DESIGN AND CONSTRUCTION OF SMARTDOOR SECURITY SYSTEM USING ARDUINO AND BLUETOOTH APPLICATION

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DESIGN AND CONSTRUCTION OF SMARTDOOR SECURITY SYSTEM USING ARDUINO AND BLUETOOTH APPLICATION

By

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A Project Report submitted to the department of Electrical and Electronics Engineering, Abubakar Tafawa Balewa University, Bauchi in partial fulfillment of the requirement for the award of Bachelor of Engineering (B.Eng.) Degree in Electrical and Electronics Engineering.

Department of Electrical and Electronics Engineering

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APPROVAL

This project report has been approved for acceptance by the Electrical and Electronics Engineering Department, Abubakar Tafawa Balewa University, Bauchi and meets the regulations governing the award of Bachelor of Engineering of A.T.B.U.

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DEDICATION

I dedicate this research work to my creator and anyone involved in helping me achieve my goal directly or indirectly.

ACKNOWLEDGEMENTS

I will like to acknowledge the effort of my loved one's Maj.MA Halliru, Haj. Hauwa Adamu and the whole Halliru Muhammad and Muhammad Uban Iya family.

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ABSTRACT

Recently home security system has been very poor. These research projects consist of a smartdoor locking system which provides a great solution to improve the home safety management of doors. Arduino IDE software and a Bluetooth module hc-05 were used to connect between the smartphone, the microcontroller and the door lock to give an easy access to authorized persons. The person with the authority to open the door can have access within their fingertips by installing the required application which has open/close button. The hc-05 serves as a receiver and transmitter but also communicates with the microcontroller which serves as a processing unit in this project and decides whether the password entered by the user is right or wrong and then send the servo motor to either open or close the door. If the password is right the user can have access to the door and when the password is wrong the user will have no access whatsoever. Enhancing the safety and security of main entrance doors.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Security has become a major concern in the twenty first century; everybody wants to feel safe at his or her own home, workplace and a safe environment as a whole. Smartdoor security system using Arduino and Bluetooth application is a project aimed at increasing and advancing the safety and security of lives and property of the people. The project deals primarily with the protection of doors and making it more secured within our houses, office or public related buildings. With the help of smartdoor, when indoors or while you are away from your home and workplace, the doors are protected primarily to grant access to only authorized persons using their smartphone and Bluetooth application. With the advancement of technology smartphone has become a household requirement. As of 2007 smartphones were not more than two percent of phone industries, but in 2009 the smartphone world has taken more than fifty percent of phone market (www.Wikipedia.com/androiddevelopers) With this it is quite logical to say that there is at least a smartphone owner in every house. With this smartphone we can simply interface it with a arduino (microcontroller) to keep our houses and offices safer and more secure with a single click to lock or unlock the resulting door. The microcontroller will be mounted on the door which will then communicate with the device through a Bluetooth module which will be connected to the microcontroller. This project is aimed at making security better and securing the lives and properties of people at home or their work places.

1.2 Background of The Study

Issues of theft and burglary increases with high rate as such door security is a necessity, Door safety is now of paramount importance which triggers the need for project such as ”smartdoor security system” to provide a more safe and secure environment in generally.

1.3 Problem Statement

In order to make sure that every door is safe people now look for counter measures to protect their doors. With the vast and different forms of keeping doors locked from unauthorized persons many people tend to use low means of protection. Meanwhile the deployment is of more advanced technology like the use of smartdoor security is a step forward. This project aims to keep doors safe and also ease access. The latching of the door is solely controlled by smartphone via the Bluetooth connection established between the device and the microcontroller.

1.4 Aim and Objectives

The aim of this project is to design and implement a smart door security system using arduino and Bluetooth application that could help advance the protection of doors at home and public buildings

- Designing of a smartphone application to control the movement of doors
- Interfacing of arduino uno with the smartphone via Bluetooth module to establish a connection between the arduino the smartphone
- Controlling the position of a servo motor to open or close a door which I controlled and processed due to the response of the microcontroller

1.4 Scope of The Project

The project is about interacting with component and devices with the help of HC-05 (Bluetooth module). The project is limited to performing the task of opening and closing of

doors precisely main entrance doors of a building. It is not designed for the purpose of surveillance in a home or any building nor is it a burglar alarm that alarms you in any case of perimeter bridging it’s only limited to performing the task of opening and closing.

CHAPTER TWO

2.0 LITERATURE REVIEW AND THEORITICAL BACKGROUND

2.1 Introduction

This chapter comprises of the literature review and theoretical background of the project. The literature review deals basically with related project written by other researchers, the difficulties they encountered, limitations and modifications that should be made. Theoretical background explains in details some of the most important component used in the project

2.2 Review of Relevant Literature

Smartdoors have been implemented using different methods such as Radio frequency identification (RFID) and Biometric lock to unlock and lock door. Both the RFID and biometric lock are real ideal and smart ways to make a door smart, due to necessity and limitations such as cloning of biometric prints or card. The use of Bluetooth and smartphone is much simpler and easier to adapt and use. It gives you more access to communicate with the door and it also give access to physically challenged persons that might not have a finger to use for biometric lock or is crippled to use RFID but with respect to this project physically challenged can simply open their door by single click in device. Adarsh V Patil et al (2008) did a similar project Android based smart door locking system which also employed the use of android phone which is also a smartphone and also a GSM module to access the door. Also Agbo David et al (2017) did a somewhat similar project based on door locking system using android application. Shafarana A.R.F et al (2017) did android based automation and security system for smart homes. There are many other

projects done on smartdoor in different countries. They are all different from each other in terms of designs, features, devices, and algorithm. They are mostly designed according to specific needs and availability of components in the respective areas. Some of them are cheap; some of them are very expensive. Availability of both hardware and software is necessary to work. After a long searching, I have found a lot of articles. Searching for security purpose articles, also found some projects done for door security. These are mainly done in western countries. Many projects are done only for security purpose With Arduino or Raspberry Pi. Again, the projects are done only for controlling home Appliances using Arduino or Raspberry Pi. Most of the previous researches encountered problems in their design especially in terms of cloning by other third party and availability of components

2.3 Justification

In general terms my project is a more user friendly project with easy access to users. People that have problems physically like cripples or half paralysis can have access to doors without the help of anybody not even an assistant, as long as they are in position of smartphone. The physically challenged persons can open or lock any door they have permission to, or even lock or unlock a door while sitting on their wheel chairs, resting sofas or sleeping bed.

