Smart Door Lock Security System Using Raspberry-Pi Micro Controller

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Abstract-

This paper discusses the design and implementation of a GSM based digital door lock security system using Raspberry pi controller platform. A 4-digit password was used to lock/unlock the doors by employing a stepper motor. Three consecutive unsuccessful attempts in entering the correct password results in sending a warning message, was sent to preset mobile numbers, as a means of detecting unauthorized intrusion. A 3D scaled model of a house with door controlled by a stepper motor was constructed to implement and demonstrate the proposed system. A separate arrangement was made to install the control. The experimental result and analysis were promising. The proposed system developed based on Raspberry pi micro controllers.

*Index terms –*Microcontroller Raspberry Pi, GSM module, 16x2 LCD display, Servo motor, switches, buzzer

I. INTRODUCTION

In 2010, the Federal Bureau of Investigation (FBI) [1] reports that there were more than two million home burglaries in the United States, over 70 percent of which took place in residential homes. According to 2011 reports by National Crime Records Bureau (NCRB) [2], in India, the number of burglary cases registered was 58862 cases, with a total worth of USD 50 million. According to a 2010 study by the Alarm Industry Research and Educational Foundation (AIREF) [3], burglars spend less than 60 seconds for breaking into a home. So, anything that made a house harder to access, including home security systems, deadbolt locks, bars on windows, acted as a deterrent. Further, according to the Electronic Security Association's (ESA) [4] "Home Safety Fast Facts"report, 9 out of 10 burglars avoid homes with alarm systems and said if they did encounter an alarm, they would not attack the home and drop the attempt. These facts have encouraged the development of numerous security systems for both residential and commercial applications.

Security alarm systems employing various sensors are becoming increasingly popular in residential communities. Mallory et al. [5] implemented a security alarm system that has a number of sensors for fire, smoke, intrusion and appliance operation. A central monitor was provided for monitoring and continuously indicating the status of the sensors. Transmitters were placed on the sensors and receivers were placed on the monitor for effective communication. The central monitor then indicates the appropriate alarm based on the identified transmitter of a particular sensor. Murakami et al. [6] described a home security system which includes a number of sensors detect an alarming situation in different locations inside a facility. Cameras captured images of different locations and a controller memorized the associations between sensors and cameras. Similarly, Pyle et al. [7] had developed a system which alerted an intrusion disturbance at an entry point to a residence or alerting as to other emergency conditions by producing an alarm.

There are security systems interfaced with GSM module, as the one described in Zhao et al. [8]. The system was a wireless home network which contained a GSM/GPRS gateway and three kinds of wireless security sensor nodes that are door security nodes, infrared security nodes and fire alarm nodes. This system was designed for nocturnal security and power saving purpose. PIC was used for the programming purpose. Another system was proposed by Ushieet al.[9], wherein security door that can be remotely controlled by a GSM phone set acting as the transmitter and another GSM phone set with a dual tone multi frequency (DTMF) connected to the door motor through a DTMF decoder interfaced with microcontroller unit and a stepper motor. Similarly, SMS Technology was collaborated with GSM/GPRS services to achieve controlling of door lock by Pratiksha et al [10], where they could lock/unlock the door by receiving a predefined message from the user. In this paper we discuss the design and development of a Raspberry Pi supported security system prototype with 4 digit passwords and GSM system for sending out intrusion alerts.

This paper is organized in five sections. After this introduction, in Section II, existing method discussed of the paper Section III about theproposed method explained, as well as the novel feature of the proposed method. Finally, Sections IV and V provide the Experimental results and the conclusions, respectively.

II.EXISTING SYSTEM

The existing design and implementation of a GSM based digital door lock security system using PIC platform. A 5-digit password was used to lock/unlock the doors by employing a gear motor.

III. PROPOSED SYSTEM

A. Block Diagram
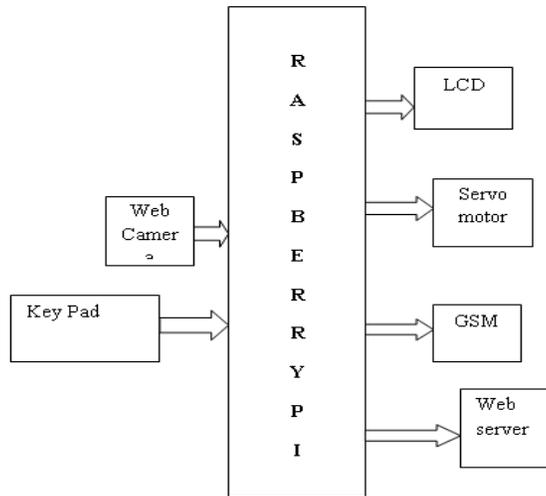
Figure 1: Proposed Block Diagram

The Block Diagram (Fig.1) shows the connections of GSM module, web camera, 16x2 display, Servo motor, Keypad with the Raspberry Pi.

