



DESIGN & DEVELOPMENT OF ANDROID BASED HOME MONITORING SYSTEM

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ABSTRACT

Automation of the surrounding environment for a modern human being has become need and necessity allowing him to increase his work efficiency and ease of comfort. There has been an immense development in the area of an individual's routine tasks and those can be automated. In the present times, we can find most of the people clinging to their mobile phones and smart devices throughout the day. Hence with the help a smart mobile phone, some daily household tasks can be accomplished. This paper presents design and development of home monitoring system model using Android platform to automate an 8 bit Blue-tooth interfaced micro-controller which controls a door gate, lights, fans, and monitors room parameters like temperature, humidity etc using Bluetooth activated sensors. This work depicts an automated approach of monitoring the room parameters and controlling the room entry access.

Keywords: *Android device, Bluetooth, Embedded system, Smart home & Wireless sensor*

I. INTRODUCTION

Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android boasts a healthy array of connectivity options, including Wi-Fi, Bluetooth, and wireless data over a cellular connection for example, GPRS, EDGE (Enhanced Data rates for GSM Evolution), 3G and 4G etc. Android provides access to a wide range of useful libraries and tools that can be used to build rich applications. In addition, Android includes a full set of tools that have been built from the ground up alongside the platform providing developers with high productivity and deep insight into their applications [8]. Analyzing the current smart phone market, most mobile users are opting for Android based phones. It has become a second name for a mobile phone in layman terms.

This paper mainly aims at designing a complete home monitoring system providing security or access control from the intruders .It uses a Bluetooth technology embedded with microcontroller, sensors & motor activation devices. Aim of this prototype model is to economically design & develop a system to remotely monitor & give entry access to a room using wired or wireless sensors.

The idea of this work is to develop an intelligent and versatile home monitoring system that could secure the access of a room, continuously display & transfer room environment parameters to the user through an android phone. Section 2 introduces the background of the technology used; section 3 introduces an overview of existing work & literature review. Section 4 gives the design details of the system, section 5 and 6 discusses the system



blocks & implementation details respectively. Section 7 shows a simple demonstration of prototype model section 8 discusses results obtained and section 9 makes the conclusion & future improvements

II. BACKGROUND

Android is an open source platform. Neither developers nor handset manufacturers pay royalties or license fees to develop for the platform. The underlying operating system of Android is licensed under GNU General Public License Version 2 (GPLv2), a strong “copy left” license where any third-party improvements must continue to fall under the open source licensing agreement terms. Android is a software platform and operating system for mobile devices, based on the Linux kernel, and developed by Google and later the Open Handset Alliance. It allows developers to write managed code in the Java language, controlling the device via Google-developed Java libraries. The unveiling of the Android platform on 5 November 2007 was announced with the founding of the Open Handset Alliance, an association of 48 hardware, software and telecom companies devoted to advancing open standards for mobile devices. Google released most of the Android code under the Apache license, a free-software and open source license. Android versions available are Android 4.0 "Ice Cream Sandwich", Android Jelly Bean, Android 4.4 "KitKat", Android Lollipop, Android 6.0 "Marshmallow" etc. Network Connectivity of android has many options like It supports wireless communications using: GSM mobile-phone technology, 3G, 4G Edge, 802.11 Wi-Fi networks etc

Bluetooth is an open standard specification for a radio frequency (RF)-based, short-range connectivity technology that promises to change the face of computing and wireless communication. It is designed to be an inexpensive, wireless networking system for all classes of portable devices, such as laptops, PDAs (personal digital assistants), and mobile phones. Bluetooth itself is a low-power, short-range radio that will operate on average from 10 meters to 100 meters. These radios are built on silicon using the most common chip fabrication technology, a CMOS (complementary metal oxide silicon) process, although some will be built on silicon-germanium wafers. The module, which essentially is a commodity radio, also includes a baseband hardware link controller, a link management interface, and software applications to run the module.