2.4 Theoretical Background

2.4.1 Smartdoor

Smart and door are two different words with different meanings. Advanced oxford dictionary has given a clear and precise definition of both words smart meaning intelligent while a door is any metal, glass, wood etc. that is opened and closed so that people can get in and out of a room, building, car etc. by definition of smart and door smartdoor can easily be referred to as doors that can be accessed easily without having to touch it physically.

Smartdoors are intelligent doors that can be controlled with any other external force to grant access in or out of the building, car etc.

2.4.2 Smartphone

The first smartphones, the IBM Simon and Nokia communicator 9000 were released way back in 1994 and 1996 respectively, and integrated the features of a mobile phone and a personal digital assistant (PDA) for managing calendars and contacts both were larger than regular phones. It wasn't until 2000 that first real smartphone, the Ericson r380, was released. It wasn't any larger than a regular phone, and in the early 2000s many other followed suit, with phones like blackberry and palm achieving big success. In 2007, apple released iphone, which eschewed hardware buttons for full touchscreen control and has since been the template of smartphone ever since.

Phones used to be all about making calls, but now your mobile phones have more application. The range of new touchscreen smartphones allows you to access the internet, use social media, get live news or sport updates, play music and video, and more. Smartphones can do so much more than just make phone calls, many things can be done such as play games, access the internet and browse the web, make video calls, navigate with GPS (global positioning system) send and receive emails, manage contacts and make appointments, send and receive large files through Bluetooth or mobile hotspot. Below are the examples of smartphones interface.

Plate1: Smartphone Interface

2.4.3 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328p. It is simple, inexpensive, open source prototyping platform extensible to hardware and software. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, and a reset button. It contains everything needed to support the microcontroller. We either need to connect it to a computer using a USB cable or power it with an AC-to-DC adapter. The Arduino circuit acts as an interface between the software part and the hardware part of the project.

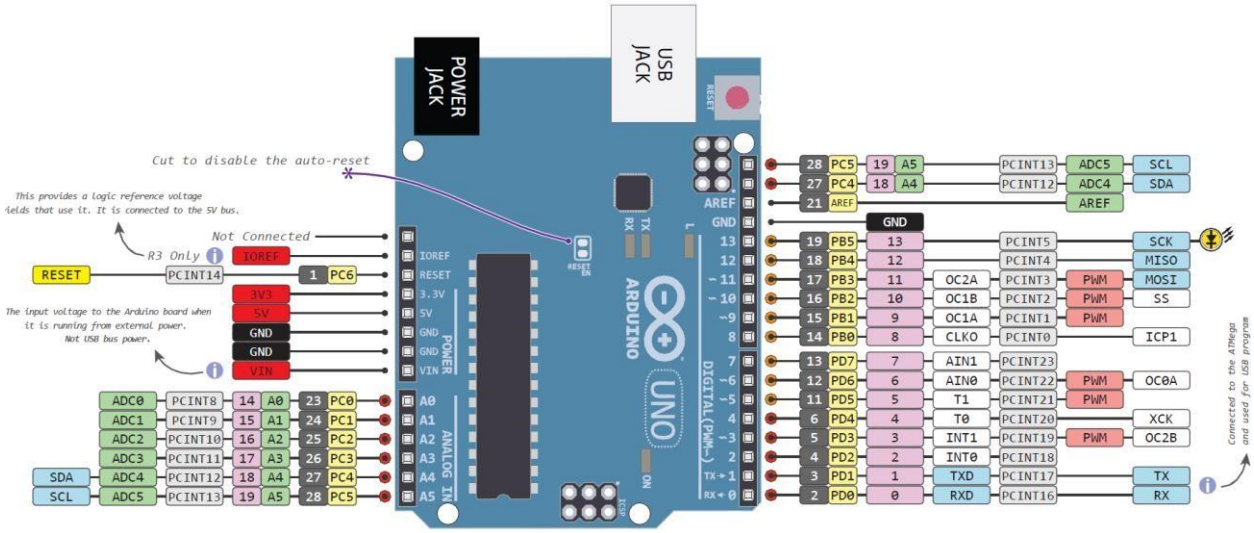


Plate 2: Arduino

Specification of Arduino Uno

Microcontroller ATmega328p

Operating Voltage 5V

Input Voltage (recommended) 7-12V

Input Voltage (limit) 6-20V

Digital I/O Pins 14 (of which 6 provide PWM output)

PWM Digital I/O Pins 6

Analog Input Pins 6

DC Current per I/O Pin 20 mA

DC Current for 3.3V Pin 50 mA

Flash Memory 32 KB (ATmega328P)

SRAM 2 KB (ATmega328P)

EEPROM 1 KB (ATmega328P)

Clock Speed 16 MHz

IO with built-in LED 1 (on pin #13)

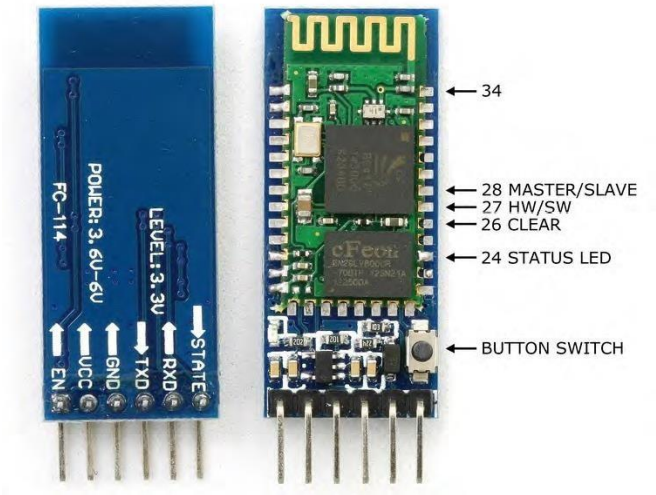
Length 68.6 mm

Width 53.4 mm

Weight 25 g

2.4.4 Bluetooth Module

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices and building personal area networks (PANs). The Bluetooth module being used allows us to transmit and receive signals. It receives the text from the Android phone and transmits it to the serial port of the Arduino Uno. The Bluetooth module being used here is the HC- 05 module, shown below. It is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The Bluetooth module HC-05 is a master/slave module. By default the factory setting is slave. The Role of the module (Master or Slave) can be configured only by at commands. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices.



