RESEARCH ARTICLE OPEN ACCESS

Fingerprint Based Security System using GSM Module

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ABSTRACT
This paper mainly focuses on using wireless technology for security effectively. The system is SMS-based and uses biometric technology to revolutionize the standards of security. It uses a GSM Modem to send an SMS to the authorized person in case of an intrusion. The project is realized by interfacing a fingerprint sensor with a 89c51 microcontroller and a GSM Module. As the system uses GSM technology, it provides ubiquitous access to the system for security.
Index Terms: Bank Security, 89c51, GSM, GSM SIM 900.

I. INTRODUCTION

Now a day's safety has become an essential issue for most people. Increasing incidence of crimes against banks needed a serious re-look at the security arrangements and guidelines followed by the banks. This scenario demands compatible, efficient and reliable security and safety measures. Currently, Personal Identification Numbers, passwords or identification cards are used for personal identification. However, cards can be stolen; numbers and passwords can be guessed or forgotten.

We have tried to overcome these problems using application of biometrics which is fingerprint sensor, microcontroller, GSM Modem and a Relay circuit. When an unauthorized person access the fingerprint module, an interrupt is sent to the microcontroller which is further interfaced with a GSM module. It sends an SMS to the authorized person to alert him/her. The basic flow of this system is shown in Figure 1. Thus, this project takes some action after the intrusion has already taken place. This project gives the access of locker to only an authorized person and possible theft is immediately notified by using GSM module. This system is easy to install and can be used in any environment.

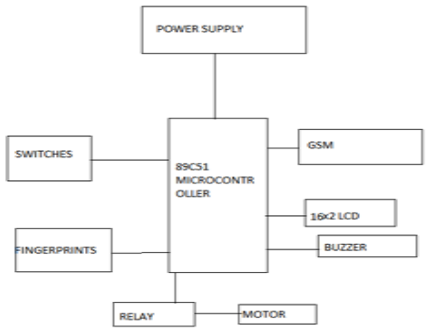

Figure 1: Block Diagram of Entire System

II. FINGERPRINT MODULE

Fingerprint sensor module R305 (connected across CON2) has UART interfaces with direct connections to the MCU or to the PC through max 232/USB serial adaptor. The user can store fingerprint data in the module and configure it in 1:1 or 1: N mode. For identification FP module can directly interface with 3v3 or 5v microcontroller.

The module supports USART communication protocol. Here, USART protocol is used for communicating with the microcontroller. Transmit pin of module is connected to the receive pin of microcontroller. Receive pin should be connected to the transmit pin of microcontroller. VIN is 5V and GND is connected to ground.

Figure 2: Fingerprint Sensor Module R305

III. MICROCONTROLLER

The project consists of 89C51 microcontroller of 8051 family microcontroller. It is 8 bit microcontroller and has 23 programmable input and output pins. It has 8KB flash memory, 512 bytes of EEPROM, 1KB of SRAM. The microcontroller is a 40 pin IC. The IC and its pin configuration are shown Figure 3.

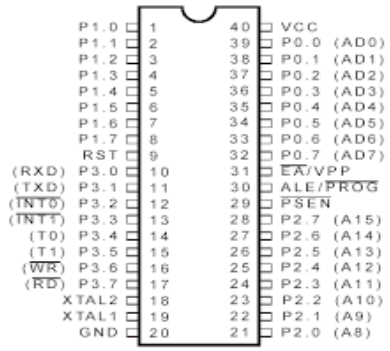

Figure 3: Pin Configuration of 89C51

In this system a 12V adaptor is used to supply power. This input power is fed to a Voltage regulator – LM7805 which gives output of 5V. This is then supplied to the rest of the circuit. This board also includes a reset pin, a power LED, capacitors, resistor, and LCD and relay circuit. The circuit is shown in Figure 4. Embedded C is the language used to program the IC.

IV. LCD

LCD (Liquid Crystal Display) screen is an electronic display module. A 16x2 LCD is very basic module. It can display 16 characters per line and there are 2 such lines. In a LCD display each character is displayed in 5x7 pixel matrix. The LCD is shown in Figure 5.

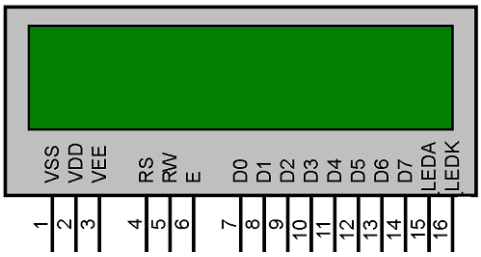

Figure 5: LCD display

This is interfaced to PORT A (pin 21-28) of the microcontroller. LCD in 8 bit mode is connected to microcontroller. D0-D7 pins are connected to PA08-PA15 pins of microcontroller. RW pin is connected to the GND.

V. GSM MODEM

Global System for Mobile Communication (GSM) is a wireless network system that uses a mobile operator and functions just like a mobile phone. The GSM modem has a SIM card slot, thus giving the modem a mobile number of its own and enabling it to activate communication. The user is able to send or receive a SMS as well as make/receive voice calls over the interface of the modem.

The GSM modem used in this project is SIM 900 module. It has a power and network LED which makes it convenient to debug. There is also wire antenna on the modem to provide better reception. The operating voltage range is 7-15V.

The ubiquity and low cost of implementation of the GSM standard makes it the ideal communication medium for a low budget security system. The GSM modem used in this device is shown in Figure 6.

