

# AUTOMATION OF HOME APPLIANCES BY USING ARDUINO MICROCONTROLLER WITH ANDROID

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**Abstract-** In this paper we revolve around creating a home automation system prototype which focuses on the ability to on/off home appliances through Smartphone. In this paper we present a design and implementation concepts for wireless real-time home automation system. The proposed system can be operated in two ways. In the first method the system can monitor and control the home appliances using the Smartphone through wireless communication technology within the specified range of the bluetooth of smart phone. The second method is automated by sending the messages to the smart phone in which we have the application to do the necessary action. By this we can control our home appliances from anywhere just by sending an SMS even from a basic mobile phone. The user can't use these two operational modes at same time. The proposed system is a simple cost effective and flexible that making it a suitable and a good candidate for the smart home. This type of home automation system can be used in malls and villas.

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**Key words-** Android; Home automation; Smart Scheduling; Relay boards; Energy management.

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## I. INTRODUCTION

A typical home automation system allows one to control house hold appliances from a centralized control unit. These appliances include lights, fans, air conditioners, television sets, security cameras, electronic doors, computer systems, audio/visual equipment, etc. These appliances usually have to be specially designed to be compatible with each other and with the control unit for most commercially available home automation systems. In this paper we demonstrates a system that can be integrated into a building's electrical system and allows one to wirelessly control lights, fans, and turn on or off any appliance that is plugged into a wall outlet. The system can be controlled from a Bluetooth of a mobile phone or tab, while arduino microcontroller acts as the server. Thus the installation cost and hardware cost is kept to a minimum as most of the users already own the requisite hardware like a mobile phone or desktop PC. A Bluetooth dongle or a standard Wireless Access Point is used to provide connectivity between the arduino and the mobile device. The system is capable of performing operations like on/off the home appliances. The power supply for each appliance is wired through an electromechanical relay. A number of relays are used depending on the number of appliances to be controlled. All the relays are controlled by a microcontroller. The microcontroller is connected to the server via a USB interface. This makes it plug-and-play and compatible with virtually any PC.

## II. RELATED WORKS

The home automation system is quite popular. some home automation systems has been designed to sending commands within the home only, in this

scenario the signals may be received for a short range only like infrared . Where the commands are sent from an infrared enabled device in our system we used the arduino board as a controller to perform the operations by using Bluetooth instead of infrared. Another option is to connect the microcontroller with the messages, which can be sent in a form of authorized commands given on android coding. When designing a smart home automation environment the user can manage the home automation system in two types those are direct observation .the user can perform on/off operations of home appliances when the user at home. And the second one is the user can manage the home appliances at any place when the user not in home by messaging user can communicate with the home automation application contained Smartphone. Then the message is on specific command format it will be communicated to arduino to perform operations like on/off.

## III. SYSTEM DESIGN

A low cost and efficient smart home system is presented in our design. In this system the user can control the home appliances through Smartphone. The smart home automation system consists of Smartphone running the android operating system, an arduino microcontroller to control the on/off operation of appliances. The requested hardware (Bluetooth, relay board, power supply cables, etc.)The user controls the home appliances by sending commands through the android smart phone. The smart phone forwards the commands to the arduino microcontroller, then the appliances are turned on/off based on user sending commands.



Fig: Basic View Of System

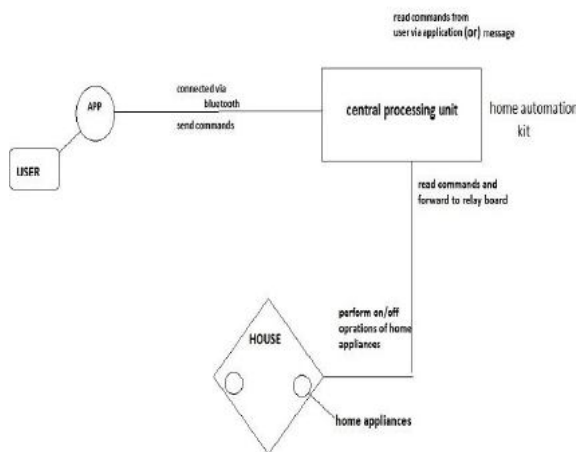


Fig: Functional Diagram Of System

Algorithm of home automation system operation:

The main part of the system is the Arduino microcontroller, which is able to manage the home appliances. We use bluetooth module to establish the communication between the arduino microcontroller and the smart phone (android mobile).

The input of our algorithm is summarised as follows:

- {Ha} : Home automation application,
- {Bs} : Bluetooth of smart phone,
- {Ba} : Bluetooth module on Arduino microcontroller,
- {La} : List of appliances,
  - {La}= {A1, A2, A3, A4}
  - {A1}: Appliance 1,
  - {A2}: Appliance 2,
  - {A3}: Appliance 3,
  - {A4}: Appliance 4.
- {Mc}: List of commands through Message.