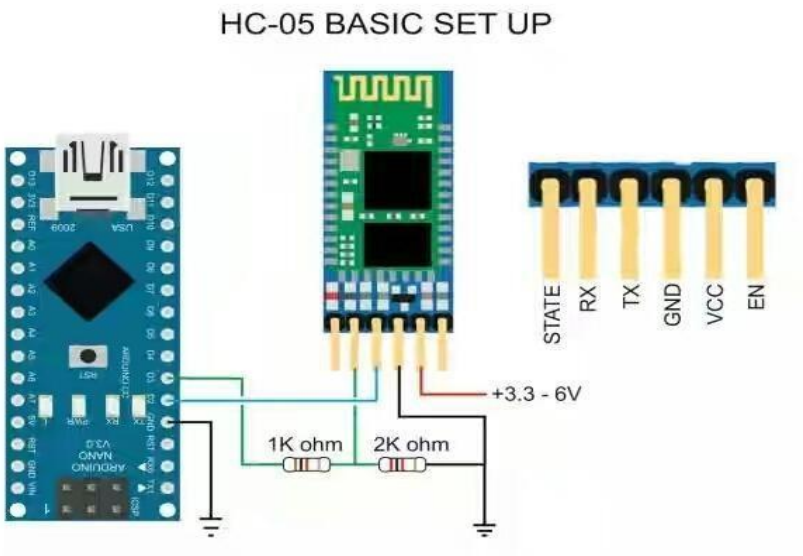


Plate 3: Bluetooth Module

Table1: Bluetooth Module

Pin Number	**Pin Name**	D**escription**
1	Enable/key	This pin is used to toggle between data mode (set low) and AT command mode (set high) by default it is in data mode
2	Vcc	Powers the module. Connect to +5v supply voltage
3	Ground	Ground pi to module, connect to system ground

4	TX-Transmitter	Transmit serial data. Everything received via Bluetooth will be given out by this pin as serial data
5	RX-Receiver	Receive serial data. Every serial data given to this pin will be broadcasted via Bluetooth
6	State	The state pin is connected to on board LED it can be used as a feedback to check if Bluetooth is working properly.
7	LED	Indicate module status.

Software Features

- Slave default Baud rate: 9600
- Data bits: 8.
- Stop bit: 1.
- No parity.
- b. PIO9 and PIO8 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while

disconnected only blue led blinks 2times/s. Auto- connect to the last device on power as default.

- c. Permit pairing device to connect as default.
- d. Auto- pairing PINCODE:"1234" as default.
- e. Auto- reconnect in 30 min when disconnected as a result of beyond the range of connection.

2.4.5 Servo Motor

A servo motor is an electrical device that can be used to push or rotate an object with great precision. If you want to rotate an object at some specific angle or distance, then servo motor can be used easily for that purpose. Servo motor can rotate ninety degrees in both directions. They can be used to move many equipment that require moving at any angle

Servo mechanism

It consists of three parts

- Controlled device
- Output sensor
- Feedback system

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal. The reference input signal is compared to reference output signal and the third signal is produced by feedback system. And signal third signal acts as input signal to control device. This signal is present as long as feedback signal is generated or there is difference between reference input signal and reference output signal. So the main task of servomechanism is to maintain output of a system at desired value.

Controlling servo motor

All motors have three wires coming out of them. Out of which two will be used for supply (positive and negative) and one will be used for signal that is sent from the microcontroller. Servo motor is controlled by PMW (pulse width modulation) which is provided by control wires. There is a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction from its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how the motor turns.

