

**DESIGN & IMPLEMENTATION OF RASPBERRY PI BASED AUTOMATIC  
DOOR LOCK SECURITY SYSTEM USING A SPY CAMERA.**

*Final Year Project Report Submitted To Kampala International University in Partial Fulfillment  
of the Requirements for the Award of the Degree*

*of*

**Bachelor of Science in Electrical Engineering**

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**AUGUST, 2019.**

## **DECLARATION**

I hereby declare that the material submitted in this report has been compiled by me and produced to the best of my own understanding, as a prerequisite to pertain a Bachelor of Science in Electrical Engineering. This report has never been submitted elsewhere for any professional award in any institution of higher learning, except where due acknowledgment has been made in the text.

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## APPROVAL

I have read and hereby recommend this project “*Design & Implementation of Raspberry pi based Automatic Door Lock Security System using a Spy Camera*” for acceptance by Kampala International University in partial fulfillment of the requirement for the award of the degree of Bachelors of Science in Electrical Engineering of Kampala International University.

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## **DEDICATION**

I dedicate this piece of work to my Father, Mother, and all my family members who stood with me in every aspect, who have supported me financially and saw that my study was a success. Despite the challenges faced, they have always given me courage and resilience to face them, which has always motivated me to continue on to the very end.

## **ACKNOWLEDGMENT**

My heartfelt gratitude goes to the Almighty God who without any of this would not have been possible. He has provided me with everything I need to accomplish what I was aiming at, and gave me the strength to go through it up to the end. I would like to extend my acknowledgment to all the people who provided assistance during the process of this report.

I would like to thank Kampala International University for the opportunity that they have given us to study for the award of our respective bachelor's degrees. Through this opportunity, I am able to complete the course and have an opportunity to practice the knowledge acquired from the university. More thanks go to my Project Supervisor Mr. Ibrahim Adabara for his professional guidance and support, his valuable suggestions without which it would not have been possible to develop these publications. Also to my lecturers and coordinators of the project who gave me ideas, technical support and sparing their time to ensure my success.

I recognize the effort of my parents in their endeavor to pay my tuition fees without which I would not be able to accomplish my studies. Their prayers, support, guidance, and sacrifices are highly appreciated.

Appreciations go to fellow students who helped me in the research process.

## **ABSTRACT**

As an essential constituent of many associations' home security and safety precedence, surveillance has established its importance and benefits numerous times by providing immediate supervising of possessions, people accessing your house and property. This project deals with the design approach of an Embedded Real-Time automatic door lock security System using Spy Camera Based on Raspberry Pi 3 for intruder observation that reinforces surveillance technology to provide essential security to our houses and associated control. The proposed system uses a camera for video surveillance and it remotely transmits images to the phone using Wi-Fi as medium. Raspberry pi serve the purpose of server as well as the microprocessor for the system. An embedded web server creates an easy way for monitoring & automatically locking the door any device. This Raspberry Pi Based Automatic Door Lock Security System Using a Spy Camera presents the idea of monitoring a particular place in a remote area.

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## ABBREVIATIONS

SBC	Single Board Computer
CCTV	Closed Circuit Television
IP	Internet Protocol
VPN	Virtual Private Network
SOC	System on chip
CPU	Central Processing Unit
DC	Direct Current
IC	Integrated Circuit
GPIO	General Purpose Input/Output
EEPROM	Electrically Erasable Programmable Read Only Memory
LED	Light emitting diode
LCD	Liquid crystal display
PCB	Printed circuit board
IEEE	Institute of Electrical and Electronic Engineers

# CHAPTER ONE

## 1.0 Introduction

In this modern world, crime has become ultra-modern too! In this current time a lot of incidents occur like robbery, stealing, etc. Doors serve as entrances to our homes, offices and many other kinds of enclosure; they may also provide access for strangers, criminals, and offenders. Doors are meant to be secured and to prevent intrusions from unwanted persons. Individuals and cooperate bodies are becoming more aware of the dangers associated with relying on keys and parameter fencing to provide security to exclusive areas of their apartments and organization because criminals and fraudsters can forge keys or make master keys that can be used to break into such rooms or offices. So the security does matter in this daily life [2]. People always remain busy in their day to day work also want to ensure the safety of their beloved things. Sometimes they forget to look after their necessary things like keys, wallets, credit cards, etc. Without these, they are unable to access their home or any place they want. To prevent such incidents many scholars came into action and tried to prohibit them. Akash V. Bhatkule and others; introduced “A GSM/GPRSbased wireless home security system [3], [4] but the system is not cost-effective as the GSM/GPRS charges a fixed amount from each SMS, call or data transfer. M.Gowsalya, M.Sangeetha, and others (2014 ) also introduced ” “Face recognition based on auto-switching magnetic door lock system using microcontroller[6] but face recognition means complex algorithms and sometimes the system may be unable to detect the visitor's identification correctly and keeps a computer chip busy for longer time. Vishnu S B3 and Sanju V 4. Invented “Password Protected Locking System Using Arduino”[7] designed a sensor-based system. Based on the programmable electronic code lock, the reprogrammable digital door locks [1] were invented in that the password can change any time as it stored in PROM. Day by day technologies are developing and techniques of robbery are also developing [5]. So, need is to develop a new smart and unbreakable technique. In this paper, a new system is designed which would control the door through utilizing a spy camera and raspberry Pi sensor-based technology without any complexity. It is very convenient and serves as a plug and play system. The user can see from anywhere in this world that who is at his doorsteps. The system keeps a picture of the visitor as evidence that would be needed if any unwanted situation occurs like stealing, robbery, etc. The user can control the door with a single command. Also for any kind of accident like fire, or stolen keys the door can be opened by a single and simple command. This is an inexpensive technology that can

be implemented for several applications such as security, asset tracking, people tracking, inventory detection, access control applications. As a result, the security is confirmed hence mental peace.