III. LITERATURE SURVEY

N. Sriskanthan [1] discusses the model for home automation using Bluetooth via PC, but the system lacks to support mobile technology. Muhammad Izhar Ramli [2] explained a prototype electrical device control using web, but it requires server and frequently needs to set it with auto restart if the server condition is low. Hasan [3] has developed a telephone and PIC remote controlled device for controlling the devices using pin check algorithm, it was with cable network but not wireless communication. G.Pradeep [4] proposed home automation system by using Bluetooth which saves lot of power and time using mechanism of preloaded list but connection to the system is always required.

Al-Ali et al [5] presented a design and implementation of a Java-based automation system through World Wide Web. It had a standalone embedded system board integrated into a PC-based server at home. A Jadhav [6] developed an application in a universal XML format which can be easily ported to any other mobile devices rather than targeting a single platform. M.Ismail et al[7] proposed a system embedded web server for industrial

applications but it requires web & Ethernet connectivity. In all the previous existing systems high power devices are used in control board & more hard ware devices are depicted. Operational & computational cost is high and complicated .As per survey [11],[12]&[13] currently there exists no system at economical rates with simple and adaptable technology for a affordable home automation. Various available systems are hard to install, difficult to use & maintain , generally proprietary closed and are also not easily customizable by the end user.

IV. DESIGN IMPLEMENTATION

System proposed here uses a simple 8 bit PIC 16F873 Microcontroller activated through Bluetooth app in an android phone. Through a password enabled system a model of the door is opened or closed using DC motor & driver L293D and the room parameters are remotely monitored. Humidity sensor DHT11 and Temperature sensor LM 35 get continuous data of the closed room and transmit them through Bluetooth to the user's mobile phone. As the Bluetooth used here is of full-duplex one the sensor parameter details are also displayed on LCD connected to the door outside room and alerts through buzzer if any drastic conditions are reached .Hence system provides a cost effective solution for security and monitoring indoor room parameters like temperature ,Humidity etc. Fig 1 shows a design diagram of Home Automation and Security System using Android [10]

Objectives of the proposed work are:

1. Controlling of door wirelessly through mobile phone.
 2. Usage of Android touch screen smart phone in performing the task.
 3. Bluetooth wireless transmission of sensor data to android device & LCD Display