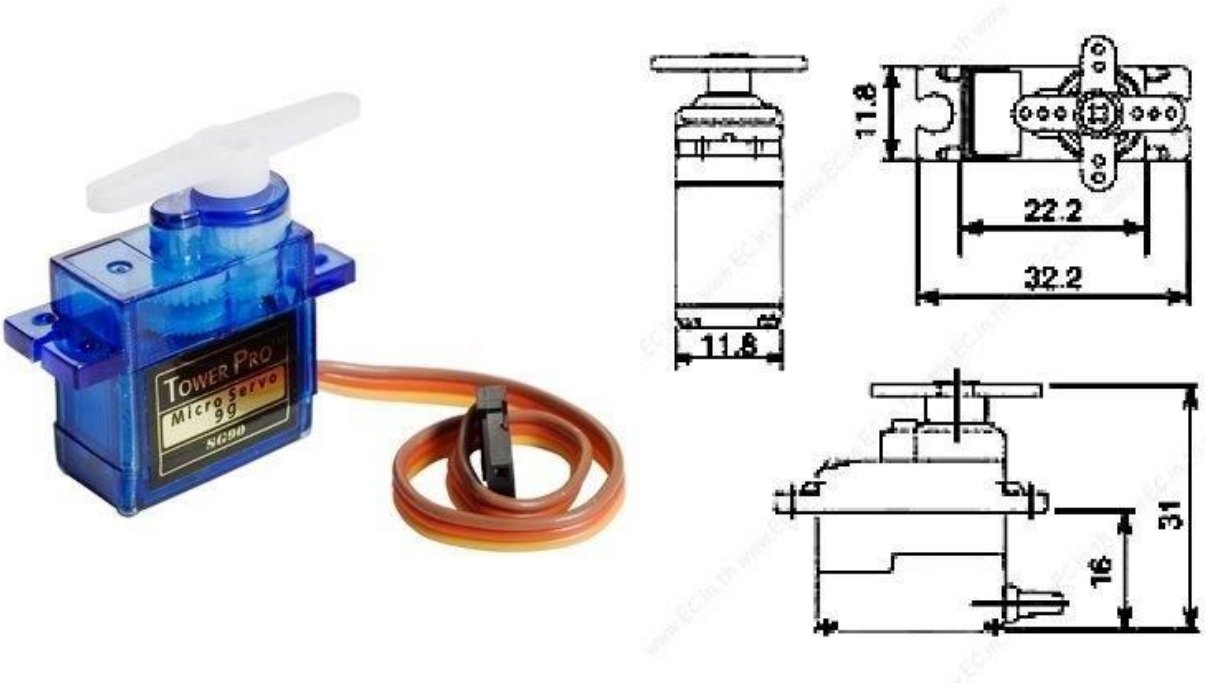


Plate 4: Servo Motor

• Weight: 9g

• Dimension: 22.2 x 11.8 x 31 mm approx.

• Stall torque: 1.8 kgf cm

• Operating speed: 0.1 s/60 degree

• Operating voltage: 4.8 V (~5V)

• Dead band width: 10µs

• Temperature range: 0 ºC – 55

CHAPTER THREE

3.0 DESIGN AND IMPLEMENTATION

3.1 Introduction

This chapter explains in details the various stages involved in this research, the stages are explaining in form of units such as input unit, receiver unit, processor unit and output unit. According to the proposed system, I designed a system structure shown in the block diagram in this chapter. The model was designed in such a way that it can be kept at a safe place within. This is done in the easiest and lowest cost possible. However, the system is flexible and can be customized for future enhancement. Changing one of the components setup has to be compatible with the right software available. Every component used in this system was Programmed and tested separately for safety measures and matching with the right driver. Each component was programmed separately with Arduino UNO using different Arduino IDE. Also they were run in different computers. Later on all were combined in a single Arduino IDE.

3.2 Methodology

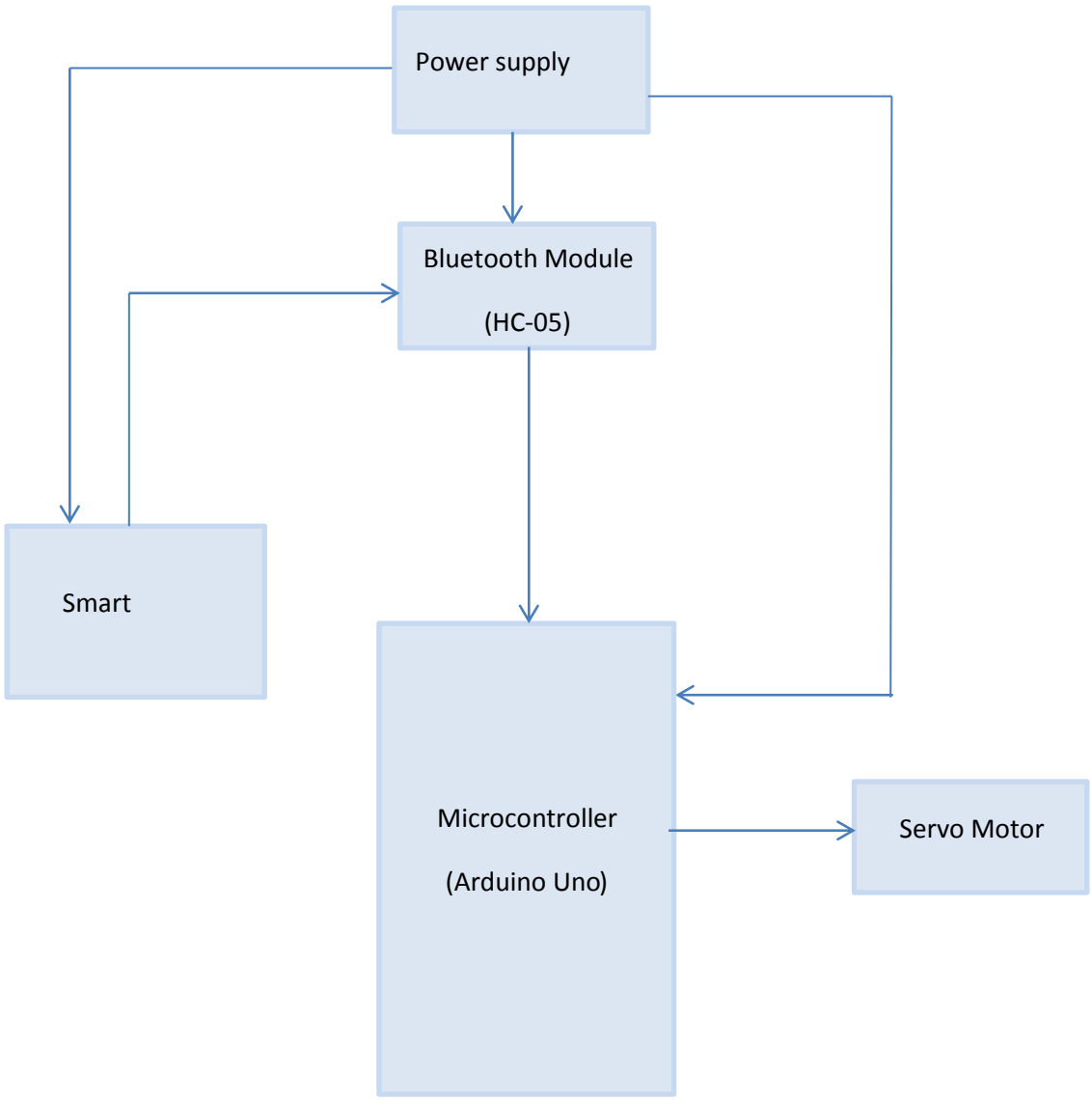


Figure 1: Block Diagram

3.2.1 Input Unit

This is the unit in which command is given to start the execution of a program and in this project the smartphone is the devices that serves the purpose of sending command as input. The mobile smartphone sends signal when connection is established between the device's Bluetooth and the Bluetooth module (HC-05). The smartphone sends the input command through a developed application which has lock and unlock slider in the application which is to say a person operating the smartphone can either send lock (which is close) or unlock (which is to open) the respective door. The input command can only be executed when and only when a Bluetooth connection is established between the device and the module and be operated within Bluetooth range limit.