{Mc}={on1,off1,on2,off2,on3,off3,on4,off4,onall,ofall}

The algorithm consists of the following steps:

1. Launch the system; includes a power-on for microcontroller with its peripherals.
2. The user can manage the home appliances through home automation application.

$$\{Ha\} = \{Bs \rightarrow Ba\}$$

In this the home automation application user has to pair the bluetooth of the Smartphone and the bluetooth on the Arduino microcontroller.

3. Binding appliance1 (light1) through the home automation application.

{Ha}= {A1} (HIGH); the serial pin number of the appliance1 is 3,

a) To turn on the appliance1 the home automation application send command to the arduino microcontroller (3, HIGH) arduino read the commands and it is on specified format arduino can forward the command to relay board to allow power supply to the appliance1.

{Ha}= {A1} (LOW); the serial pin number of the appliance1 is 3,

b) To turn off the appliance1 the home automation application send command to the arduino microcontroller (3, LOW) arduino read the commands and it is on specified format arduino can forward the command to relay board to deny power supply to the appliance1.

Similarly we can bind the all home appliances in the following format.

c) Turn on and off of the appliance2,

{Ha}= {A2} (HIGH);

{Ha}= {A2} (LOW);

d) Turn on and off of the appliance3,

{Ha}= {A3} (HIGH);

{Ha}= {A3} (LOW);

e) Turn on and off of the appliance4,

{Ha}= {A4} (HIGH);

{Ha}= {A4} (LOW);

4. User can manage the home appliances through message by sending SMS to the home automation application containing mobile. To process this operational mode we have to mention some specific commands on the android coding session.

When the user can send the specific command on the message form to home automation application it can read that message and forward to Arduino microcontroller.

{Mc}={on1,off1,on2,off2,on3,off3,on4,off4,onall,ofall}

on1=appliance1 on; off1=appliance1 off;

on2=appliance2 on; off2=appliance2 off;

on3=appliance3 on; off3=appliance3 off;

on4=appliance4 on; off4=appliance4off;

onall= on all appliances; ofall=off all appliances.

a) Turn on the appliance1 through message

{Mc}(on1) → {Ha};

The user can send message from any basic mobile to home automation application containing mobile as (on1).

{Ha}= {A1} (HIGH);

Home automation application read that message and it is on specific format it can be forward to the arduino board. The microcontroller read that command and forward to relay board and the appliance1 is on.

b) Turn off the appliance1 through message

{Mc}(off1) → {Ha};

The user can send message from any basic mobile to home automation application containing mobile as (off1).

$\{Ha\} = \{A1\}$  (LOW);

Home automation application read that message and it is on specific format it can be forward to the arduino board. The microcontroller read that command and forward to relay board and the appliance is off.

Similarly we can bind the all home appliances in the following format.

c) Turn on the appliance2 through message

$\{Mc\}(on2) \rightarrow \{Ha\}; \{Ha\} = \{A2\}$  (HIGH);

Turn off the appliance2 through message

$\{Mc\}(off2) \rightarrow \{Ha\}; \{Ha\} = \{A2\}$  (LOW);

d) Turn on the appliance3 through message

$\{Mc\}(on3) \rightarrow \{Ha\}; \{Ha\} = \{A3\}$  (HIGH);

Turn off the appliance3 through message

$\{Mc\}(off3) \rightarrow \{Ha\}; \{Ha\} = \{A3\}$  (LOW);

e) Turn on the appliance4 through message

$\{Mc\}(on4) \rightarrow \{Ha\}; \{Ha\} = \{A4\}$  (HIGH);

Turn off the appliance4 through message

$\{Mc\}(off4) \rightarrow \{Ha\}; \{Ha\} = \{A4\}$  (LOW);

f) Turn on all home appliances through message

$\{Mc\}(onall) \rightarrow \{Ha\}; \{Ha\} = \{A1, A2, A3, A4\}$  (HIGH);

Turn off all home appliances through message

$\{Mc\}(ofall) \rightarrow \{Ha\}; \{Ha\} = \{A1, A2, A3, A4\}$  (LOW);

#### IV. MODULES AND INTERFACES

The smart home automation system has hardware and software (user interface) implementations.

##### A. Arduino Implementation(Hardware)

Arduino is a microcontroller programmed using a wiring based language similar to C++ with some slight simplifications and modifications, by using this microcontroller we can control electronic devices. In our project we used the arduino board as a brain for the home automation system. We connect relay board and bluetooth to the arduino.