### **1.1 Background of the Study**

Over the years, various control systems have been designed to prevent access to an unauthorized user. The main reason for providing locks for our buildings (home, office, church, school, etc.) is for security of our lives and property. It is therefore important to have a stress free and convenient means of achieving this purpose. In order to save the belongings most of the people employed watchdogs and security personals. They both did well for some time. But both of them can be easily deceived. If properly planned, the burglars could easily deceive a watchman and could even kill him. A single watchman can't fight against 4 or 5 burglars. Even the watchdogs can be made unconscious with the help of chloroform. These failures paved way for the development of intelligent door security systems, which have promised perfect protection of the assets and life.

So many security systems are employed to protect ourselves from burglary and robberies. Nowadays most of the supermarkets, banks, and industries make use of the security facilities to protect them against the burglars. Industry and banks are the places targeted by most of the burglars. To safeguard these places, surveillance cameras associated with burglar alerts are being employed. Using the camera, we can watch each and every person who enters and leaves the place. It helps the owner as well as the cops to identify the burglar and apprehend him soon. The burglar cameras are useful in catching the burglars red-handed at the moment of burglary. The main objective of this project is to design and implement an RFID automatic access control system which residents need to use RFID card reader to access the door where only authentic persons can be entered at their home. This system will consist of two main parts which include: the hardware and the software. The hardware consists of the Raspberry pi, spy camera, PIR sensor, LCD display, and RFID reader. Besides that, the proposed security system will contain door locking system using passive RFID which can activate, authenticate and validate the user and unlock the door in real time for secure access. The advantage of using passive RFID is that functions without a battery and passive tags are lighter and are less expensive than the active tags. Since the access control is such a typical interaction between a security system and people, a spy camera will be incorporated to detect and recognize the presence of an individual, uniquely identify it hence the door locking system will function well in real-time as the door open quickly when user put their tag in contact of the reader.

## **1.2 Problem Statement.**

Identity theft is one of the fastest-growing types of crime nowadays since it is more profitable than other types of crime. Different door locking techniques like the use of normal door lock key and diverse electronic automatic locking and identification systems have been used. In general, locks are very simplistic device that is employed to address a very straightforward problem. Basically, lock can easily be hacked by unwanted people allowing unauthorized people in.

## **1.3 Objectives of the Research**

The aim of this research is to design and develop an automatic door lock security system that includes features such as motion detection, image processing and SMS to the facility owner. The system is to be based on Raspberry Pi B+.

### **1.3.1 Specific Objectives**

The specific objectives are:

- To study and describe how the Raspberry Pi can be interfaced with a motion detector and Pi camera.
- To study how a Raspberry Pi can be programmed so as to be able to notification alert to a prescribed user.
- To develop and build a prototype of the surveillance system based on the Raspberry Pi B
- To design and implement a motion-detecting and tracking system for real-time video analysis.

## **1.4 Research Questions.**

How to study and describe how the Raspberry Pi can be interfaced with a motion detector and Pi camera.

How to study how a Raspberry Pi can be programmed so as to be able to send a notification alert to a prescribed user.

How to develop and build a prototype of the surveillance system based on the Raspberry Pi B.

How to design and implement a motion-detecting and tracking system for real-time video analysis.

## **1.5 Significance of the Project**

The door lock security system to be designed in this project can be used extensively to monitor facilities by owners. The owner shall be able to monitor their property from wherever they are in the world using a camera surveillance system, this will reduce the cost of implementation of a basic security system. This thus will enable small homeowners to secure their facility at a cheaper cost.

Another aspect of this project is to present an idea of monitoring and tracking of an intruder through the use of a camera. Any object passing through the field of view of the camera will be detected then tracked. This camera feeds directly to the mobile phone of the homeowner using the cellular network. This allows the owner some form of access control to his home. The homeowner can then interact with a visitor via chatting with the visitor via video streaming, sending and receiving messages amongst others.

## **1.6 Scope of the Project**

### **1.6.1 Content scope**

This project is focused on developing a surveillance system that contains the RFID section which serves as the key, a motion detection sensor that detects motion and camera that responds speedily by capturing an image and relaying it to an administrator device. The system will require Raspberry Pi module. It will come up with the implementation of a surveillance system that presents the idea of monitoring a particular place in remote areas. The system can be monitored by the user from anywhere in the world. It will, therefore, use these systems together with a suitable program script to accomplish a real-time surveillance system as desired.

### **1.6.2 Time scope**

This project was based on both theoretical data and methodological data, thus it approximately took a maximum of five months.

### **1.6.3 Geographical scope.**

The system will be designed for use in small residential homes as well as confidential places such as banking business areas and offices.

## CHAPTER TWO

### 2.0 A LITERATURE REVIEW

#### 2.1 Introduction

Security represents the protection of our life and assets. Ensuring the safety of peoples and their valuable things is very important for the prevention of illegal handling. Hence, mainly focusing on door lock security or gate security is very important to avoid further problems in monitored area. Even with the use of mechanical locks, the crime, robberies happen due to the fact that such locks can be easily broken. So, there is a need to invent another kind of locks that cannot be easily broken. So, many authors present different kinds of digital door locks that are classified based on technology used as automatic password based door locks, biometric-based, GSM-based, a smart card-based or RFID based, door phone-based, Bluetooth based, Social networking sites based, Motion detector based and combined systems. All these have been widely used in houses and offices. This paper, therefore, tries to review the various recent works on Automatic door lock system as presented in latest publications as below;

#### 2.2 Related works

In (Postolache 2018) a Raspberry Pi Single Board Computer with internet connectivity via the Local area network was used as an IoT based security, a secure access control system in the front of the door using a camera and face recognition features were proposed.