3.2.2 Receiver Unit

This unit deals primarily with the receiving of command signals sent from the input. The command sent by the mobile smartphone is received in this unit with the help of a Bluetooth module (HC-05). The module also serves as a link to establish connection between the mobile device and the Arduino microcontroller.

3.2.3 Processing Unit

This unit is the brains and work of any project. This unit determines the output of the project, it determines what command to execute, how to execute, when to execute and where to execute it. The Arduino microcontroller serves the purpose of processing the command of this project. The Arduino receives the command from the mobile smartphone on what command to execute via the Bluetooth module and then the microcontroller determines what function to perform and how to perform the particular task and give the required output of the given task. The Arduino that serves as the main processing unit has two units the hardware (which is the Arduino board) and the IDE (integrated development

environment) which comprises of software program that runs the whole operation and how the circuit basically works.

Smartphone Application

In this research I have an Android application to control all the home appliances. From Android phone we select any home appliance from the options that appear in the App then we select open or close. The user cannot run the App from outside the house unless within the Bluetooth range related with the Bluetooth module. It allows establishing point-to-point connection with Bluetooth support devices. This technology is known by Android support for the Bluetooth network stack which permits to exchange data wirelessly.

The Android Software Development Kit (SDK) provides all necessary tools to develop Android Application (API). This application is a Java based program. The Android uses .apk file to install the application. The code is written in Android Studio IDE. The code is written according to the appearance of the options in the phone.

To open device lists

Important android widget button;

Important android widget List View;

To create variables for Bluetooth:

Private Bluetooth Adapter my Bluetooth = null;

Private Set paired Device;

After initialization, The code starts with initializing characters as „String".

3.2.4 Output Unit

This is the final stage of the methodology on receiving the command from the microcontroller. The task to be performed could either be to open or close the door. Servo motor is the device used in this unit to perform the task. When the servo motor receives the command from the microcontroller to open it moves its position to ninety degrees which moves up and opens the slider while when the command is to close the servo motor moves to one hundred and eighty degrees which moves the slider to lock position which closed the door in turn. All this action is performing and written in form of a computer code in the Arduino integrated development environment and how the task will be performed