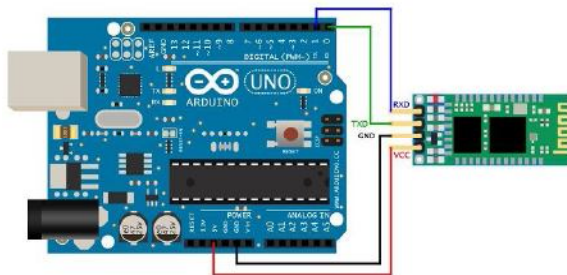


Fig: Pin Diagram Of Arduino And Bluetooth

HC-05 is a serial port module which makes it very easy to use. The pin configuration of Bluetooth.

1. Connect VCC with 3.3V or 5V of Arduino.
2. Connect GND with any GND of Arduino.
3. Connect Rx pin with Tx of Arduino.
4. Connect Tx pin with Rx of Arduino.

Now power-up the Uno using USB cable, a red light LED on HC-05 will start blinking, means we are ready to go forward to the next step.

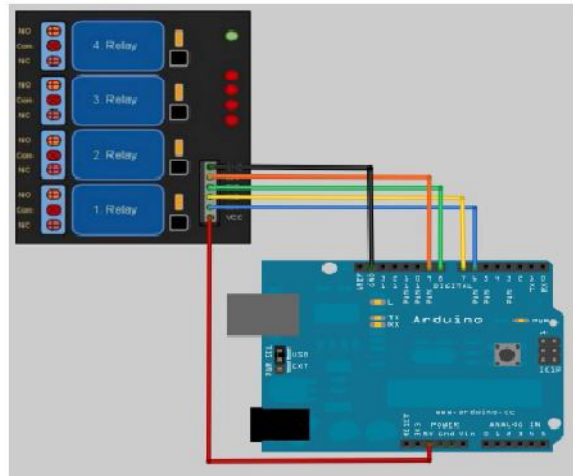


Fig: Pin Diagram Of Arduino And Relay

For example we used Arduino pins 7, 8, 9, 10. Avoid using Data pins 0 and 1 as they are used by the Arduino for serial communication and can cause problems when uploading code to the Arduino. To connect the Relay board to an Arduino is very easy and allows you to turn on and off a wide range of devices, both AC and DC. The first connections are the ground and power pins, you need to connect the Arduino +5v to the Relay board VCC pin and the Arduino ground to the Relay board GND pin. Then it's a only a matter of just connecting the communication pins, labelled IN1, IN2, IN3 and IN4, two data pins on the Arduino.

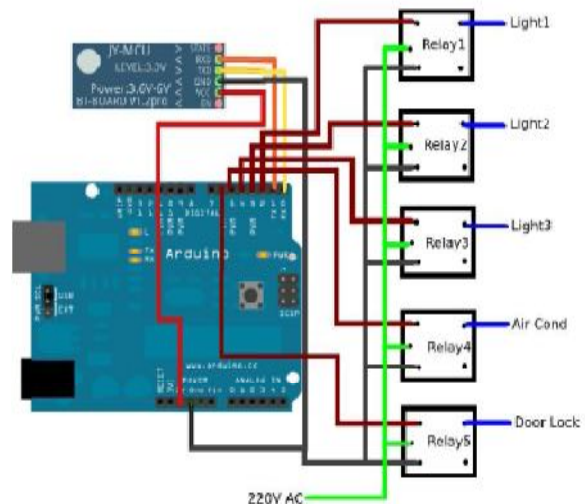


Figure: Circuit Diagram.

##### B. Android to user Communication(User Interface)

We have developed an android application to enable the user communication with the home automation system. The application has option for connecting to the Bluetooth. We can control the appliances by perform the operations like on/off.

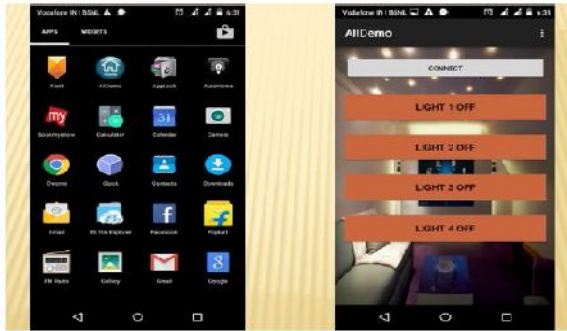
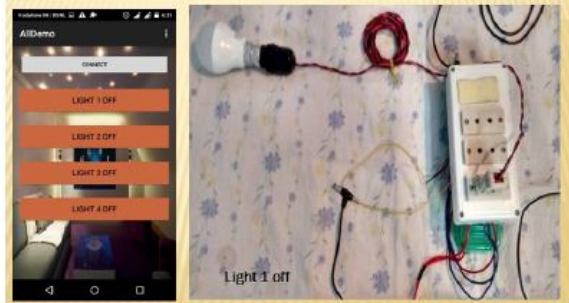
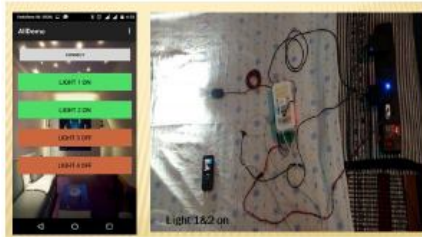


Fig:Application Screenshots.