The main focus was to notify the system administrator through a mobile application if anyone spends time in front of the door more than a specified limit.

A hybrid access control security system integrating an access control system and a security system was presented in (Arti Barde Feb-2018). It used The Raspberry Pi which incorporates a Broadcom BCM2836 system on a chip running a web server and interfacing with a surveillance camera and Sensors for home security.

The system designed by (Ketan Rathod<sup>1</sup>, Prof.Rambabu vatti<sup>2</sup>, Mandar Nandre<sup>3</sup>, Sanket Yenare , 2017 ) uses an Arduino having an HC-05 wireless Bluetooth Transceiver for controlling door. The application uses Arduino as its controller and HC-05 as a communication link between mobile applications.

In recent (Nareshkumar R. M. November, 2017), Door Automation is traced to be the emerging technology in Home Automation. From the last decades, a number of standards have been defined



for Door Lock Appliances. With tremendous advantages such as secure locks for doors, comfort, convenience and energy efficiency for the user with the help of IoT. The research aimed at developing Door Automation Application using Raspberry Pi, GSM with a camera for surveillance capture of the intruder and biometric used as secondary for security purposes. However, for further enhancement, the study reminds the need to use to Retina Scanner instead of biometric.

Some new digital locks take advantage of technologies like fingerprint scanning, iris scanning, retinal scanning, and voiceprint identification to authenticate users. Arduino based door locking system provides advance and fastest accessible security with ease of use for home doors and gates (Karan Khar NOV 16 TO OCT 17). In the work proposed by (Sriharsha B S 2015, 2016) exhibits a keyless system for locking and unlocking purposes using a pre-defined password. Unauthorized access is ensured by setting a password by the User, if the entered password matches, door will be opened automatically otherwise a message showing incorrect password will be displayed on the LCD display and an SMS will be sent to the owner that the security was tried to be breached.

The latest security system (Adebayo A. K. , 2017 ) is designed where the locking security system can be enhanced with the help of RF and a 4 digit password which provides authentication. This paper focuses on the development of a simple security system that combines Radio Frequency Identification and password to provide a low cost and formidable access control for entrances. The system is built on ATMEGA8 Microcontroller that directs the RFID reader to scan and authenticate users' identification tags and further request for a password through a keypad before activating a motor to grant access.

A cellphone controlled password-protected door lock system which was proposed in (Agbo David O. AUGUST 2017) to open the door with the help of an Android app that generates a password that is recognized by the Bluetooth to control the opening and closing of the door located at some distance from the user. The Bluetooth module that is installed on the door receives the commands from the android phone and passes these commands to the microcontroller that controls the opening and closing of the door. In their findings includes that there will be issue on locking function during electricity blackout, the system becomes easily vulnerable and a user will be trapped until the supply is restored. However the system is low cost, easy to implement and use for home security. Bluetooth based system is a bit like innovations that utilize Bluetooth function available in smart devices. According to (Lubhansh Kumar Bhute , May 2017 ), Smart home automation system plays a major role which helps in reducing work by using some technologies. The researchers proposed a smart

door lock system using Bluetooth system where an administrator or owner of an apartment or building can manage and send a digital signal to other persons in order to allow them to access an apartment, building, or specific room in a building by using their NFC equipped smartphone or an NFC smartcard. The ideal purpose of the work was, if the door is not locked in first floor or on any other floor, the user from ground floor can open the door or unlock the door from mobile phone or laptop, which makes a person reduce its energy or save time.

Latest RFID based door lock security system is based on Arduino platform (Dhrubajyoti Adak -2017), with audio acknowledgment at the point when card put close to the RFID module, it peruses the card data and it matches with the data stored in the program memory and shows authorize/unauthorized entry. Arduino is also used by many other applications, for example, a specific Arduino ATMEGA processor can be used for sensing and recognition of person.

Access Security Deadlock System which points out authorized peoples and permits just them was discussed by (Součková 2016). Project aimed to create a complete system to allow cards compatible with the ISO/IEC 14443a standard commonly known as RFID cards, such as International Student/Teacher Identification Cards, to be used to unlock doors and access other electronic equipment and for this system to be useful, the researchers point out requirements such as trustworthiness in that, it must protect valuable resources, Reliability in that there is ease of accessibility, security, practicability, ease of use and many others.

A wireless monitoring system based on RFID and MMS Technology were effectively created by (Murugan.E , April 2016). The person who wants the access has to provide a valid RFID tag which is read serially by the microcontroller in RFID section and then Search the read information in a memory chip for a match in RFID section thereby triggering the microcontroller in MMS section accordingly. while the microcontroller in MMS section is responsible for issuing AT commands to GSM module for capturing the user image and transferring the image to owner mobile phone using MMS, a multimedia service of GSM network. The owner then replies with the text message for either granting or denying access. The ideal purpose of the study is user verification and theft identification. With help of latest advanced technology, demonstration of an intelligent door system using the Internet of Things is given by (S. Nazeem Basha ,March 2016 ) , the system provides notification of intrusion by sending out email notification to the owner. It logs all the intrusion data into a Google spreadsheet of owner's Google Drive account. ADXL345 accelerometer detects the change in motion

of the door and raspberry pi reads the sensor intrusion data and to communicate to the Amazon Web Services Internet of Things (AWS IoT) console.

