Six Tier Multipurpose Security Locker System Based on Arduino

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***Abstract*—This study presents a security system for transporting or storing valuable while restricting unauthorized access. The system consists of Memory Module, PIR sensor, fingerprint security, Encoder-Decoder, RF module, GPS and GSM module etc. to provide the maximum level of security. The proposed security system can be a major uplift in transporting important documents, money or ornaments from one place to another especially for banks in transporting valuables as the proposed security system is designed in such a way that the vault can only be opened by an authorized person, in specific places, using proper credentials, hence providing maximum security.**

Keywords—DS3231 RTC module, PIR sensor, RF module, Encoder Decoder, Fingerprint sensor, Password keypad, Global positioning system (GPS) and Global System for Mobile communications (GSM).

I. Introduction

The job of a security system is to keep valuable objects safe and secured for its rightful owner. Day by day security for valuable objects is becoming a major issue with increased crime rate. The conventional method of lock and key system is no longer appropriate in today's modern world. In recent times, use of alarm systems with dual key lockers, digital passwords, RFID, etc. is common. Variety of locker or vault type systems are available but each has its room for improvement, hence having its own flaws in the system. Theft of gold ornaments from Amin Jewelers is still a thing of commotion in Dhaka, Bangladesh [1]. Also, in terms of documents, leaking of classified information is nothing new. For example, over the years SSC and HSC examination question leaks was a threateningly auspicious debatable issue for Bangladesh. [2][3].

As a solution to these addressed issues and more, the study of a six-tier locker system has been proposed keeping in mind the drawbacks of the available systems. It has been prototyped, focusing on transporting valuables from one place to another in the most secured form. These valuables can be jewelry, bank drafts, antiques, gemstones, stamps, question papers and many more. Top most security is ensured in transporting such valuables. The six-tier locker system is made using DS3231 RTC module, PIR sensor, RF module, Encoder Decoder, Fingerprint sensor, Password keypad, GPS and GSM.

II. Background Study

One widely used security system is a locker having two keys and both are needed to open the lock, where one key generally is for the owner of the contents in the locker and another key is for the agent (a person who ensures security of the locker). But in this case, someone can easily pick the lock or make duplicates of the keys to open the lock causing a security issue.

There are also digital locking systems available but the problem with this is that by knowing the password or hacking into the system one can easily gain access.

Also, Srivatsan Sridharan in a paper [4] proposed a method which uses two levels biometric authentication meaning 2 people's biometric identities are needed to open the vault, ensuring only certain individuals to be able to open the vault. But it has no security check on time, date and location the vault is being opened at. Authors in paper [5] showed a project which uses RFID reader module along with fingerprint and iris to secure the locker. Similarly, in the paper [6] they proposed a GSM-based locker system using RFID with fingerprint and a password. In paper [7], they used GPS, fingerprint module and password protection to make a secured vault hence denying any access inside the locker while in transit. Ch. Sumalatha et al in a paper [8] in 2016, proposed a bank locker security system also on RFID and GSM technology. The system was developed using GSM modem, microcontroller AT89C52, RFID reader, keyboard, and LCD. The id number is read via the RFID reader and conveyed to the microcontroller. After that, the microcontroller checks if the id is authorized and if authorized, the locker is opened. In paper [9], U. J. Ogri, D. E. B. Okwong and A. Etim created a model to use in security doors. Here one GSM device is used as a transmitter and another GSM device with the DTMF associated with the motor attached to a door with the use of DTMF decoder, a stepper motor and microcontroller unit.

All these existing systems are promising but all have their own drawbacks or faults in the system.

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III. System Description

This system is developed for smart and efficient performance. Below are the main components of the Six Tier Security Locker System:

TABLE I. MAIN COMPONENTS AND THEIR FEATURES

Component name	No. of unit	Use
Arduino Mega	1	• To control all of the sensor and module. • Input voltage 6-20V
DC3231 RTC Module	1	• Operating voltage 3.3-5.5V • Used as a real-time clock • Storage capacity is 32K
PIR Sensor	1	• To detect any suspicious movement inside the box. • Operating voltage 4.5V
Fingerprint sensor	1	• Operating voltage is 3.6-6V. • For inserting a biometric password.
Password keypad	1	• For inserting a keypad password.
Encoder Decoder	1	• Wide operating voltage and high noise immunity • For encoding and decoding operation.
GPS	1	• The global positing system is used for tracking location. • Operating voltage 5V.
GSM	1	• GSM is used to send the updated status of this box to the user through SMS or phone call.
RF module	1	• This module has two part one is receiving and another one is transmitting. • RF module and Encoder Decoder is used to make a wireless password system.

IV. System Design

A. *Simulation:*

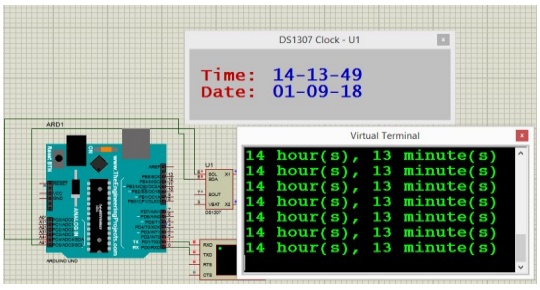

Fig.1. Simulation for timing system (off condition).

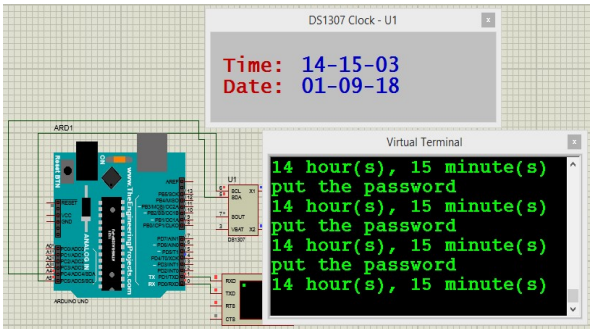

Fig.2. Simulation for timing system (on condition).

In Fig 1 and 2, it shows the simulation of the timing part. Where the Arduino and DS1307 RTC module has been used instead of DS3231 RTC module. Here DS1307 RTC module is working as a real-time clock. The whole system has been programmed in such a way that it will ask for the password over and over again after certain periods of time. For the rest of the time it will be inactive.

B. *System overview:*

The system will only unlock at specified destinations and at specified time. Upon arrival at the correct geographic location, when the clock approves of the correct time, to unlock the system user will have to enter the correct password as shown in fig. 4. Once the password has been accepted, the authorized person's fingerprint needs to be provided as shown in fig 5. An extra feature of grand access has been also added to the system. If a person has grand access, he/she shall be able to open the locker using his fingerprint alone, regardless of time and location.

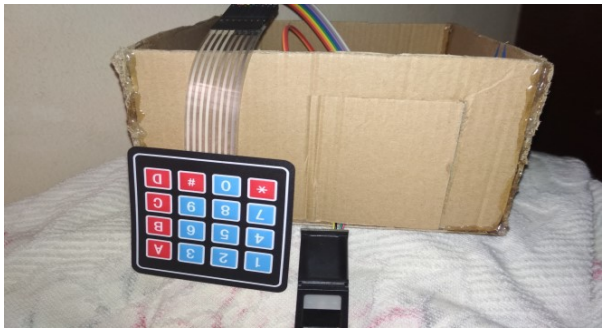

Fig.3. Prototype box.

Fig.4. Giving password.