DESIGN & IMPLEMANTATION OF DOUBLE SENSOR AUTOMATIC DOOR LOCK SECURITY SYSTEM USING RASPBERRY PI

FINAL YEAR PROJECT

Final Year Project Proposal Submitted to Kampala International University in Partial Fulfilment of the Requirements for the Award of the Degree

of

Bachelor of Science in Electrical Engineering

BY

TAREMWA MIRIAN

BSEE/46643/152/DU

SCHOOL OF ENGINEERING AND APPLIED SCIENCES (SEAS)

DEPARTMENT OF ELECTRICAL, TELECOM AND COMPUTER ENGINEERING

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DECLARATION

I hereby declare that this is my own original work of the project design reflecting the knowledge acquired from research on my final year project about "**Design & Implementation of double sensor automatic door lock security system using Raspberry PI".** I therefore declare that the information in this report is original and has never been submitted to any other institution, university or college for any award other than Kampala International University, Department of Electrical Telecommunications and Computer Engineering, School of Engineering and Applied Sciences, for my pursuit of Bachelor's degree in Electrical Engineering.

Name: .....
Signature: .....
Date: .....

APPROVAL

I have read and hereby recommended this final year project design entitled "**Design & Implementation of double sensor automatic door lock security system using Raspberry PI"** acceptance of Kampala International University in the partial fulfillment for the requirement of the award of the Bachelor's degree in Electrical Engineering.

……..

Adabara Ibrahim
Asst. Lecturer
Email. ibrahimadabara@hotmail.com

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DEDICATION

I dedicate this project to my two lovely children Nina Eliana Atukunda and Emmanuel Atkirize Tumuhimbise who gives me the reason to work hard and their love keep pushing me higher. I also dedicate this project to the LORD almighty for the gift of life, His protection and provision. Without God, I would not have made it this far.

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ABSTRACT

In this current situation, the degree of security is feeble. So there is a lot of robbery, theft going on in and around the world. So, people fear to keep any of their valuables in their homes. Henceforth, many people prefer to keep it in banks. However, in this insecure world even banks are not too safe enough to satisfy people needs. A common man/woman feels his/her valuables are secured if there is efficiency in security. Hence this project can give effective security in minimal cost.
Index-Terms: Raspberry pi, Servo motor, LCD 16x2, Proximity sensor, RFID.

CHAPTER ONE

1.0 INTRODUCTION

Security represents protection of our life and assets. Ensuring 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 the further problems in monitored area [2]. Even with the use of mechanical locks, the crime, robberies get happened due to the fact that such locks were easily broken. So, there is a need to invent other kind of locks which cannot be easily broken. So, many authors present different kinds of digital door locks, automatic password based door locks, software based door locks etc. which have been widely used in houses and offices.

The prevention of unauthorized entry into buildings through the main doors is done by using ordinary, electronically operated locks, digital codes and biometrics technique like the finger print technology or some are based on thumb printing only. Nowadays, advanced automatic door security systems are available with the use of palmtop recognition systems face recognition systems, face detection systems, wireless sensors, PIR sensors, RFID techniques, smart cameras and many more that helps people to make their home or organizations secure from long distance. Hence, people need not to be worry about the home security though they are away from home.

Doors are to keep people out. They are being made of metals not simply wood any longer. The security sectors are experiencing variousness as it has never seen before. So, demand is to audit the authenticity of currently available systems and need is to research for the creation of more reliable and good systems which operate smartly with no more efforts. The important thing is to provide higher security. In this project RFID is used to access the door.

RFID, Radio Frequency Identification is a fundamental and inexpensive technology that enables wireless data transmission [1]. This technology has not been very often used in industry due to lack of standardization among the manufacturing companies earlier. RFID technologies are efficient [2] and secure compare to other network [3]. With RFID, wireless automatic identification takes a very specific form: the object,

location, or individual is marked with a unique identifier code contained with an RFID tag, which is in some way attached to or embedded in the target [6]. RFID is not a single product but a comprehensive system, a typical RFID system include three basic elements: RFID tag (transponder), reader (transceiver) and back-end application system (or database), which demands the support of the computer network. The software is used for management, controlling, transaction, operation and maintaining record of the various users.

1.1 Background of the study

Over the years, various control systems have been designed to prevent access to 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. Today security and safety is becoming more and more popular day by day and it is getting improved and used for the ease in our life. Now days, technology has become an integrated part of people's lives therefore the security of one's home must also not be left behind.