The earlier system, a specific system in which identification of a visitant is done for the most part by direct communication with the set of the housing estate concerned has been presented in the research paper (Patel , February 2016), In research , presented a part of smartphone locking and unlocking technology which uses Wi-Fi technology in a mobile device. This allows the user to lock and unlock any system or appliances from inside or outside a house with a Wi-Fi range available.

The motion detector system (Choksi , February 2016) working is based on the principle of the amount of light falling on the photodiode. At the point when the motion is detected through PIR sensor inside the room the image is captured through camera and temporarily stored in the raspberry pi module. Internet of things based applications can be used remotely to view the activity and get notifications when motion is detected. One android application is used to get the notification on motion detection and automatic lock can be activated.

A model entryway security framework (Keane 2014) is intended to permit an authorized person for getting a safe (without the need of any key) entryway where valid card of smart RFID is necessary for ensuring the pass of the door. Total control activity is performed by the microcontroller.

## CHAPTER THREE

### 3.0 METHODOLOGY

The proposed security system makes use of a passive RFID tag and password combination supported by a microcontroller to provide access control to facilities or rooms within premises by opening and closing of a door. The system consists of a hardware module and an application program for the Microcontroller unit. The application program was developed using the mikroC programming language. The hardware module comprises of the input units (RFID tag, RFID reader, and Password keypad), the display unit, the microcontroller unit, and the power supply unit. The block diagram of the system is shown in Figure 1.

### 3.1 Block Diagram of the Double Sensor Automatic Door Lock Security System

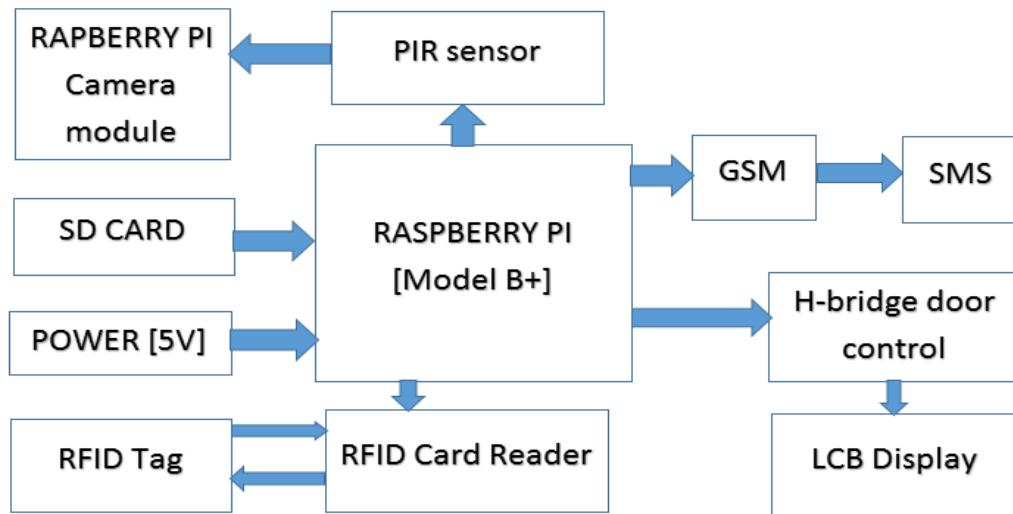


Figure 1: Block Diagram of the Double Sensor Automatic Door Lock Security System

### 3.2 Circuit Diagram of the Double Sensor Automatic Door Lock Security System

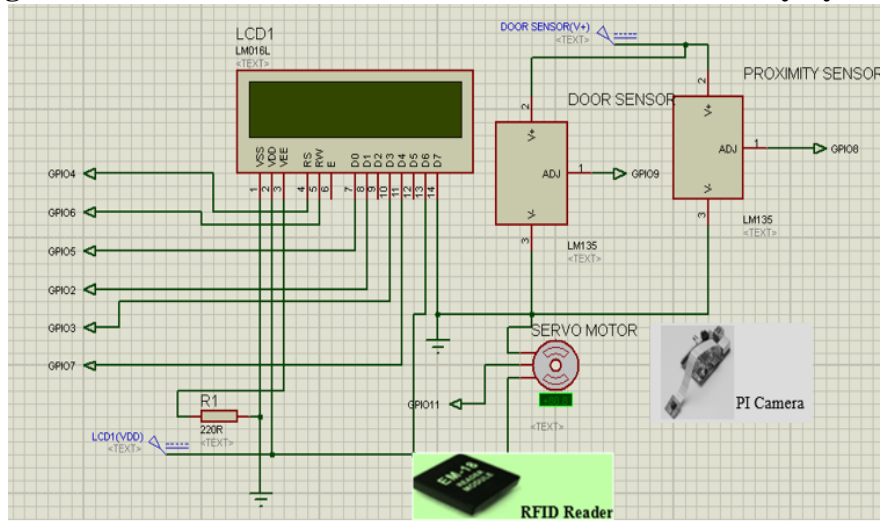


Figure 3: Circuit Diagram of the Double Sensor Automatic Door Lock Security System

