IOT Based Low Cost Smart Locker Security System

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Abstract: This paper project the simple IOT based low cost smart locker security system for domestic and office lockers, which is very useful to the public where they can safeguard their jewels, money and documents from the thieves when the owner is in/out station. The system alerts the owner of the smart locker by sending a message to the mobile. This security system is done using Arduino with GSM module and a biometric scanner.

Keywords: Smart Locker, Internet of Things (IOT), Arduino, GSM Module, Biometric Scanner.

I. INTRODUCTION

The proposed documented project deals with the security system of the locker that can be implemented as smart lockers in ever home and office. Now a days the breaking of locker and stealing of valuable things inside this becoming very common in the home and office during night time and also when the owner is outstation. During robbery few peoples were killed or seriously injured in a scuffle with the thieves to safeguard their valuable things. Also, this type of cases is difficult for the police to investigate without any clue.

Even today in most of the home and office there is no exact protection system except the lock and key method, there are many possibilities of missing a key or making duplicate key to the same lock.

Therefore this system will protect the precious life of human and valuable things inside the locker from the thieves and intimate the locker breaking to the owner by text message without keys and duplicate key issues.

II. EXISTING SYSTEM

There is very high tech security system in commercial place and the bank which a common man cannot afford. Also, the normal lock and key method are not enough because it can be easily breakable with low noise.

III. PROPOSED SYSTEM

The proposed system is also a high tech smart locker but the cost is very low were all the common man can purchase who is having the adequate important documents and valuable things to be safeguarded. The proposed system developed with basic knowledge as in [4] consists of an Arduino, biometric scanner, electromagnetic door lock system, piezoelectric sensor, GSM module and rechargeable battery with charging adaptor.
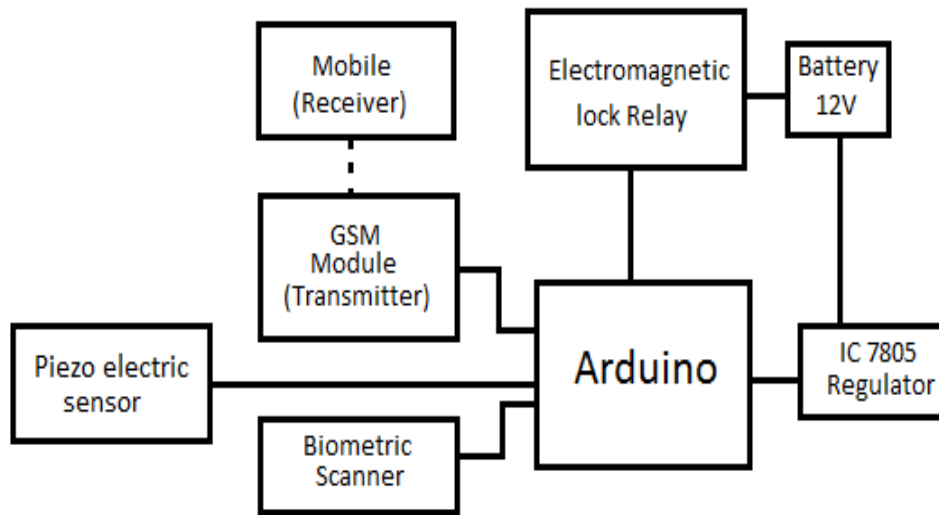
Fig.1 Block Diagram of the Proposed System

The above figure 1 shows the block diagram of proposed smart locker system. The brief explanation of the operating principle of the smart locker is narrated, here the biometric scanner is used to scan the finger print of the family members or the official whoever utilize the smart locker and this will be stored in the Arduino whenever the locker has to be opened or closed the finger print has to be recognized. If the unknown finger print is identified or the locker is under heavy vibration (trying to steal locker or trying to open by damaging) the GSM module connected to the Arduino will send text message to the owner of the locker which is already fed in the system, this alert message can be sent to one or more mobile numbers.

IV.SYSTEM REQUIREMENTS

To develop this smart locker system the following components are required:

    a.   Arduino Mega
    b.   Biometric scanner
    c.   Electromagnetic door lock system,
    d.   GSM module
    e.   Battery