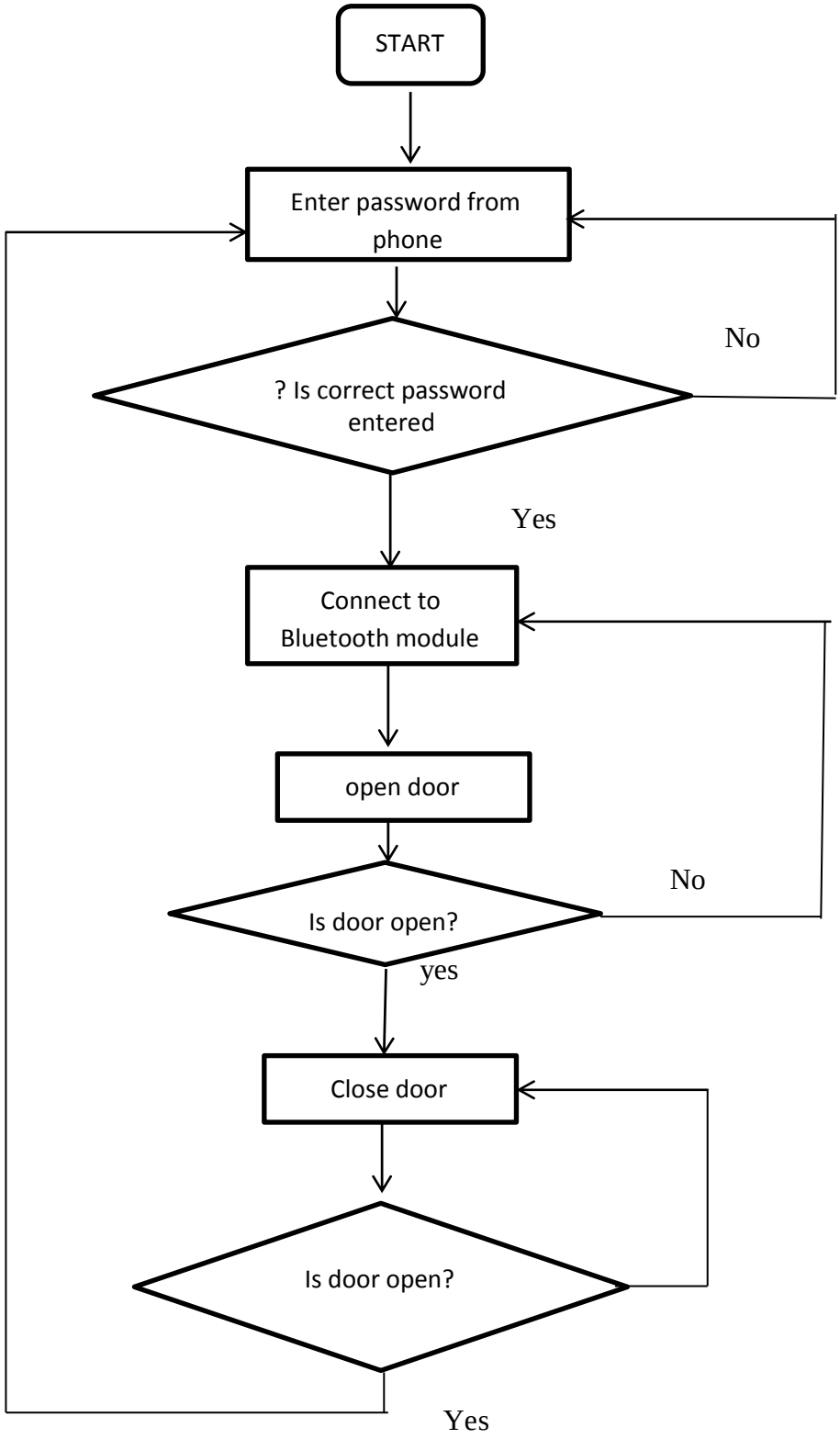


Figure 2: Flowchart

3.4 Power Supply Unit

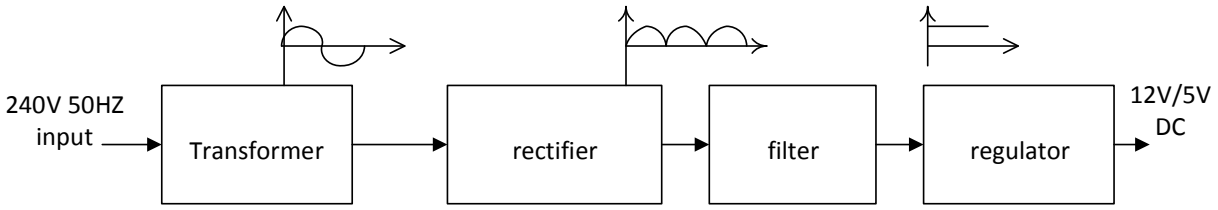


Figure 3: Supply Block Diagram

The total power requirement of this project is 5V.

The power supply unit consists of a 240v/12v step down transformer, rectifiers, filters and a voltage regulator

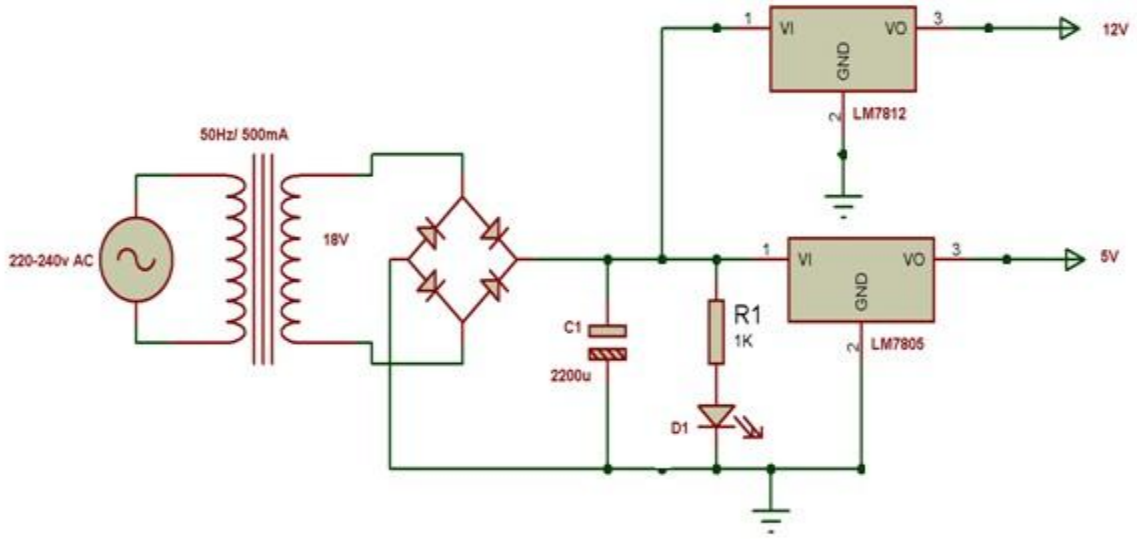


Figure 4: Power Supply Circuit

3.4.1 Transformer Section

The 240v ac is stepped down to 12v ac using a transformer. The resultant output is given by

$$\text{Vpe} = \sqrt{2} \times V_{rms} \quad \ldots (3.1)$$

Where V_{rms} is the rms value of the secondary transformer voltage

$V_{rms} = 12$

So, $V_p = \sqrt{2} \times 12$

$V_p = 16.97v$

3.4.2 Rectifier Section

A full wave bridge rectifier of 5A is chosen for the capacity to a load up to 2A using IN4001 diodes.

The DC value of the rectified voltage is given by;

$$V_{dc} = \frac{2}{\pi} V_p \quad \ldots (3.2)$$

$V_{dc=}$ = (2/□) × 16.97

$V_{dc=}$10.80

The maximum load current is given by;

$$I_m = \sqrt{2} \times I_{rms} \quad \ldots (3.3)$$

$I_m = \sqrt{2} \times 500mA$

$I_m = 707.1mA$

Hence the Average load current can be obtained from;

$$I_{dc} = \frac{2}{\pi} I_m \quad \ldots (3.3)$$

$I_{dc} = 0.636 \times 707.1mA$

$I_{dc} = 449.72mA$

Hence, due to standard and transformer size, the final transformer specification chosen was $12v, 500mA$ transformer.

3.4.3 Filter Section

The ripple voltage (V_r) is represented by the equation below;

V_r $0.308V_m$ . . . (3.5)

Therefore,

$V_r = 0.308 \times 16.97$

$V_r = 5.22V$The filtering capacitor is calculated as shown below, a peak to peak ripple of 1% is chosen i.e. 0.01 is approximated. Hence the ripple factor is 0.01

The shunt capacitor filter is obtained from;

$$V_r(rms) = \frac{I_{dc}}{4\sqrt{3}fC} \quad \ldots (3.6)$$

Therefore;

$$C = \frac{I_{dc}}{4\sqrt{3}fV_r(rms)r}$$

Where, I_{dc} = current taking by the load (mA); f = frequency of supply (Hz)*;* C = shunt filtering capacitor (microfarads); and $V_r(rms)$ = rms value of the ac component ripple voltage and, I_{dc} = 449.72mA, r = 0.01, F = 50Hz,

and ,$V_r(\text{rms}) = 7.84\text{V}$

$$C = \frac{449.72 \times 10^{-3}}{50 \times 0.01 \times 5.22 \times 4\sqrt{3}}$$

$C = 24870.3\ \mu F$

Hence, due to standard and capacitor size, the final capacitor specification chosen is$2200\ \mu F, 35V$.