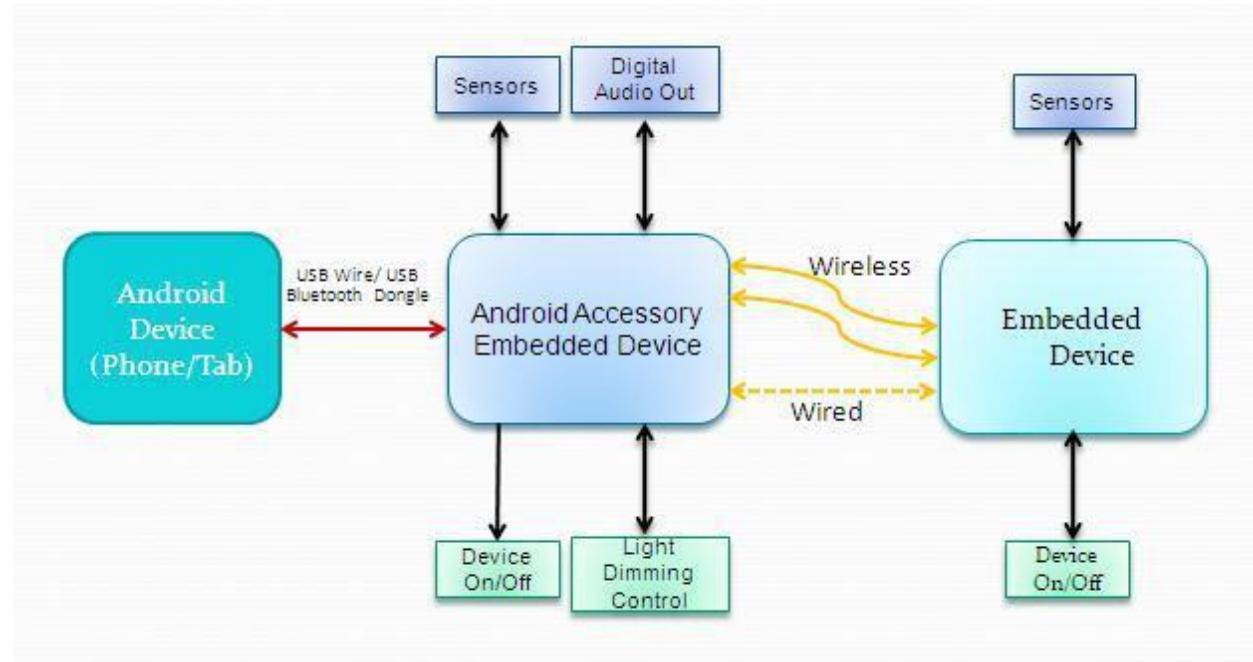


Figure 1 Design Diagram of Home Automation and Security System using Android

Android Open Accessory Protocol [9] is used which is included in all android operating system starting from Android 3.1 allowing external USB hardware to interact with an Android-powered device in a special accessory mode. When an Android-powered device is in accessory mode, the connected accessory acts as the USB host

(powers the bus and enumerates devices) and the Android-powered device acts in the USB accessory role. Android Open Accessory Protocol, allows to detect Android-powered devices that support accessory mode[10]. Accessory mode is ultimately dependent on the device's hardware and all the devices do not support accessory mode.

In general, the accessory/android enabled sensors used here carries out the following steps:

1. Wait for and detect connected devices
2. Determine the device's accessory mode support
3. Attempt to start the device in accessory mode if needed
4. Establish communication with the device if it supports the Android accessory protocol.

V. BLOCK DIAGRAM

The proposed system consists of the following major blocks: Micro controller (PIC16F873), Bluetooth module, DC motor, Temperature sensor ,Humidity sensor, Android device, LCD, Buzzer, Crystal oscillator, Regulated power supply (RPS) etc. Fig 2 shows block Diagram of Home monitoring System using Android.