### 3.3 Flow Chat of the Double Sensor Automatic Door Lock Security System

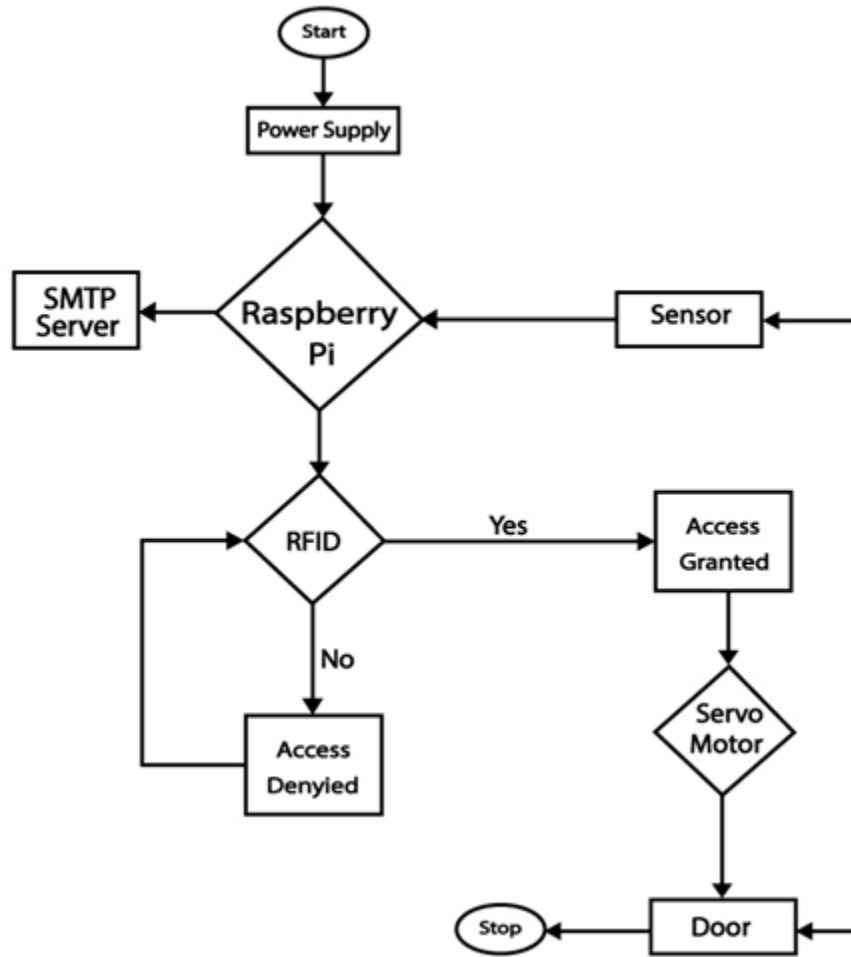


Chart 1: Flow Chart of the Double Sensor Automatic Door Lock Security System

As shown in the above structure, System mainly works on Door using different technologies and different components like Wireless LAN module, Proximity Sensors, Raspberry Pi B-3 model, RFID module, Servo Motor, and display Screen and mobile device. Basically System is featured for security of home implemented for door security having automation in it. Raspberry pi requires 5v DC supply which has in-build Wi-Fi module. Using Proximity sensors, it senses the status of Door and to trigger message. Proximity sensors send signals to Raspberry pi. Raspberry pi sends to user's email device using Internet module on Raspberry pi. These all operations are done on door using these different modules, therefore, the door act as Smart Door.

Smart Door Security System has modules like

- Raspberry Pi-3Model B
- RFID module
- Wi-Fi Module
- Proximity Module
- Servo Motor

### System Components

- Hardware and Software Components used.

### RFID Tag and Reader

**A.** RFID Tag IPC80 passive RFID tag operating at a frequency of 125KHz is issued to the user. The tag transmits information to the reader in ASK format [11].



Figure 4: RFID Tag and Reader

**B.** RFID Reader IP10 proximity card reader with operating frequency of 125KHz and reading distance up to 4 inches is used. The reader can be easily installed on metal doors, provides the tag information serially in RS232 format and is suitable for indoor as well as outdoor operations [11]. Three such readers are installed for hostel security: hostel entrance gate, hostel exit gate, and mess entrance gate.

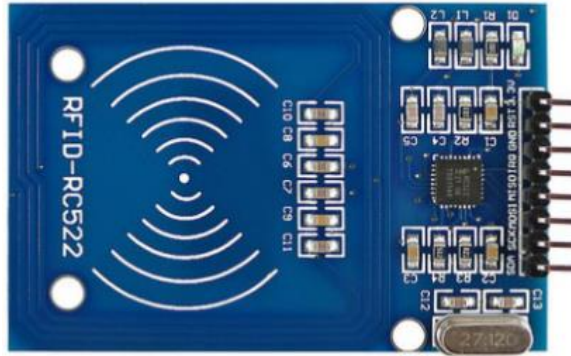


Figure 5: RFID Module

### Raspberry Pi-3Model B

Raspberry Pi-3Model is the third generation Raspberry Pi. It replaced with Raspberry Pi 2 Model B in February 2016. As of January 2017, Raspberry Pi-3 Model B is the newest version of Raspberry Pi. It is as small as credit card size. Also, it is open source, therefore, changes can be made to it as and when required. Compared to the Raspberry Pi 2, it has 802.11n Wireless LAN as well as Bluetooth 4.1 and Bluetooth Low Energy (BLE). For the Raspberry Pi-3 Model B, CPU speed ranges from 700 MHz to 1.2 GHz and onboard memory range from 256 MB to 1 GB RAM.