Engineers with business methodologies are the greatest support to our society. The advancements in technologies drive their thoughts and speculates to achieve various goals in fields of science. Arduino and other Microcontrollers has been used as a platform to work for a long time. But with the dispatch of Raspberry pi, a credit card size low-price affordable computer, Arduino and others are no longer used in application platform though some are still using it. Raspberry pi platform is being used widely from the past few years as it provides easy use support and documentation. It is readily available to all the end users. From simple educational to smart application projects, Raspberry Pi has proved its significance in the development of applications spreading out in various fields. Raspberry Pi equipped with an internet access (Wi-Fi USB dongle or Ethernet cable) is used as a network device.

The security system was basically divided into two types: used normal door lock key and used electronic automatic identification system. In general, locks are very simplistic device that are employed to address very a straightforward problem.

Basically, lock was easy be hacked by unwanted people allowing unauthorized people in. The lock system was not real practical used in security system and easy explores to high risk enable thieves hack this system.

Therefore, there was several automatic identification technologies including barcode, magnetic stripe and Radio-frequency identification (RFID) applied in security system. Radio-frequency identification (RFID) is an emerging technology and one of most rapidly growing segments of today's automatic identification data collection industry. RFID usage is steadily increasing and companies across many industries are 2 now looking at RFID to streamline operations, meet regulatory requirements and prevent the introduction of counterfeit product into the supply chain to protect both consumer safety and company profitability.

Since, the RFID technology used widely based on the business requirements of the organization for end users. This project will implement the RFID technology to replace the conventional lock system to tighten the security system in our homes. This RFID system monitor the incoming and outgoing people when they entry any door in house via door sensor notification. All of the residents will use RFID tag which is their identification cards know as smart cards. The RFID reader transmits a signal that is received by an antenna intergraded and the chip is activate only when an RFID reader scans it. The doors will open about 2 second and if does not closed, and LCD will display access granted.

1.2 Problem Statement

Most doors designed with key lock commonly suffer from some possible flaws such as lost key, unauthorized key part, forgot to bring keys and the most serious problem is they forgot to lock the door because of carelessness. Even if they are forgotten to lock the door, the system will be locked automatically by using proximity sensor and servo motor.

This system will provide an efficient and reliable system to help the user especially staffs in-charge of exam to unlock the door and lock automatically, and it will also send notifications to the user notifying him/her the status of the door (either Closed or Open).

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1.3 Objectives of the study

1.3.1 Main objectives:

The main objective of this project is to design and implement a double sensor automatic door lock security system using various form of technology such as Radio frequency Identification (RFID), Proximity sensor, SMTP server and Raspberry pi3.

1.3.2 Specific objectives

1. To carry out economic benefit of using double sensor automatic door lock security system.
2. To examine the existing system, use at Kampala International university.
3. To develop two security system using Raspberry pi3
4. To validate the developed system

1.4 Research question

1. How to carry out the economic benefit automatic door security system.
2. How to examine the existing system, use at Kampala International university.
3. How to develop two security system using Raspberry pi3
4. How to validate the developed system

1.5 Significance of the study

Since this project lies with improvement in technology. If we replace all the manual door lock with an automatic door lock one that opened by person and locked immediately closed on its own automatically not only we can save time but also have a best security system. Therefore, this system will be cost-effective, compact and easily maintainable system that solves the problem.

1.6 Scope of the study

1.6.1 Context scope

The study will cover the implementation of double sensor automatic door lock security system using raspberry pi 3.

The function of the project is to improve security by having a more convenient double sensor automatic door lock security system.

1.6.2 Geographical scope

The study will be conducted in any University exam room, hospitals, offices, homes, business areas etc. around Uganda.

1.6.3 Time scope

This project is based on both theoretical and methodological data, thus it is approximated to take a maximum of twelve (12) months, but can be done before twelve (12) months.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

The growing number of illegal entry cases over the years, require of many companies encouraged to design and production for automated door security systems. Door security systems are intended to look after houses, shops, offices and additional buildings from enforced entry and reduced the chances of theft. Door security systems can be install on dissimilar types of entries such as metal, wood, plastic, glass and fiberglass. They are existing in different conditions to outfit the security necessities of different types of buildings. Home security systems may contain of a PIN enabled electronic securing device, whereas top door security systems are regularly combine with invader alarms and security combination lock to offer greater security.

