. Thermal scanners sense the temperature differences on the contact surface, in between fingerprint ridges and valleys.

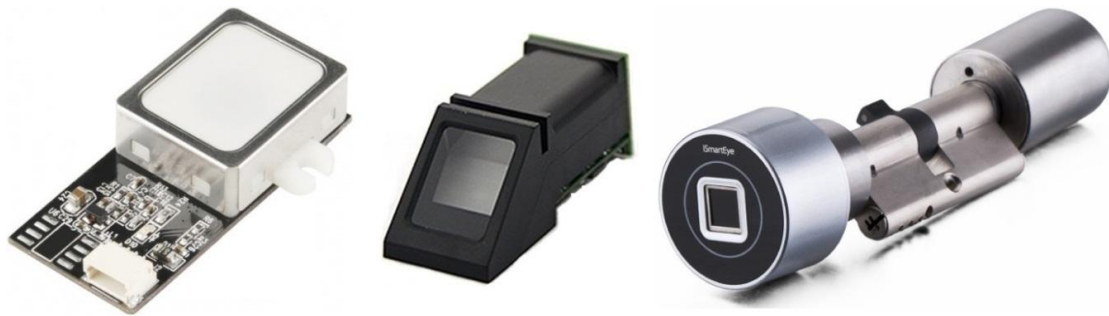


Fig. 2.3 Various types of Fingerprint scanner modules

- iv. **Relay:** A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two contacts in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open.

Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB. When an electric current is passed through the coil it generates a magnetic field that activates the armature and the consequent movement of the movable contact either makes or breaks (depending upon construction) a connection with a fixed contact.

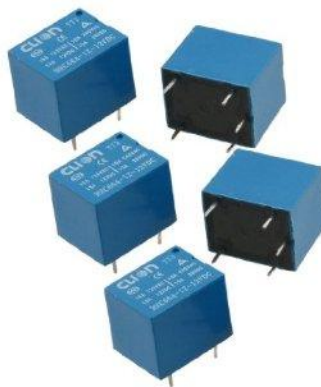


Fig 2.4 Relay (5 pin, 12 volts)

III. Proposed System

A. System Circuit Diagram

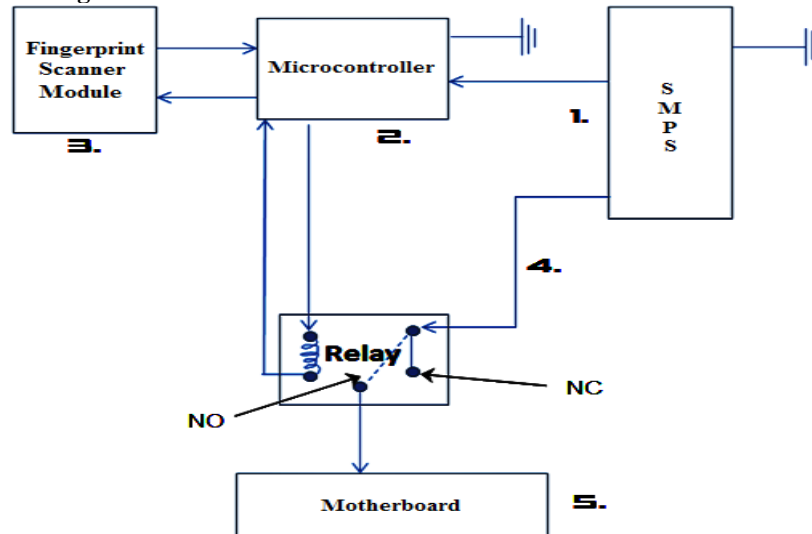


Fig. 3.1 System Circuit Diagram

B. Working of the system

This system basically necessitates 5 main components whose working is explained below -

- 1. SMPS:** From SMPS (Switched Mode Power Supply), the output comes, one goes to relay and discontinues there. Another power goes to Microcontroller.
- 2. Microcontroller:** Microcontroller will receive power supply of 12 volts from the SMPS. After the user will put his finger on the fingerprint module for the authenticating process to get access to the computer system. It will be used as an interface between Microcontroller and the fingerprint module.
- 3. Fingerprint Module:** The Fingerprint scanner will capture the image of the fingerprint and the image will be sent to the Microcontroller for processing the fingerprint matching algorithm Based on Tree Comparison using Ratios of Relational Distances [3]. Once the matching process will be done, a signal will be forwarded to the relay from Microcontroller.
- 4. Relay:** After the matching process will be completed, input signal will be forwarded to the relay. Relay, here is used as an AND gate between the SMPS and Microcontroller. In a relay, input section has a coil which generates magnetic field when a small voltage from the Microcontroller is applied to it. The output section consists of contactors which connect or disconnect mechanically. Signals will be further forwarded to the motherboard.
- 5. Motherboard:** Motherboard receives power and the system boots.