Figure 6: Raspberry Pi-3Model B

Raspberry Pi-3Model B which uses the system on chip (SoC) BCM2835. It does not have storage drive but one can use SD card for storing operating systems as well as for booting and long term process. The Raspberry Pi-3Model B runs on Raspbian OS and it is programmed using python 2.7.6. Also one can install various different types of software for different purposes. Four USB ports for external storage, 40 GPIO pins for interfacing with hardware and full HDMI port are available on



Raspberry Pi- 3Model B board. The Broadcom BCM2835 SoC used in the first generation Raspberry Pi is somewhat equivalent to the chip used in first-generation smartphones (its CPU is an older ARMv6 architecture),[14] which includes a 700 MHz ARM1176JZF-S processor, VideoCore IV graphics processing unit (GPU),[15] and RAM. It has a level 1 (L1) cache of 16 KB and a level 2 (L2) cache of 128 KB. The level 2 cache is used primarily by the GPU. The SoC is stacked underneath the RAM chip, so only its edge is visible. The Raspberry Pi 2 uses a Broadcom BCM2836 SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor (as do many current smartphones), with 256 KB shared L2 cache. The Raspberry Pi 3 uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache

### **Liquid crystal display**

The microcontroller board's LCD port provides the signals needed for standard character-based LCD modules. The display has 8 pins that are connected directly into the microcontroller. It displays 16 characters by 2 lines; the characters are black against a green background. The LCD includes a green LED backlight, which allows the characters to be viewed without ambient light. In normal room light, the characters are visible without the backlight. A resistor is included for current limiting to the backlight.

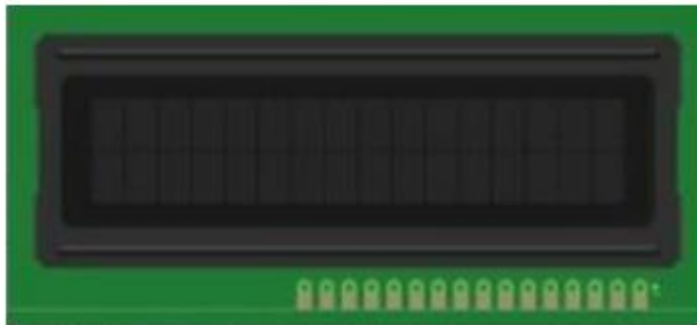


Figure 7: Liquid crystal display

## **Pin Summary of LCD 1602a**

**Pin 1:** VSS.

**Pin 2:** To VDD 5V input.

**Pin 3:** VL to adjust LCD contrast with the help of a 10K potentiometer. Low VL indicates light contrast and high VL indicates dark contrast.

**Pin 4:** RS for register select. Data registers used for high RS. Similarly, instruction register for low RS.

**Pin 5:** R/W signal stands for reading/writing. When R/W bit is high, it indicates a read operation. If R/W bit is low, it indicates write operation.

**Pin 6:** Clock Enable- Edge triggering.

**Pin 7:** to 14: Represents from Bit 0 to Bit 7.

**Pin 15:** backlight Anode.

**Pin 16:** backlight cathode.

## **Power supply unit**

The power supply circuit consists of the circuit for conversion of 220 volts, 50Hz AC into 12V and 5V DC. This is achieved by the use of a step-down 12V-0-12V center-tapped transformer with a full-wave rectifier. The AC ripples are eliminated using the capacitor and the LM78 and LM79 voltage regulator series used to regulate the output voltages. 5V DC is used to power the Microcontroller and the LCD. The 12V DC is used to power the DC motor that drives the door, it also powers the relay circuits.

## **Servo motor**

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. This article discusses what is a servo motor, servo motor working, servo motor types, and its applications.



Figure 8: Servo motor

### **IR Proximity Sensor**

This IR Proximity Sensor is a multipurpose infrared sensor that can be used for obstacle sensing, color detection, fire detection, line sensing, etc. and also as an encoder sensor. The sensor provides a digital output.

The sensor outputs a logic one(+5V) at the digital output when an object is placed in front of the sensor and a logic zero(0V) when there is no object in front of the sensor. An onboard LED is used to indicate the presence of an object. This digital output can be directly connected to an Arduino, Raspberry Pi, AVR, PIC, 8051 or any other microcontroller to read the sensor output.



Figure 9: IR Proximity Sensor

IR sensors are highly susceptible to ambient light and the IR sensor on this sensor is suitably covered to reduce the effect of ambient light on the sensor. The sensor has a maximum range of around 40-50 cm indoors and around 15-20 cm outdoors.

## Features:

- Can be used for obstacle sensing, color detection(between basic contrasting colors)
- Comes with an easy to use the digital output
- Can be used for wireless communication and sensing IR remote signals
- The sensor comes with ambient light protection
- The sensor's hole of 3mm diameter for easy mounting

## Specification:

- Operational Voltage: 5V
- Ambient Light & RGB Color Sensing
- Proximity Sensing
- Gesture Detection
- Operating Range: 4-8in (10-20cm)
- I2C Interface (I2C Address: 0x39)

### 3.4 Raspbian

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi.

The initial build of over 35,000 Raspbian packages, optimized for best performance on the Raspberry Pi, was completed in June of 2012. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible.

**Note:** Raspbian is not affiliated with the Raspberry Pi Foundation. Raspbian was created by a small, dedicated team of developers that are fans of the Raspberry Pi hardware, the educational goals of the Raspberry Pi Foundation and, of course, the Debian Project.



## Resources

For an embedded real-time surveillance system to be utilized for effective monitoring and alerting, the system has to have at least three functions. These functions are detection, image processing, and alert mechanism. This Raspberry Pi-based security system is thus composed of mainly two parts. These are: design hardware and design software

### **Design Hardware (System Modules Set Up and Configuration).**

The entire system modules consist of seven parts components namely:

- Raspberry Pi Model B+ controller,
- PIR motion sensor,
- RJ45 Ethernet connector,
- Pi camera module
- MicroSD card
- LED and 220 Ohms resistor
- USB powered cable.