This chapter reviews some of the journal or studies which associated with this topic such as show effective use RFID technologies now generations in some application and reputation of a RFID system in security system .Besides, this chapter analyses some principles for the important device used in this project. Therefore, some conventional door security system was explained here.

2.1 Radio Frequency Identification (RFID)

According to Harvey Lehpamer in studies of RFID design principles where Radio frequency identification (RFID) technology is interesting extensive attention as an accompaniment or even substitute for bar code because of the substantial range, speed and unattended reading advantages it affords. However, users should expect more than improved analysis before participating in an RFID system. RFID has read/write ability, and users can reveal the full worth and benefits of the expertise by taking advantage of the capability to add and change data on the tag in real time. Read/write RFID creates many new applications in the supply chain and helps accommodate changes in business processes, customer requirements or standards.[1]

RFID is expected to become persistent and universal, as it can be embedded into everyday items as smart labels. A typical RFID system comprises of a base radio transmitter/receiver, or reader, RF transponders or tags and the back-end database that associates records with tag data collected by readers. The RFID reader consists of an antenna, a radio interface, and a control unit that has an ability to interrogate and display electronic code held in a remote device, transponder and thus identify any item with which the transponder is associated. The reader control unit will execute the communication protocol with the tags and then interprets the data received from the tags. While the radio interface will perform detection, modulation and demodulation of the reader's signal and the tags replies. The readers communicate wirelessly with the tags to obtain the information stored on them. The data sent by the reader is modulated and backscattered from a number of tags.

RFID system is always made up of two components (shown below):

• The transponder, which is located on the object to be identified.

• The interrogator or reader, which depending upon the design and the technology used, may be a read or write/read device.

A reader typically contains a radio frequency module (transmitter and receiver), a control unit and a coupling element to the transponder. In addition, many readers are fitted with an additional interface (RS 232, RS 485, etc) to enable them to forward the data received to another system (PC, robot control system, etc).

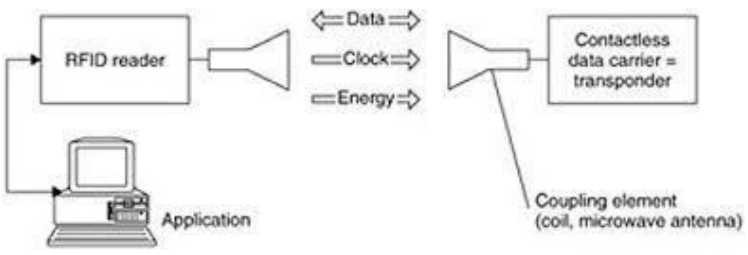

Figure 1: communicating system

The transponder, which represents the actual data-carrying device of an RFID system, normally consists of a coupling element and an electronic microchip. When the transponder, which does not usually possess its own voltage supply (battery), is 5 not within the interrogation zone of a reader it is totally passive. The power required to activate the transponder is supplied to the transponder through the coupling unit (contactless), as are the timing pulse and data.

RFID system has better characteristic in identification system compared to others technology. Table below shows the advantages of RFID system according to system parameters given.

System parameters	Barcode	OCR	Voice Reorganization	Biometry	Smart card	RFID systems
Typical data quantity/byte	1-100	1-100	-	-	16-64k	16-64k
Data density	Low	Low	High	High	Very high	Very high
Machine readability	Good	Good	Expensive	Expensive	Good	Good
Influence of dirt/damp	Very high	Very high	-	-	Possible (contacts)	No influence
Influence of covering	Total failure	Total Failure	-	Possible	-	No influence
Influence of direction and position	Low	Low	-	-	Unidirectional	No influence
Degradation/wear	Limited	Limited	-	-	Contacts	No influence
Operating cost/Reading electronics	Very low	Medium	Very high	Very high	Low	Medium
Operating cost	Low	Low	None	None	Medium	None
Unauthorized copying/ Modification	Slight	Slight	Possible	Impossible	Impossible	Impossible
Reading Speed	Low – 4s	Low – 4s	Very low > 5s	Very low >5-10s	Low – 4s	Very fast – 0.5s
Maximum distance between data carrier and reader	0-50cm	<1cm	0-50cm	Direct contact	Direct contact	0-5m microwave

2.2 The Principle of RFID Technology

The RFID tag is essentially a memory device with a means of revealing and communicating its memory contents, when prompted (scanned) to do so. The

memory consist of a plurality of binary (two state) digits, also known as bits, and the communication comprises RF reception and transmissions means. The binary data (bits) are formed into binary words comprising typically 8, 16 or 32 bits that can make up letters and numbers in the same manner as in computing, the Internet and texts on a mobile phone. The tag may comprise an electronic circuit (printed circuit board) with its own power supply – an active device; or be a very low power integrated circuit that is able to gain enough energy from the scanner/reader RF signal to actually power itself for long enough to transmit the contents of its memory–a so called passive device. In its passive embodiment RFID tag transmission power is very low and measured in millionths of a watt i.e. microwatts (μW). Figure 2.2 shows diagrammatically one of the latter style devices which may be found on products, particularly consumer durables.