3.4.4 Voltage Regulation Section

7805 IC Rating

- Input voltage range 7V- 35V
- Current rating $Ic = 1A$
- Output voltage range $V_{Max=}$5,2V, $V_{Min=}$4.8

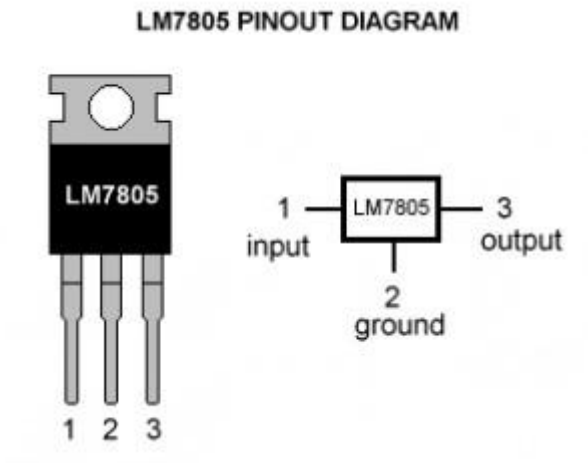


Figure 5: Voltage Regulator

Table2: Voltage Regulation Test

Pin No.	**Pin**	**Function**	**Description**
1	INPUT	Input voltage (7V-35V)	In this pin of the IC positive unregulated voltage is given in regulation.
2	GROUND	Ground (0V)	In this pin where the ground is given. This pin is neutral for equally the input and output.

3	OUTPUT	Regulated output; 5V (4.8V-5.2V)	The output of the regulated 5V volt is taken o

3.5 Soldering

Soldering is the process of a making a sound electrical and mechanical joint between certain metals by joining them with a soft solder. This is a low temperature melting point alloy of lead and tin. The joint is heated to the correct temperature by soldering iron. For most electronic work miniature mains powered soldering irons are used. These consist of a handle onto which is mounted the heating element. On the end of the heating element is what is known as the "bit", so called because it is the bit that heats the joint up.

Solder melts at around 190 degrees Centigrade, and the bit reaches a temperature of over 250 degrees Centigrade. This temperature is hot enough to inflict a nasty burn, consequently care should be taken. Good soldering is a skill that is learnt by practice. The most important point in soldering is that both parts of the joint to be made must be at the same temperature. The solder will flow evenly and make a good electrical and mechanical joint only if both parts of the joint are at an equal high temperature. Even though it appears that there is a metal to metal contact in a joint to be made, very often there exists a film of oxide on the surface that insulates the two parts. For this reason it is no good applying the soldering iron tip to one half of the joint only and expecting this to heat the other half of the joint as well.

CHAPTER FOUR

4.0 TESTS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter discuss the various test carried out during the cause of this project. Various results from different test were gotten. And also brief discussion about the guiding principle and process of the entire project.

4.2 Tests

Below is description of tests carried out at each unit of the system. These tests were carried out at power supply unit to determine maximum load to be connected, current sensing unit to determine whether load connected to the system is detected

4.2.1 Power Supply Unit

The output of lm7805 Voltage regulator was connected to 5W 7.5Ω chalk resistor as load the output of regulator before (no load) and after the connection (on load) was measured and tabulated.

4.3 Result

The program for the Arduino Uno microcontroller was written in C language and was then compiled into an executable file using the Arduino IDE. The executable file was then imported into the Proteus Design Suite, where the hardware circuit shown was designed and simulated. Figure shows the installed android app, the Proteus simulation of the door security system results for each process of entering the correct and wrong passwords respectively. Upon successful completion of the software simulation, the system‟s hardware was constructed on a bread board and programming of the arduino microcontroller was carried out using Arduino IDE. The hardware construction with

connections and various operations of the system are shown in the figure below. The response of the hardware of the security door when communicating with the Arduino board

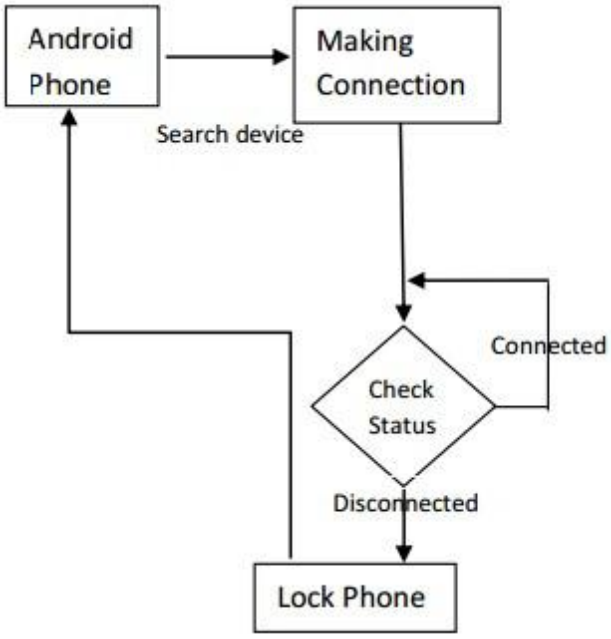


Figure 6: Result Flow

Table2: Power Supply Test Result

Description	**Input**	**Output voltage On-No-load**	**Output voltage ON load**
Transformer	220V	23.8V	
Load current (0.7A)	30.9V	5.07V	4.02V

Table4: Result

Distance	**Connection**	**Result**
2m	Connected	Open/close
3.4m	Connected	Open/close
5.8m	Connected	Open/close
10.5m	Not connected	no signal

4.4 Discussion

This project gives idea of how to control door locks. Carbon paper door lock system was used as a prototype for indoor and outdoor key lock system. It also provide a security and easy for smartphone users. This project based on smartphone and Arduino platform both of which are Free Open Source Software. So the implementation rate is inexpensive and it is reasonable by a common person. Accomplishment of wireless Bluetooth connection in microcontroller permits the system installation in more easy way. The system has been successfully designed and prototyped to control the door condition using smartphone Bluetooth-enabled phone and Bluetooth modules via Bluetooth HC-05. A simple prototype is discussed for this research purpose.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

Recently proposed door lock systems based on Biometrics Techniques, Password Based and RFID have been studied and developed. This research project is centered on door locking system via smartphone controlled locking system with the help of arduino and Bluetooth module.