### **Raspberry Pi Model B+**

This is the model that was chosen to implement the project. It has merits over other models in that it has an increased number of USB ports and large number of GPIO pins. Moreover, this piece of hardware was available at the department.(refer to section two for diagram)

### **Booting Up the Pi Model**

Raspbian ‘Wheezy’ image was written into the 4GB Micro SD card. This was the operating system chosen to run on the Pi because the OS has been optimized and ported to the Raspberry Pi ARM architecture. This OS has very good integration with the hardware and comes pre-loaded with GUI and development tools.

After slotting in the Micro SD card and connecting RJ45 Ethernet cable to the Pi and the personal computer with Putty software (Putty is an SSH client used to remotely access and control the Pi from a computer running on Windows platform) the system was powered. Putty was then started and the default static IP address of the Pi was typed into the hostname field. While doing this, windows pc was set to manual IP configuration. This was to allow it communicate with the Raspberry Pi.

### 3.5 Setting Up internet connection on the Pi

Internet was necessary so that the Pi can communicate over network protocols and thus allow for installation of necessary Python packages. The architecture below was used to achieve that.

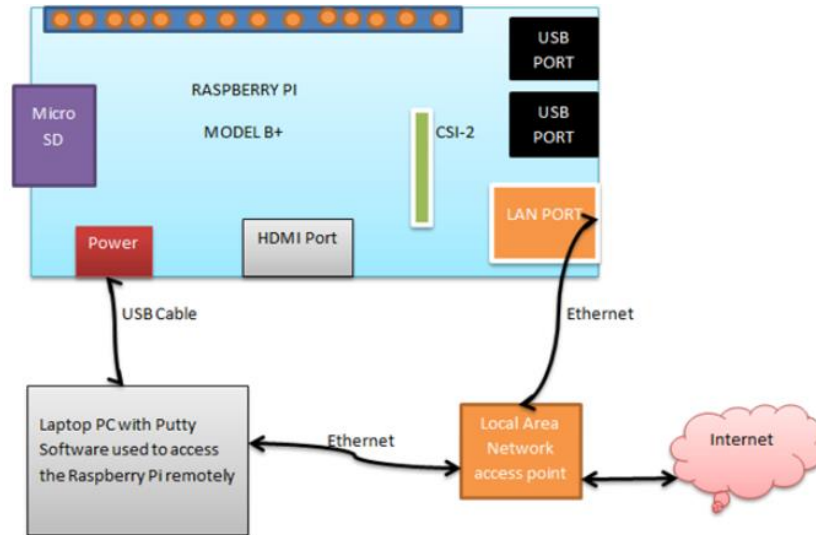


Figure 10: Setting up an internet connection on the Pi

Since the broadcast router uses Dynamic Host Configuration Protocol (DHCP) to dish out IP addresses to devices connected to it, it was necessary to change the IP address of the Pi from static to dynamic. This was done by editing the network interfaces file using the command;

```
sudo nano /etc/network/interfaces
```

### Update and Upgrade of the Raspberry pi

The commands for updating and upgrading Raspberry pi are shown below.

```
sudo apt-get update
```

```
sudo apt-get upgrade
```

### 3.6 Design of the System

In this study, we proposed a security system contains a door locking system using passive type of RFID. The system is implemented in three spaces using central database system. The secure space

located on same or different part of buildings as illustrated in figure1. The system used hardware as well as software. The hardware components are RFID reader, tags, USB connections, and connecting cables, etc. In addition we have used actuator (stepper motor for this purpose). The proposed scheme is showing in figure2.

The detail of the proposed scheme is showing below:

**Step 1:** The RFID reader retrieves the information contains by tag as it comes in the range of few millimeters from reader.

**Step 2:** After receiving the tag information, reader sends this information to database for confirmation. If it holds, the information stored for further operation.

**Step 3:** The central server queries to database and retrieves corresponding information after receiving the query from the reader.

**Step 4:** The reader computes timestamp (date, time) after receiving the reply from the server and create a log.

**Step 5:** Once the tag information verified, the system generates a control signal through the parallel port which controls the opening and closing of the door by means of the stepper motor.

We implement the system using passive tags. The RFID tag is detected when touched or come in the range of few millimeters from the reader. The tag is automatically detected by RFID reader in every mile second and reader sent the information containing by tag to the central control though serial port. The central controls already have information on different users registered with system. The signal information coming from RFID reader is matched with the stored information in local as well as central control. When the information matched with the stored information, system displays the information. The information contains details of user like name, id no, category, check-in time, check-out time, date and photo as well. All the coming information of RFID tag gets stored by central control server. The system can also generate report of a single user as well as multiple users according to the date, time. Once the tag user authentication is performed, system generates a control signal through parallel port. This control signal goes to a control circuit.