Figure 2 coils system for receiver and transmitter

The typical RFID tag portrayed in Figure 2.2, comprises a host substrate which is typically but not exclusively, a flexible (polymer), with an attached flexible etched aluminum alloy or conductive antenna, plus a small (few millimeters square) attached integrated circuit connected to the antenna. The whole assembly is typically 30 millimeters square, a fraction of a millimeter thick and is encapsulated so that it forms a flexible durable, attachable label. The data in the RFID tag memory may be pre-loaded (determine at time of manufacture) as Read Only Memory (ROM), or may be dynamically variable (Static Random Access Memory) and take up the status of the last write/read cycle. The data is always read out serially so that it

can be correctly parsed. The information contained in the RFID tag memory is deliberately kept to a minimum and typically, dependent upon the data format (its syntax, numerical format – decimal, hexadecimal etc.) requires translating into a human readable form via host system.

2.3 RFID Reader

The RFID reader sends a pulse of radio energy to the tag and listens for the tags response. The tag detects this energy and sends back a response that contains the tags serial number and possibly other information as well. In simple RFID systems, the readers pulse of energy functioned as an on-off switch; in more sophisticated systems, the readers RF signal can contain commands to the tag, instructions to read or write memory that the tag contains, and even passwords. Historically, RFID reader were designed to read only a particular king of tag, but so-called multimode readers that can read many different kinds of tags are becoming increasingly popular.

RFID readers are usually on, continually transmitting radio energy and awaiting any tags that enter their field of operation. However, for some applications, this is unnecessary and could be undesirable in battery-powered devices that need to conserve energy. Thus, it is possible to configure an RFID reader so that it sends the radio pulse only in response to an external event. For example, most electronic toll collection systems have the reader constantly powered up so that every passing car will berecorded. On the other hand, RFID scanners used in veterinarians' offices are frequently equipped with triggers and power up the only when the trigger is pulled. Like the tag themselves, RFID readers come in many size. The largest readers might consist of a desktop personal computer with a special card through shielded cable. Such A reader would typically have a network connection as well so that it could report tags that it reads to other computers. The smallest readers are the size of a postage stamp and are designed to be embedded in mobile telephones.[2]

Nowadays lot of RFID reader sold with multiple brands such as Mifare, Hitachi, and Philip. Because of the major application used in worldwide, many systems require the simultaneous use of more than one operating frequency. Most systems available on the world market at present operate at one of the following frequencies or frequency ranges: below 135 kHz (125 kHz, 134.2kHz for example), 13.56MHz, UHF

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(860/960 MHz), 2.45GHz and 5.8GHz. The operating and control characteristics are different for each of these frequencies, and therefore each of them is more appropriate for certain types of application or certain countries.

2.4RFID Tag

The tag, also known as the transponder (derived from the terms transmitter and responder), holds the data that is transmitted to the reader when the tag is interrogated by the reader. The most common tags today consist of an Integrated Circuit with memory, essentially a microprocessor chip. Other tags are chip less and have no onboard Integrated circuit. Chip less tags are more effective in applications where simpler range of functions is all that is required; although they can help achieve more accuracy and better detection range, at potentially lower cost than their Integrated Circuit-based counterparts. From here on out, we will use the term tag to mean Integrated Circuit15 based tag. We will refer to chip less tags explicitly, when needed. RFID tags come in two general varieties which are passive and active tag. Passive tags require no internal power source, thus being pure passive devices (they are only active when a reader is nearby to power them), whereas active tags require a power source, usually a small battery. [4]