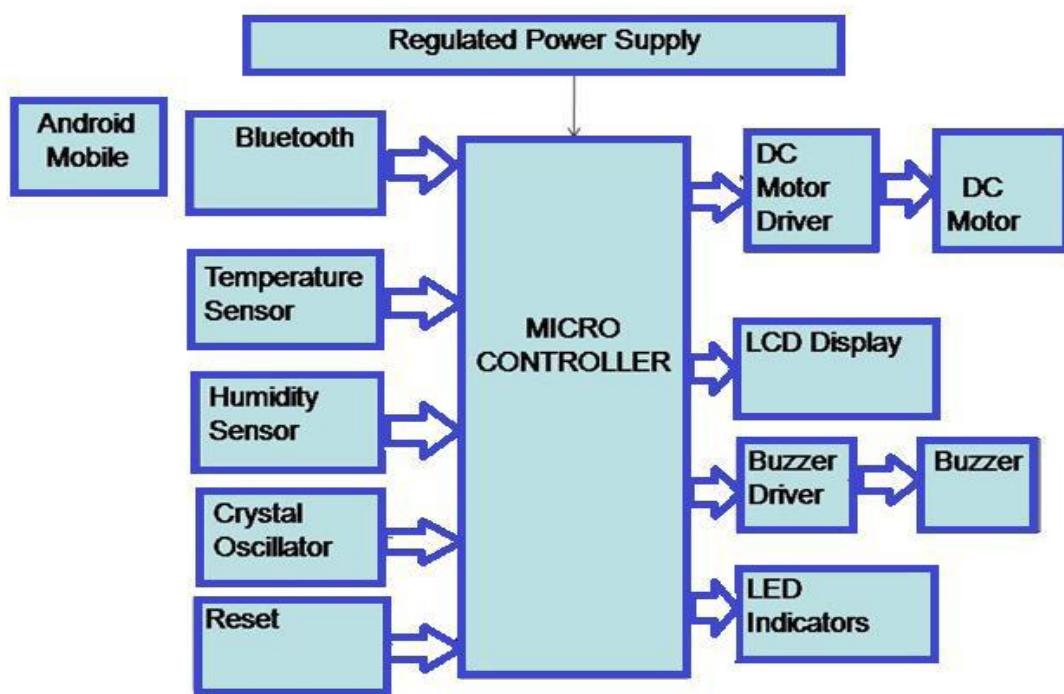


Figure 2 Block Diagram of Home monitoring System using Android

The microcontroller PIC16F73 CMOS FLASH-based 8-bit is upward compatible with the Bluetooth module devices. It features 200 ns instruction execution, self-programming, an LCD, 2 Comparators, 8 channels of 8-bit Analog-to-Digital (A/D) converter, 2 capture/compare/PWM functions, a synchronous 28 serial port that can be configured as either 3-wire SPI or 2-wire I2C bus, a USART, and a Parallel Slave Port. A rectifier IC DB107 is used for RPS with voltage regulator LM7812.

LM 35 temperature sensor precision IC is used to get output voltage linearly proportional to the Celsius (Centigrade) temperature, Humidity sensor DHT11 is used to sense Relative Humidity with a range of 20%-

80% RH. A 12 V DC motor is used with motor driver L293D to operate the door mechanism with reset switch facility. A emergency piezo electric buzzer is used for alerting & alarming adverse conditions.

VI. DESIGN & IMPLEMENTATION

Fig 3 & 4 shows the implementation flow chart of the programs to run & activate master and slave settings of the system respectively