4.1 ARDUINO MEGA

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analogue inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, 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. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila. [1]. The technical specification about power consumption is tabulated in Table.1 and pin diagram is shown in fig.2.
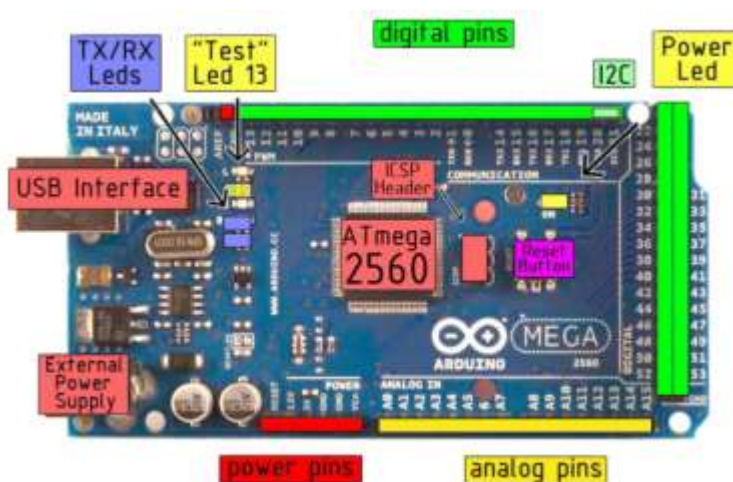

Fig.2 Pin diagram of ATmega 2560

Table.1 Technical Specification Microcontroller ATmega2560

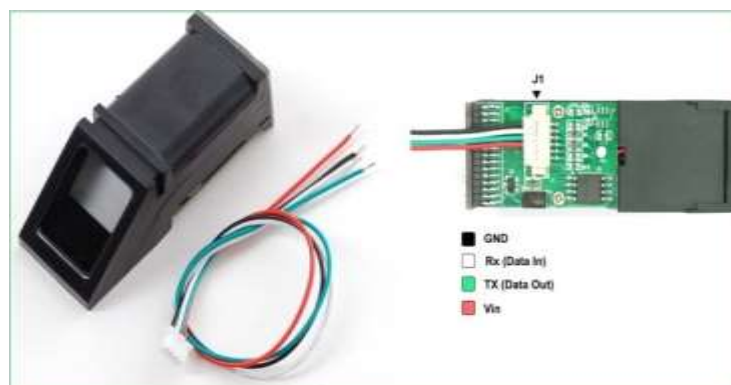| Operating Voltage	5V
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB

4.2 BIOMETRIC SCANNER

Fig.3 Biometric Scanner with Terminal Lead

The Fingerprint is one of the safest ways to detect and identify the authorized person, we know that fingerprint is unique even identical twins do not have identical fingerprints. By using this we can make pretty sure about security needs. To add fingerprint verification in microcontroller projects we can use this all in one optical fingerprint sensor-scanner (R305), it makes fingerprint detection and verification super simple [2].

4.3 ELECTROMAGNETIC DOOR LOCK SYSTEM

Fig.4 Electromagnetic Door Lock

This Electromagnetic door lock device is simple, compact, clean and easy to control since there are moving parts. It provides more security professional, most rigorous and instantaneous release even it can be remote controlled also it is easy to fix as shown figure 4.

4.4 GSM MODULE

IComsat is a GSM/GPRS shield for Arduino and based on the SIM900 Quad-band GSM/GPRS module. It is controlled via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands), and fully compatible with Arduino / Iteaduino and Mega. The GSM module is shown in figure 5.

Fig.5 GSM Module

Features

- Quad-Band 850/900/1800/1900
- Compliant with GSM phase 2/2+
- Class 4 (2W@850/900MHz)
- Class 1 (1W@1800/1900MHz)
- Control via commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands)
- Short message service
- Free serial port selection
- All SIM900 pins breakout
- RTC supported with Super Cap
- Power on/off and reset function supported by Arduino interface

4.5 BATTERY

Fig.6 Battery

A battery is a device that converts chemical energy into electrical energy. Figure 6 represents the battery that is used in this project. Nowadays the battery has become an essential part of our life starting from remote all electronics equipment's have the option to work with the battery. In this project, a maintenance free rechargeable lead acid battery is used to ensure continuous working since the power consumption of the entire locker is only 250mV excluding door lock. Including door lock it consumes max 10W, therefore it will operate for more than 2days for 12V/50AH battery.