2.5 RELATED WORK DONE

Optimized Door Locking and Unlocking Using IOT is very secure solution for locking and unlocking the door within Wi-Fi range. This system plays a major role in helping reduce the work by using Arduino Yun Board and Android App, especially for children, old aged people and physically challenged. The proposed work is to send a signal to door from a Computer or Tablet or mobile devices by using Arduino Yun Board having Wireless system. This allows the user to lock and unlock a door from inside or outside a house with a Wi-Fi range available. Like Arduino Yun Board Raspberry pi is also interfaced with sensors to obtain related sensor reading data in an Intelligent Door System. They are using Google spreadsheet of owner's Google drive account which communicates with Amazon Web Services IOT by notifying intrusion by sending out email notification to the owner by detecting motion of Door. It logs all the intrusion data into Google spreadsheet of owner's Google drive

account. Also using combination of Raspberry pi and GSM, Home Based Security Control System is designed and implemented. Due to GSM, it has very short response time and it covers wide area coverage. So the user can interact with home security system even from a very remote place far from urban areas. The Global System for Mobile communication is used to alert the user by sending and receiving the messages, which is controlled by AT command. Home security system is designed to detect burglary, the image of person is captured by camera and sends to mobile and email as well as alarm gets on; and leaking in harmful gas, the smoke caused by fire as such suspicious activity is also detected. Raspberry Pi-3 Model B released in February 2016 with on-board Wi-Fi, Bluetooth and USB Boot capabilities. It includes various features such as

ARM compatible central processing unit (CPU) and an on-chip graphics processing unit (GPU, a video core IV) for IOT Based Home Automation system.

CHAPTER THREE

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 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.

BLOCK DIAGRAM OF THE DOUBLE SENSOR AUTOMATIC DOOR LOCK SECURITY SYSTEM

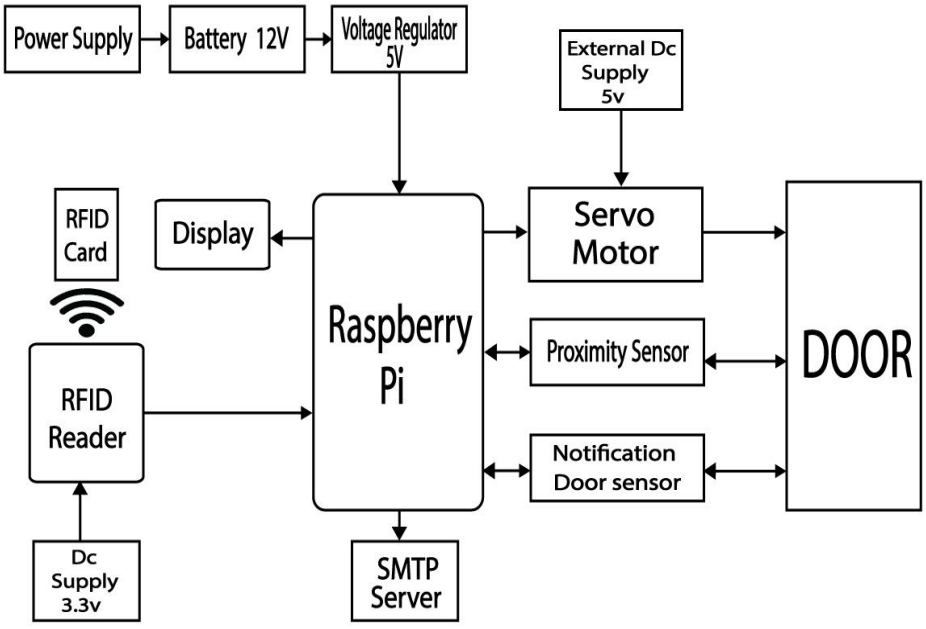


Figure 3: **Block Diagram of the double sensor automatic door lock security system**