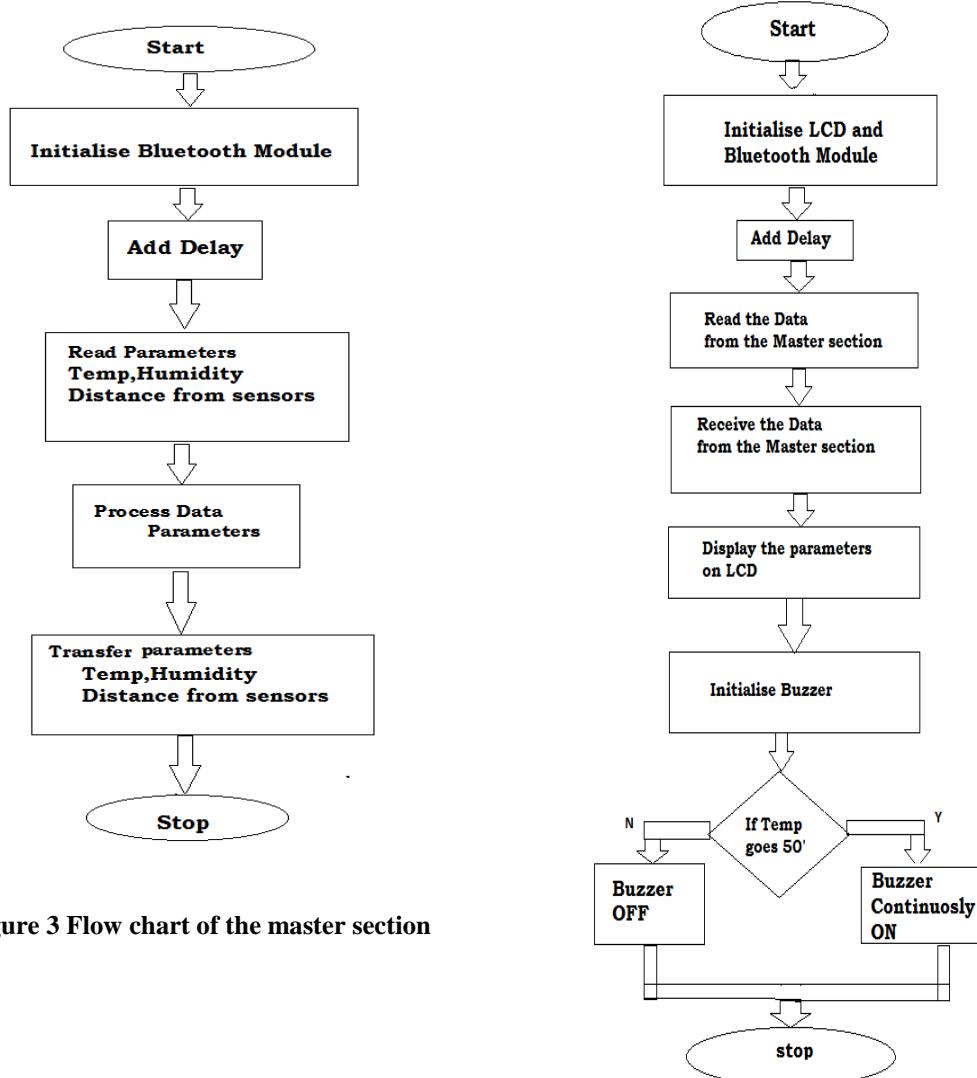


Figure 3 Flow chart of the master section

Figure 4 Flow chart of the slave section

Algorithm for master section: Step 1: Start Step 2: Initialize Bluetooth Module Step 3: Add Delay Step 4: Read the parameters Temp, Humidity, Distance from Sensor Step 5: Process Data parameters Step 6: Transfer parameters Temp, Humidity, Distance from Sensor Step 7: Stop

Algorithm for Slave section: Step 1: Start Step 2: Initialize LCD and Bluetooth Module Step 3: Add Delay Step 4: Read the Data from Master section Step 5: Receive the Data from Master section Step 6: Display the parameters on LCD Step 7: Initialize Buzzer Step 8: If Temp goes 50' Step 9: If no Buzzer OFF Step 10: If temp goes Buzzer continuously ON Step 11: Stop

The Fig 5 shows schematic diagram of **Android Based Home Monitoring System** explaining the interfacing section of each component with microcontroller , motor speed control and sensor parameters.