The proposed system was implemented for interior door locks, which functions like opening the door when someone came near to the door. Raspberry Pi controls the complete process like taking password form keypad module, comparing passwords, driving buzzer, opening/closing the gate using servo motor and sending status to LCD display. Keypad is used for entering password. LCD is used for displaying status or messages on it. GSM is used for generating the one-time password for locking/unlocking the door. The web servers help to send the captured image in front of the door.

When user runs the code in Raspberry Pi, LCD shows some welcome message and after pressing '#' key "Input Password" message is displayed on LCD and whenever OTP is received to registered mobile then pass key will be entered for opening the door. If the pass key is valid, it opens the door otherwise it captures the image in front of the door and sends it to user owner mail or website with the help of web server.

The one-time passwords will be randomly generated each time and send through GSM

Basically, opening and closing the gate can be done by rotating a Motor clock wise and anti-clockwise to open and close the door. For a small project you can simply add a DC motor to open and close the door. We can also use Servo or stepper motor, but we need to change the Code accordingly.

B .Hardware components Description

- **Raspberry Pi 3 Microcontroller**

Figure 2: Raspberry Pi 3 Microcontroller

Raspberry Pi is the Visa measured adaptable PC is fit for the essential number of the things thatpurchaser desktop accommodating PC will, like spreadsheets, word-getting ready and beguilements. The Raspberry Pi has a Broadcom BCM2837 framework on a chip, which wires anARM1176JZF-S 700MHz processor, video focus IV GPU, and was at first passed on with 256 megabytes of RAM, later refreshed (Model B and Model B+) to 512 MB. It avoids an undeniable hard plate or strong state drive; regardless it utilizes a SD card for booting and chose gathering, with the Model B+ utilizing a Micro SD.

- **GSM**
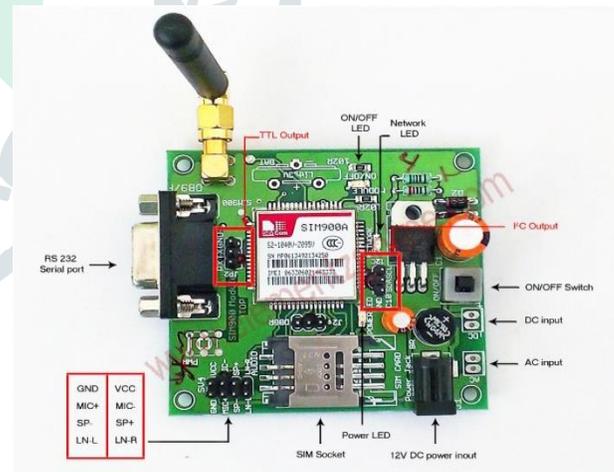
Figure 3: GSM

GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. GSM supports voice calls and data transfer speeds of up to 9.6 kbps, together with the transmission of SMS (Short Message Service). GSM operates in the 900MHz and 1.8GHz bands in Europe and the 1.9GHz and 850MHz bands in the US.

GSM (Global System for Mobile Communications) [12], is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones .The GSM module is interfaced with the PIC for sending warning messages at time of intruder attack. The port number 25, which is TX port of PIC, is interfaced to GSM module via RX port of GSM and the GND port of
GSM is grounded.

- *16 x 2 LCD display*
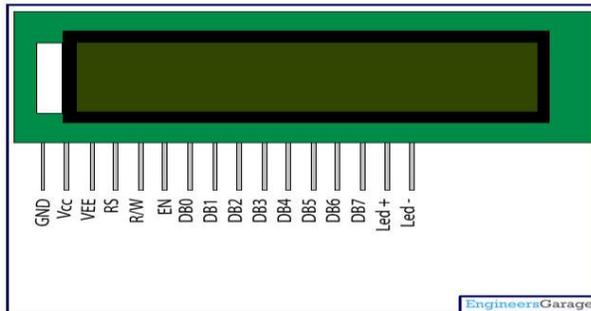
Figure 4: LCD Display

The JHD162A 16 x 2 LCD has 16 pins and can be operated in 4-bit mode or 8-bit mode [13]. Here we are using the LCD module in 4-bit mode.