CIRCUIT DIAGRAM OF THE DOUBLE SENSOR AUTOMATIC DOOR LOCK SECURITY SYSTEM

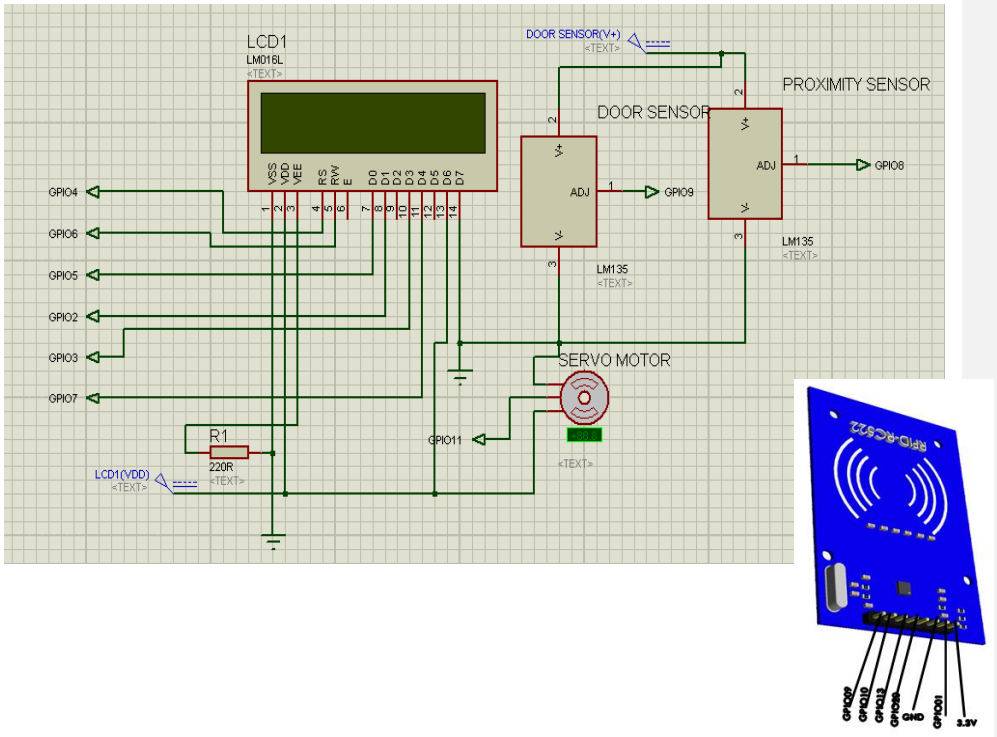


Figure 4: Circuit Diagram of the double sensor automatic door lock security system

FLOW CHAT OF THE DOUBLE SENSOR AUTOMATIC DOOR LOCK SECURITY SYSTEM

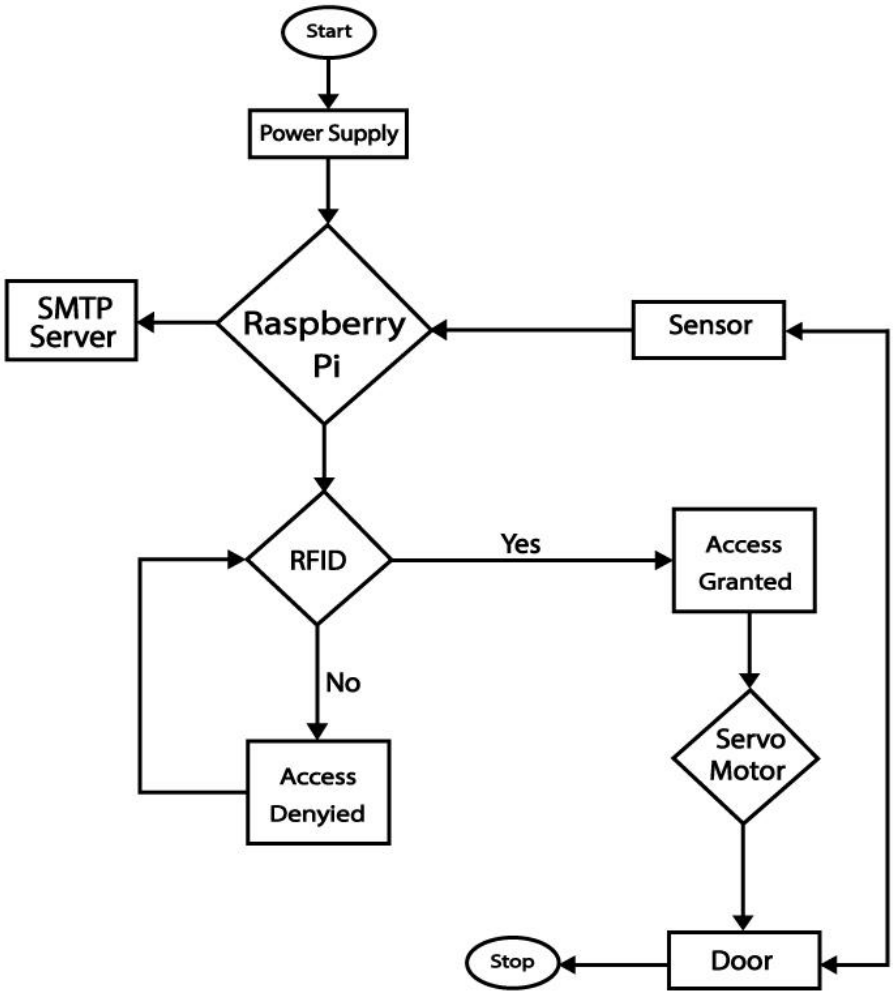


Figure: 3 Flow Chat of the double sensor automatic door lock security system

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 have in-build Wi-Fi module. Using Proximity sensors, it senses the status of Door and to trigger message. Proximity sensors sends 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 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

3.1 **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].