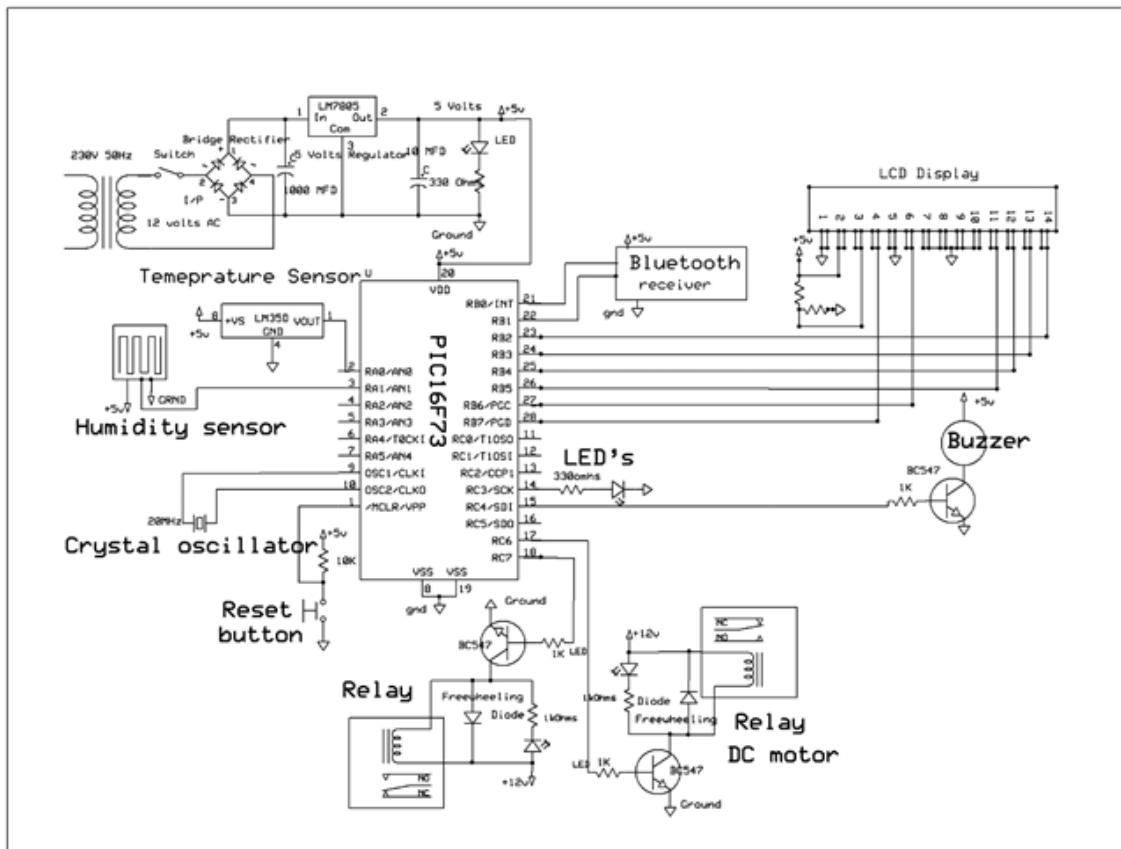


Figure 5 Circuit diagram of the model

Interfacing of PIC16F73 Microcontroller is as follows Port A pins connected to Temperature & Humidity sensors, Port B pins to LCD & Bluetooth module, Port C Pins to Buzzer, motor Relay& LED, Clock pins connected to crystal oscillator & Power supply pins connected to RPS.

The program pseudo code which is dumped in the microcontroller system is shown below

Pseudo code

```
#include <16F73.h>
#include <delay.h>
#include <P16F73.inc>
#use delay(CLOCK=20M)
#use rs232 (baud = 9600, xmit=PIN_B1,rcv=PIN_B0,stream=BT)
//New RFID Reader baudrate

#include <BT136.c>
int i = 0;
char data[15];
char ch;
void main()
{
    int j = 0;
```



```
output_high(pin_A0);
output_high(pin_A1);
delay_ms(800);
output_low(pin_A0);
output_low(pin_A1);
delay_ms(800);
output_high(pin_A0);
output_high(pin_A1);
delay_ms(800);
output_low(pin_A0);
output_low(pin_A1);
delay_ms(800);
while(1) //working with pull up of 10 at output pin of Hall Effect Sensor
{
ch = fgetc(BT);
if strstr(data,up1))
{
if(i< 12)
{
i++;
output_c(up[i]);
output_high(PIN_A0);
delay_ms(250);
output_low(PIN_A1);
output_low(PIN_A0);
}
else
{
output_high(PIN_A0);
}
}
if strstr(data,down1))
{
if(i> 0)
{
i--;
output_c(up[i]);
output_high(PIN_A1);
```



```
delay_ms(250);
output_low(PIN_A1);
output_low(PIN_A0);
delay_ms(52);
}
else
{
output_high(PIN_A1);
}
}
}
}
}
}
```

VII. EXPERIMENTAL SET UP

Fig 6 shows interfacing with relays and fig 7 shows prototype operated with door open, Pictorial Representation of the prototype can be seen in fig 8 and interfacing of microcontrollers is shown in fig 9.