- *Servo Motor*

A Servo motor was used to control the door lock. The servo motor is most commonly used for high technology devices in the industrial application like automation technology. It is a self contained electrical device, that rotates parts of a machine with high efficiency and great precision. The output shaft of this motor can be moved to a particular angle. Servo motors are mainly used in home electronics, toys, cars, airplanes, etc.

Figure 5: Servo Motor

- **Web camera**

Figure 6: Web Camera

A webcam is a video camera that feeds or streams its image in real time to or through a computer to a computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and emailed as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

- **Keypad**

Keypads are a great way to enter passwords, and control doors.Beneath each key is a membrane switch. Each switch in a row is connected to the other switches in the row by a conductive trace underneath the pad. Each switch in a column is connected the same way – one side of the switch is connected to all of the other switches in that column by a conductive trace. Each row and column is brought out to a single pin, for a total of 8 pins on a 4X4 keypad:
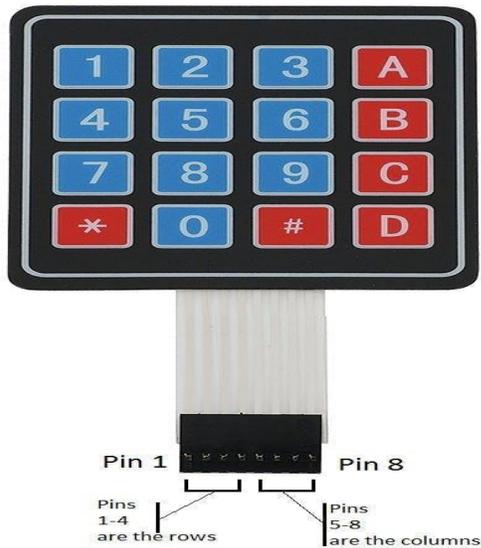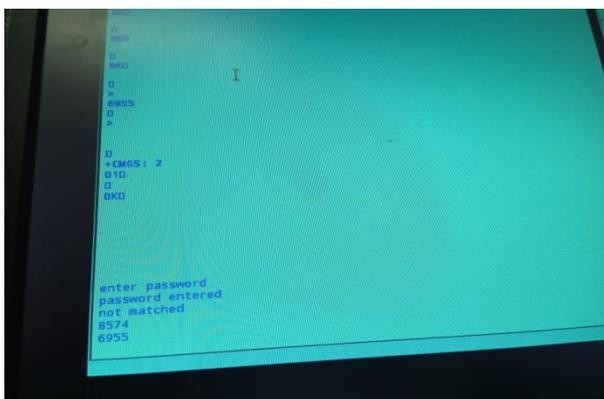
Figure 7:4X4 Keypad

IV. EXPERIMENTAL RESULTS

In the below figure shows that message displayed on LCD display when door will be closed.

In the below figure shows that when password asked that will be displayed on monitor through IoT.

V. CONCLUSION

The GSM Based Digital Door Lock Security System was designed and implemented successfully. On basis of detailed analysis and trials, we could conclude that the system was stable and can be an emerging product in field of security systems for both residential and commercial applications.

Future Scope

1) Integrating with face detecting sensors

2) Integrating with gesture sensors

3) Interfacing with CCTV network

4) Integrating with 3D holographic password input keyboard

5) Integrating with multiple locks on multiple doors inside a facility

6) Replacing motors with pneumatic valves

7) Addition of a lock tampering detection system

8) Addition of backup battery supply to facilitate uninterrupted service

REFERENCESS

[1] Available at https://www.fbi.gov/about-us/cjis/ucr/crimein-the-u.s/2010/crime-in-the-u.s.-2010/propertycrime/ burglarymain

[2] National Crime Records Bureau, Statistics2011,2011

[3] Available at http://airef.org/burglars-confirm-value-of-alarms/

[4] Available at http://www.alarm.org/HomeSafety/FastFacts.aspx

[5] John Mallory, "Central Monitor for Home Security System",US4581606A, Apr8, 1986.

[6] Takashi Murakami, YasuyukiShintani, Kazuhiro Aizu,"Home security system", US6759957 B2, Jul 6, 2004.

[7] Ronald E Pyle,"Home Security System", US4446454A, May1, 1984.

[8] Yanbo Zhao, Zhaohui Ye, "A low cost GSM/GPRS based wireless home security system", Consumer Electronics, IEEE Transactions on (Volume:54 , Issue: 2), May 2008.

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