Table.2 Technical Specification of Battery

Voltage	12 Volts
Capacity	7 Ah
Length	150 mm
Width	64 mm
Height inc. terms	98 mm

Hardware Implementation

The prototype of the hardware implementation of the proposed system is shown in the figure 7 it clearly replicates the hardware implementation and its prototype with a smart locker.
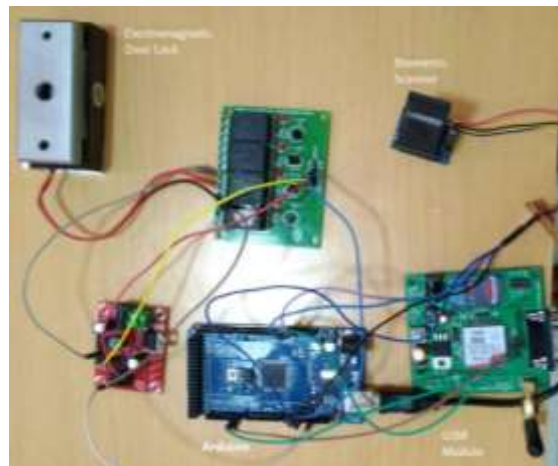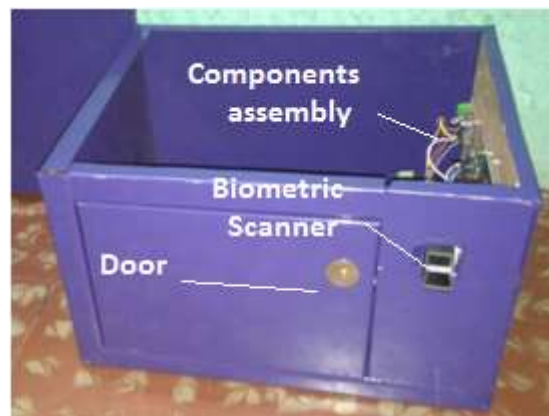

Figure.7 (a)

Figure.7 (b)

Figure.7 (c)

Figure.7 (a) Hardware assembly (b) Hardware fixed inside the locker box (c) Actual size of the locker with a smart locker.
The figure 7(a) shows the components utilized in the smart locker system and its interconnections with clear indications. The figure 7(b) shows the entire electrical system is fixed on one side of the locker with electromagnetic door lock fixed in the door of the smart locker. The figure 7(c) shows the outer view of the entire locker with biometric scanner projected outside near the locker door and components fixed inside the smart locker.

V. COST ESTIMATION
Table.3 Cost Estimation of the Smart Locker System

Component	Cost
Arduino controller	1000/-
Biometric Scanner	2350/-
GSM transmitter	1400/-
Electromagnetic Door Lock	1750/-
Total	**6500/-**

The total cost of the system comes around only Rupees 6500/- which is completely affordable for a common man who is having the property worth lakhs.
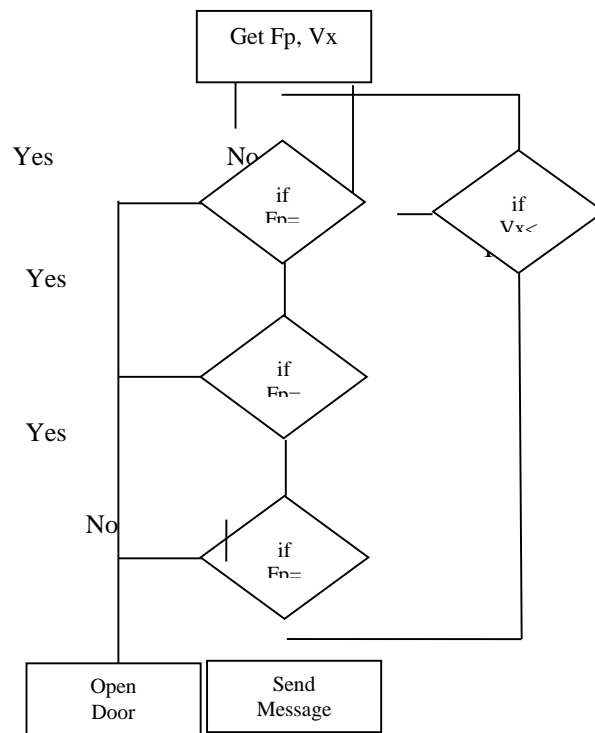
VI. FLOW CHART

FIG 8: Flowchart

The flow chart shows the procedure of program execution by getting finger print image (Fp) and this Fp is compared with three different finger print of the family members of officials say (F1, F2 and F3) if any one of the finger print image matches then the door of the locker opens if it doesn't match then system will send alert text message to the mobile numbers already fed in the sim of the GSM module. The flowchart and programming are done as [3, 4]. Suppose if anybody is trying to steal the locker then the piezoelectric sensor generates the signal Vx the value of this will be compared with the pre-set value Vs if the value of the Vx is greater than Vs then the system again send an alert text message to the numbers.

VII.   CONCLUSIONS

This smart locker is simple to implement, low cost and compact in size also it is reachable to all the common man where it gives confident that their valuable things are safe in all 24x7. Since the system is simple the repair and installation work is also very cheap. In future, this system can be upgraded with IR micro cameras to capture the face of the robber and it will be sent immediately to the mobile along with text which is very useful to identify the thief by the picture.

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