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.

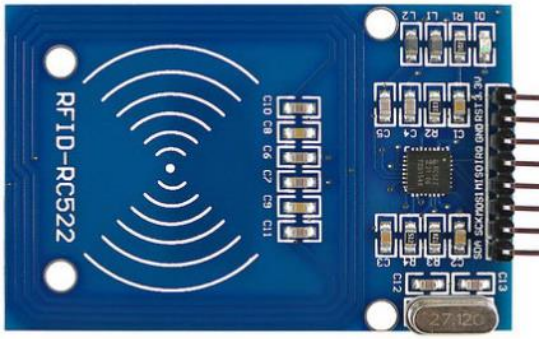


Figure 5: RFID reader

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 on board memory range from 256 MB to 1 GB RAM.

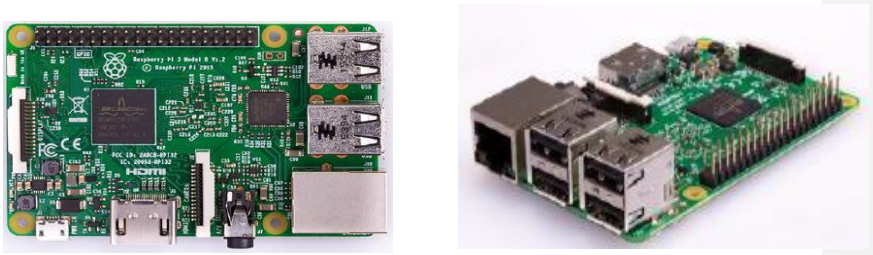


Figure 6 Respberry pi-3

Raspberry Pi-3Model B which uses system on chip (Soc) BCM2835. It does not have storage drive but one can use SD card for storing operating system 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 type of software's 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, Video Core 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 a standard character based LCD modules. The display has 8 pins which 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.

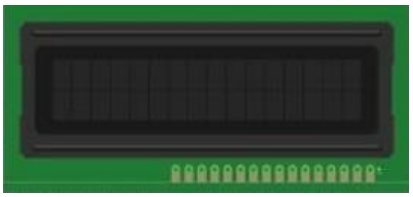


Figure 7: LCD display

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 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 read/write. 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: back light Anode.

Pin 16: back light cathode.

Power supply unit

The power supply circuit consist 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. The 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 rotate 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 about what is a servo motor, servo motor working, servo motor types and its applications.

Figure 8: Servo motor

This IR Proximity Sensor is a multipurpose infrared sensor which 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.

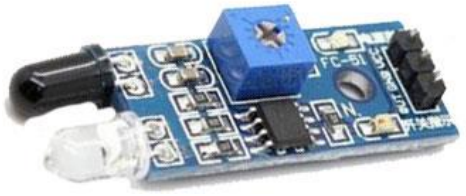


Figure 9: Proximity sensor

IR sensors are highly susceptible to ambient light and the IR sensor on this sensor is suitably covered to reduce 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 digital output
- Can be used for wireless communication and sensing IR remote signals
- Sensor comes with ambient light protection
- The sensor a 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)

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 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 a 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 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 host name field. While doing this, windows pc was set to manual IP configuration. This was to allow it communicate with the Raspberry Pi.

Setting Up internet connection on the Pi

Internet was necessary in 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.