5.2 Conclusion

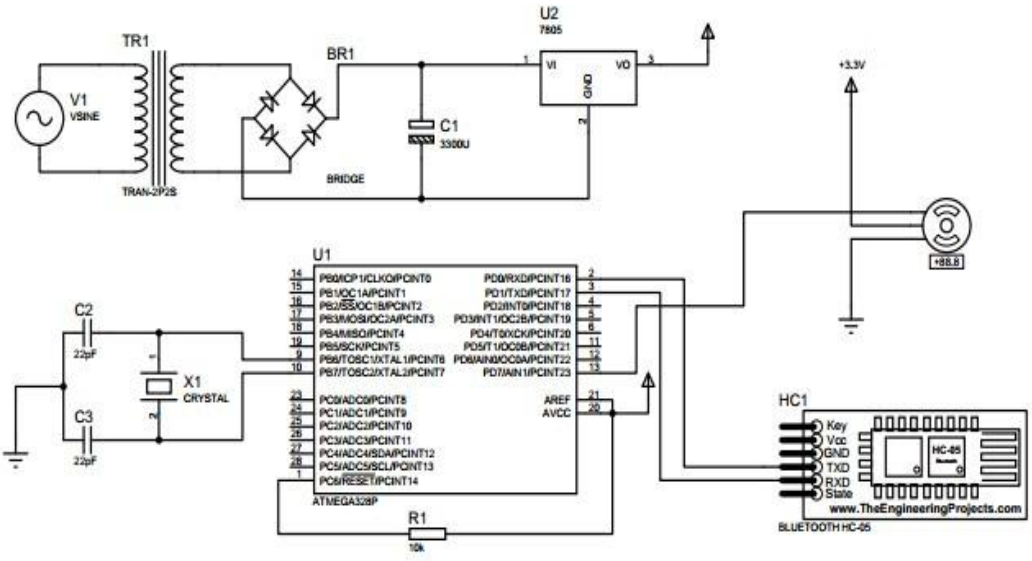
The main aim of this paper is to design a smartdoor security system using Arduino and Bluetooth application, so that people can feel safe about their home whether they are away from home or are in the house. This project is based on Arduino, and the coding is done on Arduino ide platform using the arduino application. At the end of this research the aim and objectives of the project was achieved. People can now feel more secure about their doors all the time. Doors can be controlled conveniently to those with access. Physically challenged people can open or lock doors from their fingertips without asking help of anybody. It is safe to say that the main objectives and the aim of the project were achieved at the end of the project.

5.3 Recommendation

During this research some of the problems I came across were the inability of the door to close automatically after been open for a while unless locked from the application. For future research purpose I recommend other researchers to make a room to make the doors lock automatically after a certain time delay. The door can only be accessed at a particular distance for future research the distance can be put into consideration and made to be longer.

APPENTIX A

Circuit Diagram



APPENTIX B

Program Code

```
#include <Servo.h>

Servo myservo;                          // create servo object to control a servo

String inputString = "";

String command = "";

String value = "";

String password = "umar";               // this is the password for opening and closing your
door                                    // you can set any pasword you like using digit and symbols
boolean stringComplete = false;  void setup(){
                                        //start serial connection

Serial.begin(9600);                     // baud rate is 9600 must match with bluetooth

                                        //The String reserve() function allows you to allocate a buffer in
memory for manipulating strings.
 inputString.reserve(50);               // reserve 50 bytes in memory to save for string
manipulation    command.reserve(50);    value.reserve(50);      boolean stringOK =
false;   myservo.attach(9);                    // attaches the servo on pin 9 to the servo
object
```

```
}


void loop(){

                                    // if arduino receive a string termination character like \n
stringComplete will set to true   if (stringComplete) {

                                    //Serial.println(inputString);
delay(100);

                                   // identified the posiion of '=' in string and set its index to
pos variable     int pos = inputString.indexOf('=');

                                   // value of pos variable > or = 0 means '=' present in
received string.     if (pos > -1) {

                                    // substring(start, stop) function cut a specific portion of
string from start to stop

                                    // here command will be the portion of received string till
'='

                                    // let received string is open=test123

                                    // then command is 'open'

      command = inputString.substring(0, pos);

                                                // value will be from after = to newline
command
```

// for the above example value is test123

// we just ignoreing the '=' taking first

parameter of substring as 'pos+1'

// we are using '=' as a separator between command and vale // without '=' any other character can be used

// we are using = menas our command or password must not contains any '=', otherwise it will cause error value = inputString.substring(pos+1, inputString.length()-1); // extract command up to \n exluded

//Serial.println(command);

//Serial.println(value);

// password.compareTo(value) compare between password tring and value string, if match return 0 if(!password.compareTo(value) && (command == "OPEN")){

// if password matched and command is

'OPEN' than door should open

```
        openDoor();                                          // call openDoor() function
Serial.println(" OPEN");                                     // sent open feedback to phone
delay(100);
        }
   else if(!password.compareTo(value) && (command == "CLOSE")){
                                                  // if password matched and command is
'CLOSE' than door should close
        closeDoor();
        Serial.println(" CLOSE");                            // sent " CLOSE" string to the
phone
        delay(100);
        }
   else if(password.compareTo(value)){
                                                   // if password not matched than sent wrong
feedback to phone
        Serial.println("                WRONG");
delay(100);
        }
```

```
      }

                                                  // clear the string for next iteration
inputString = "";       stringComplete = false;
   }



}




void serialEvent() {    while
(Serial.available()) {
                                                      // get the new byte:
   char inChar = (char)Serial.read();
                                                    //Serial.write(inChar);
// add it to the inputString:
   inputString += inChar;
                                          // if the incoming character is a newline or a
carriage return, set a flag
                                          // so the main loop can do something about it:
```

```
   if (inChar == '\n' || inChar == '\r') {
stringComplete = true;
   }

  }

}



void                    openDoor(){
myservo.write(0);    delay(100);
}



void                    closeDoor(){
myservo.write(90);   delay(100);
}
```

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