RFID reader was connected to the system through the USB port to provide communication between system and RFID reader. The output control signal is generated by system through parallel port which

controls the opening and closing of door by means of stepper motor. The technical specifications of the RFID are as follows:

- ❖ Power: DC6V, 4 standard AA alkaline batteries
- ❖ Read speed: 0.5 ~ 1.0 second
- ❖ Capacity: 100 different cards
- ❖ Maximum reading rang: RFID card: less than 30mm
- ❖ Card format: For ID card EM.125K
- ❖ Door Lock: Motor-driven locks and unlock
- ❖ Battery life: More than 4,000 times open/close of the door
- ❖ Low voltage warning: When the CPU working voltage is less 4.8V, the lock can still be opened 200 times before the batteries are replaced
- ❖ Door thickness request: 32mm ~ 45mm

### **Python Scripting Language**

Python is a widely-used general-purpose, high-level programming language. Its design philosophy emphasizes code readability, and its syntax allows programmers to express concepts in fewer lines of code than would be possible in languages such as C++ or Java. The language provides constructs intended to enable clear programs on both a small and large scale. Python supports multiple paradigms, including oriented, imperative and functional programming or procedural styles. It features a dynamic system and automatic memory management and has a large and comprehensive standard library. Python interpreters are available for installation on many operating systems, allowing Python code execution on a wide variety of systems. Using third-party tools, such as Py2exe or Py-installer, Python code can be packaged into stand-alone executable programs for some of the most popular operating systems, allowing for the distribution of Python-based software for use on those environments without requiring the installation of a Python interpreter. CPython, the reference implementation of Python, is free and open-source software and has a community-based development model, as do nearly all of its alternative implementations. CPython is managed by the non-profit Python Software Foundation. Python is a multi-paradigm programming language: object-oriented programming and structured programming are fully supported, and there are a number of language features that support functional programming and aspect-oriented programming (including by meta-



programming and by magic methods). Many other paradigms are supported using extensions, including design by contract and logic programming. Python uses dynamic typing and a combination of reference counting and a cycle-detecting garbage collector for memory management. An important feature of Python is dynamic name resolution (late binding), which binds method and variable names during program execution. The design of Python offers only limited support for functional programming in the Lisp tradition. The language has `map()`, `reduce()` and `filter()` functions; comprehensions for lists, dictionaries, and sets; as well as generator expressions. The standard library has two modules (`itertools` and `function tools`) that implement functional tools borrowed from Haskell and Standard ML.

### **Generating and sending e-mail**

After configuring the system to send an alert to the predefined subscriber, it was then necessary to generate and send the mail. Multipurpose Internet Mail Extension (MIME) package was then called and used to generate the attachment. MIME supports characters other than ASCII, known –text attachments (Status of the door and application programs), etc. It thus extends the format of an email. The Simple Mail Transfer Protocol (SMTP) program was then used to deliver the email from the Raspberry Pi to the configured mail-hub. This can be summarized using the blocks below.

### **Pseudocode**

- ✓ Upon restart of the system, send out an email with boot IP assigned to a mail-host.
- ✓ Check the status of the GPIO pin. If the pin is LOW, GPIO output pin 13 should remain LOW and the system is idle. Else if the pin suddenly goes HIGH. Interpret this as an interrupt event.
- ✓ While the value of the input GPIO pin is HIGH (interrupt event), set pin 13 to be HIGH. This instance blinks the LED. Call the function that starts the proximity sensor.
- ✓ The sensor takes 5 seconds to initialize and save it in a file.
- ✓ The system checks whether the internet is enabled on the Raspberry Pi.
- ✓ If the internet, send email to a prescribed mail-host. If no internet, wait for 5 seconds then check again.

Reset the sensor pin to LOW and recheck again the status after 2 seconds. This should return the program to the main loop.

### **3.7 Working of the System**

The system stores all the necessary information about the user. A new user is first registered with the system and the corresponding information is burn-in RFID tag. This RFID tag will be accessible through the system. When a registered user comes to the entry point and puts the tag into reader, the system checks whether it is registered, user or imposter. If the user is registered one then the tag information is matched with the user information stored in system. The door is open to entry of the user after successful authentication and close automatically after a specified time interval. The check-in information is also stored in the database with date and time. A log is also generated by the system according to check-in information. The user check-in process is depicted in figure 3. The card detection setting is shown in figure 4. The database search is illustrated in figure 5 and output of database entry is illustrated in figure 6.

## CHAPTER FOUR

### 4.0 Results of the System

If uploading or running of the code is successful, you will see the instruction on the LCD screen. It means the system is prepared to read the tag. Now, bring the tag near to the RFID reader. If the tag ID matches the ID in the code, lock will open for five seconds. It closes when the door is closed after five seconds. The proximity sensor will indicate that the lock is open or closed. The other sensor is charge of monitoring the status of the door also triggering the emailing at the same time.



## CHAPTER FIVE

### CONCLUSION

#### 5.1 Conclusion

This paper presents the design and implementation of a two-way authentication door lock security system for general users. The security level is increased due to the usage of Raspberry pi which sends the door status to the user, has inbuilt capabilities and is easily connectable to external devices. Raspberry pi proves to be smart economic and efficient platform for implementing the home security system. Two advantages provided by the system are that Necessary action can be taken in current status span of time in the case of emergency condition and design of a PCBboard which is also small in size. Reduced size makes it more applicable to commercial manufacturing and distribution. A raspberry pi and open source applications with its ever-growing community and development provide great hope in the near future.

RFID based security and access control system is more secure and fast responded as compared to the other system like biometric. The advantage of the RFID system is contact-less and works without-line-of-sight. By using Raspberry pi, it is easy to access and works very quickly while burning the code it is like a plug and play device. User admin can change the function accordingly by using Raspberry pi. It is easier to use and accurate also. Hence this project can be useful for implementation of access control application for tracking system as well as providing the security benefits.

#### 5.2 Recommendation

This project can be further implemented and used as an independent security system. Therefore we recommend all security organs to fund the project to make it a successful and implemented project for security improvement in the places which are security conscious.

The project can further be incorporated with a GSM module to enable sending and receiving text messages to and from the people who stay in the place.

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