Fig 6 Interfacing of relays

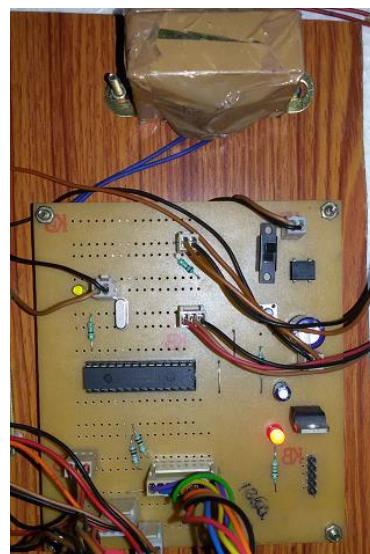


Fig 7 System set up with Door open



Figure 8.Prototype experimental setup

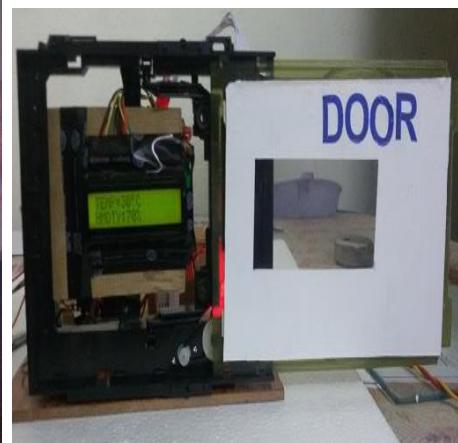


Figure 9.Interfacing of Microcontroller

VIII. RESULTS & DISCUSSIONS

Results are obtained by measuring distance from android device to the Bluetooth device with sensors embedded in the system; Obtained readings of sensors in temperature °C, relative humidity in % are being tabulated in Table 1. Fig 10 shows the graph plotted for obtained results. In the below tabular column we are measuring the sensors parameters like Distance from Sensors, Temperature and Humidity

Table1: Readings of sensor for a close room prototype With the varying distance of android device

S.no	Distance from sensor (Mts)	Temperature (°C)	Humidity (%)
1	5	29	70
2	10	30	70
3	15	31	70
4	20	32	70
5	25	34	70
6	30	34	70
7	35	36	70
8	40	37	70
9	45	38	70
10	50	38	70

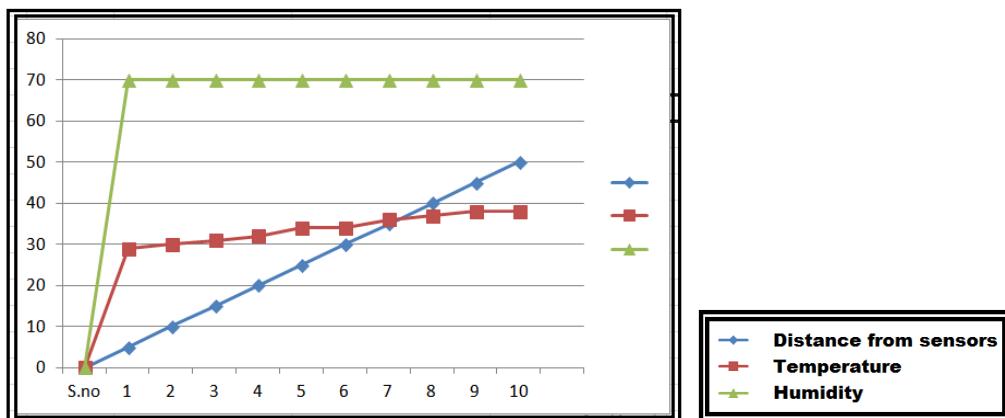


Figure 10: Plot obtained from sensor readings

From the readings obtained it is clear that the system developed successfully monitors the room parameters for distances up to 50 meters & transfers them to the android device. The designed Android Based Home Monitoring System controls the door access and also monitors the temperature and humidity data in a particular room. All the details are monitored through Bluetooth using android mobile with Bluetooth wireless communication. The above results are obtained on continuously monitoring the sensor parameters temperature, Humidity with varying distance from the android device. In figure 10, plot blue color line represents the distance from the sensors in meters using Bluetooth module ranging from 5 to 50 meters. Red color shows temperature sensors in terms of °C and green colour line shows humidity for every 5meters.

IX. CONCLUSION & FUTURE SCOPE

The above system designed is successfully tested for a model close room ,which can Control a door wirelessly through mobile phone using android app. Android based home monitoring system can economically & efficiently be used to connect Bluetooth & read sensor parameters to a remote android mobile. It is easily operable & consumes less power.

Further this system can be improved for home appliances monitoring & control using wifi or zigbee technology. It can be further modified and implemented in real time to control the electrical power usage in industries, house hold, shopping malls etc. With increased Security features it can also be implemented for applications like Medical alert / tele assistance, precise and safe blind control, detection of fire, gas leaks and water leaks etc. Using this basic system for current scenarios we can build cross platform systems that can be deployed on various platforms like iOS, Windows etc.

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BIOGRAPHY

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