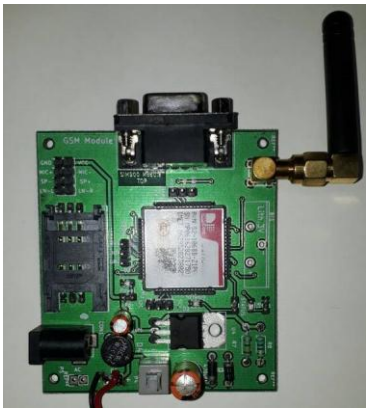

Figure 6: GSM Modem using SIM900 module

VI. RELAY CIRCUIT

The type of relay used in this system is a Solid-State Relay (SSR). An SSR is basically an electronic switching device. Whenever an external voltage, over a certain threshold, is applied across its control terminals, a magnetic field is generated which attracts a movable lever, thus establishing a flow of current and switching power to a load circuitry. Thus, it functions as an electromechanical switch without any mechanical parts. But we have added a 600 rpm DC motor to show the mechanical movement.

The relay circuit include resistors, two JQC-3FC/T73 relays working at 12V DC as shown in Figure 7. The maximum switching current for the relay is 7A-10A.

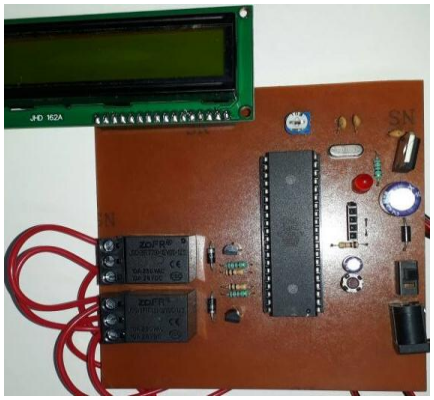

Figure 7. Circuit board with relay

The relay is used to drive the DC motor. The two relays used rotate the motor in clockwise and anticlockwise direction respectively. The relay circuit is shown in Figure 8.

VII. PROBLEM FORMULATION

During the course of the project, we came across several problems that were a hindrance to the appropriate functioning of the system. There were hardware as well as software issues. Out of many problems encountered, some of them are listed below.

A. Complication with the GSM Modem:

A 12V/1A adaptor is needed to power up a GSM modem. After inserting a valid SIM card in the SIM card slot, the GSM catches network LED on GSM modem. It is connected to a tested microcontroller via a serial communication port.

However, in spite of having network the GSM modem was unable to send an SMS to the authorized person.

B. Conflict with DC motor

The relay used **in** the circuit is connected to the DC motor. The problem occurred was when system started working the motor used to rotate continuously. It was only stopped by cutting power supply from the system.

VIII. PROPOSED PROBLEM SOUTION

So as to ensure proper functioning of the system, the problems mentioned above were overcome as follows.

A. Solution for GSM Modem: The GSM Modem can be connected to the microcontroller. We connected the modem to the computer for debugging. The working of the GSM modem can be tested using the software terminal v1.9b. When we typing the command 'AT' in command window, the terminal replies 'OK' which indicates that the GSM modem is functioning properly. However, the terminal was not responding to this command. In order to overcome this problem, we used a 12V/2A adaptor. This extra current, gave the modem boost necessary for proper functioning. After this, we had to switch back to the initial adaptor i.e. 12V/1A adaptor and the GSM modem started functioning normally. The terminal has responded with 'OK' and then showed all the AT commands being exchanged between the microcontroller and the modem.

B. Solution to the Soldering Issue: On testing the connectivity and the current flow in the soldered circuit with the help of a multimeter, we observed that a certain capacitor wasn't soldered properly. Opposite polarity had been soldered due to which the current reaching the IC exceeded the necessary level thus, spoiling the IC. Therefore, we had to resolder the capacitor and replace the IC for the proper functioning of the circuit.

IX. SYSTEM WORKING

Fingerprint processing involves two steps finger enrolment and finger matching. Initially, to enroll the fingerprint, user must give his fingerprint twice to the module. Module checks these two images and generates a template image and stores it. In second step of finger matching, for 1: N matching input is matched with the images in the library. It gives the matched image; a page id of the matched image is generated.

If the fingerprint is matched then buzzer will go on and signal goes to user and message on LCD will be "unauthorized person" and signal goes to the user. All these activities are informed to user with the help of message through GSM technology. GSM is second generation digital cellular mobile system used to send messages. GSM is also integrated to microcontroller to send message of activities.

X. RESULTS AND ANALYSIS

The Fingerprint Based Security System using GSM Module was successfully implemented.

Message on 16x2 LCD Display	**Interpretation**
System ready	Fingerprint scanner ready to scan finger
Access Granted	Fingerprint scanned is verified and the motor rotates in clockwise direction.
Access Denied	Fingerprint scanned did not match as on records and a message is sent to the registered mobile number and the system gets locked until restarted
Button	**Function**
SEARCH	Initiate the scanner
ADD	Resister the finger prints of a new user
EMPTY	Delete all registered users
RESET	Restart the entire system

XI. CONCLUSION

In this project, a simple, user friendly, secure, low cost and universally acceptable solution for bank security has been introduced. This approach has enabled us to achieve the target of controlling

the device remotely using a SMS-based system satisfying user needs and requirements. The system is cost effective as compared to the previously existing systems in market and is implemented with high reliability and security. The system is extendible and further additions can be done. Hence, we can conclude that the required goals and objectives have been achieved.

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