C. Working of the Fingerprint Module

The programming for finger image acquisition, feature extraction and finger matching algorithm can be done using Microcontroller which provides a text-editor and integrated development environment.

- Training (Developer)
 - MODULE 1 (Enrolment)
 - MODULE 2 (Deletion)
- Final Module (Developer + End-User)
 - MODULE 3 (Matching/ Identification)

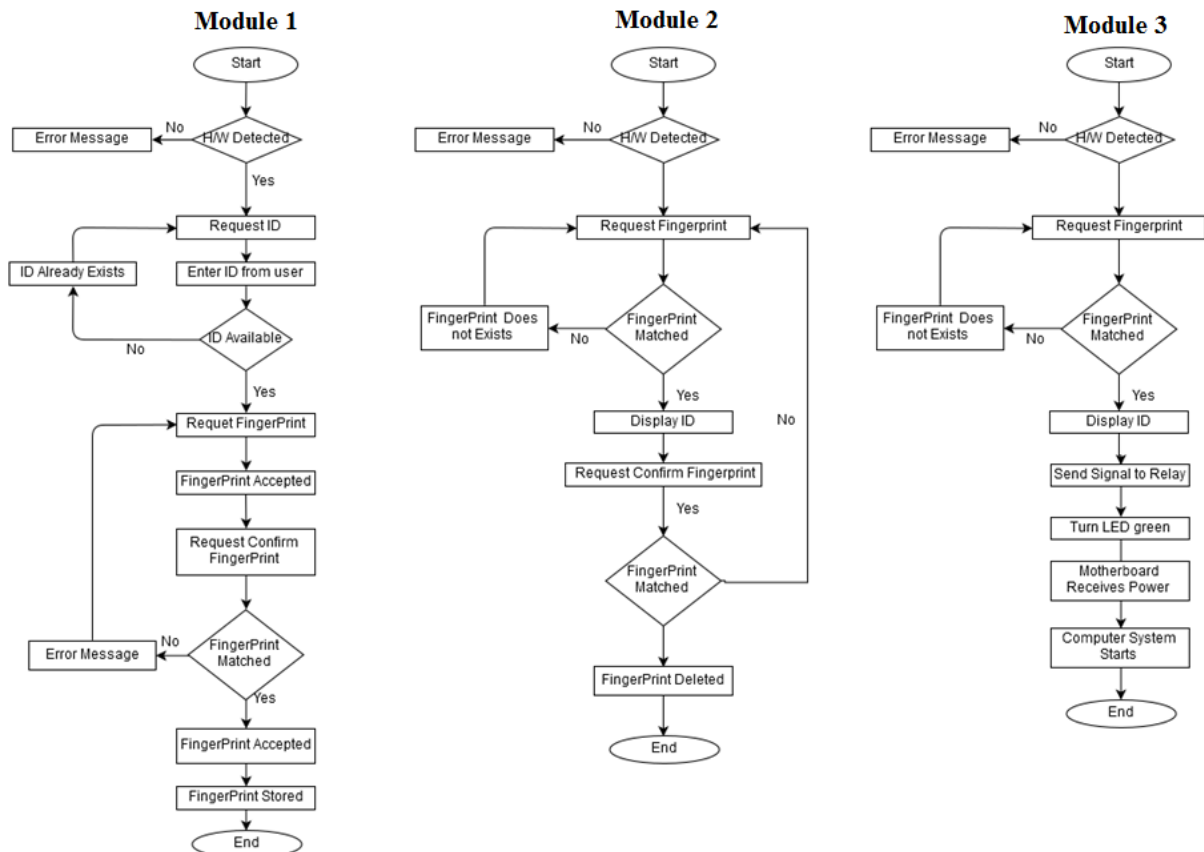


Fig 3.2 Flow Charts for Module 1, Module 2 and Module 3.

The above flow charts determine the detailed operational sequence all the three modules which are going to be executed once the idea is successfully implemented.

IV. Advantages And Disadvantages

Advantages -

1. Provide solid security.
2. Does not require system support.
3. Prevents from hackers.
4. In future we can use this instead of power button.
5. It can directly use as component in the CPU.

Disadvantages -

The computer may be totally inaccessible if Biometric Start-up System is unintentionally crashed.

V. Conclusion

B.S.S (Biometric Startup System) can be used to overcome most of the security threats by using combination of biometrics and power distribution by implementing them together with Microcontroller and using programming in the Microcontroller. By using this system, the computer can be secured well before it is booted making the system immune to software patches which bypass all the authorizations and authentications in the operating system and BIOS. It can totally eliminate the chances of spoofing and other hacking tactics and tricks.

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