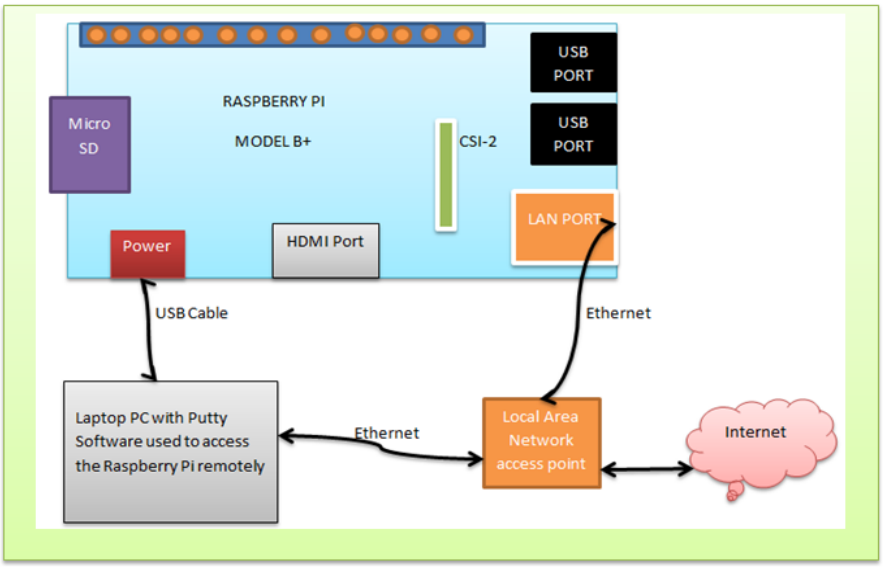


Figure 10 The connected system

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
```

3.2 DESIGN OF THE SYSTEM

In this study, we proposed a security system contains 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 illustrate 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 retrieve the information contains by tag as it come in the range of few millimeters from reader.

Step 2: after receiving the tag information, reader send this information to database for conformation. If it holds, the information stored for further operation.

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

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

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

We implement the system using passive tags. The RFID tag is detected when touched or come in the range of few millimeters from reader. The tag is automatically detected by RFID reader in every mille second and reader sent the information containing by tag to the central control though serial port. The central controls already have information of 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 as 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. 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 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 steeper 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 door

- ❖ Low voltage warning: When 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 which support functional programming and aspect-oriented programming (including by metaprogramming 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 functools) 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, non –text attachments (Status of the door and application programs) etc. It thus extends the format of an email. Simple Mail Transfer Protocol (SMTP) program was then used to deliver the email from the Raspberry Pi to the configured mailhub. This can be summarized using the blocks below.

Pseudocode

- ✓ Upon restart of the system, send out email with boot IP assigned to a mailhost.
- ✓ 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 a 5 seconds to initialize and save it in a file.
- ✓ The system checks whether the internet is enabled on the Raspberry Pi.
- ✓ If internet, send email to a prescribed mailhost. 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.

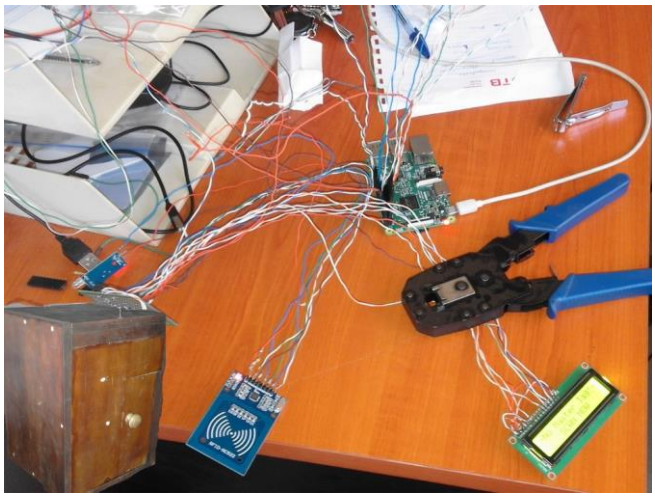
3.3 WORKING OF THE SYSTEM

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 put the tag into reader, the system checks whether it is registered user or imposter. If the user is registered one then the tab 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. User check-in process is depicted in figure 3. Card detection setting is shown in figure 4. Database search is illustrated in figure 5 and output of database entry is illustrated in figure 6.

CHAPTER FOUR

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 RFID reader. If tag ID matches with 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 in built capabilities and is easily connectible 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 is that, Necessary action can be taken in current status span of time in the case of emergency condition and design of a PCB board which is also small in size. Reduced size makes it more applicable for commercial manufacturing and distribution. A raspberry pi and open source applications with its ever growing community and development provides a 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 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

The system can be further improved by including a finger print identification; also the provision of a database system for users' logging information will make the system more robust. The system can also include an alert and warning system for repetitive violation of password or wrong RFID tag usage.

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