*C. Android to Arduino communication*

The Android application of the smart home automation system and the arduino microcontroller will communicated using Bluetooth. The arduino board contains the home appliances and also have a Bluetooth chip to receive commands from the android Smartphone. The arduino board manages the home appliances depend up on the messages or commands send by the user.



On Appliance 2 By Sending Message

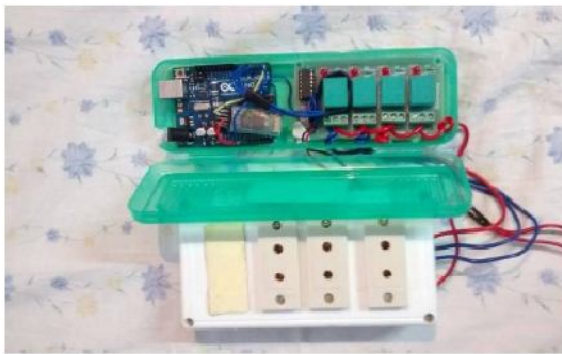
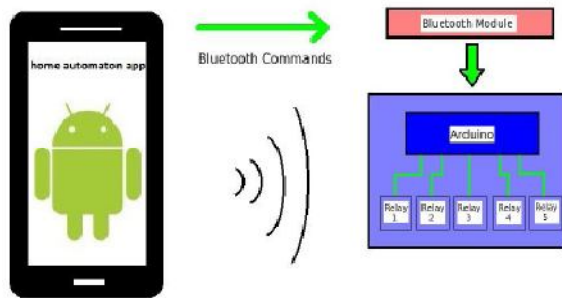


Fig: Real Time View Of Home Automation System



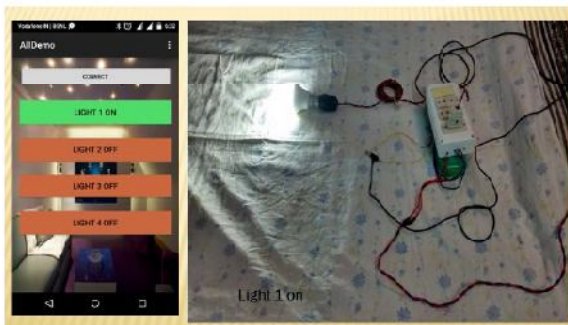
Home Automation Application Interface And Application functionality

**V. SCOPE FOR FUTURE WORK AND CONCLUSION**

This project offers a lot of scope for adding newer features. Since all appliances managing are done remotely, there are no resource constraints apart from the signal of bluetooth. We can program the home automation system such that it can perform operations like appliances turn on/off remotely. Also, we can control the home appliances from anywhere by sending commands to the arduino microcontroller. By using these types of home automation systems we can reduce the man power and wastage of electricity. The possibilities are endless. This home automation system is in its current state provides a platform for further research into improving its capabilities.

**REFERENCES**

- [1] Baris Yuksekkaya, A.Alper Kayalar, M.Bilgehan Tosun, M. Kaan Ozcan, and Ali Ziya Alkar, "A GSM, Internet and Speech Controlled Wireless Internet Home Automation System", IEEE Transactions on Consumer Electronics, Vol.52, No.3, AUGUST 2006
- [2] N.Sriskanthan and Tan Karande, "Bluetooth Based Home Automation Systems", Journal of Microprocessors and Microsystems, 2002, Vol.26, pp. 281-289
- [3] KwangYeol Lee & Jae WeonChoi, "Remote Controlled Home Automation System via Bluetooth Home Network" in SICE Annual Conference in Fukui, 2003, Vol. 3, pp. 2824-2829



- [4] Sweatha K N, Poornima M, Vinutha M H – “ADVANCE HOME AUTOMATION USING FPGA CONTROLLER”, International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 7, July 2013.
- [5] Mahesh N. Jivani “GSM Based Home Automation System Using App-Inventor for Android Mobile Phone” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 3, Issue 9, September 2014.
- [6] Belgi Y.G., Avatade P.G., Deshmukh P.V., Sakhare A.M., Shinde A.J. and Prof. Patil J.M., -“Android Based Appliances Control System” International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 12, December 2013.
- [7] D.NARESH,B.CHAKRADHAR, S.KRISHNAVENI, “Bluetooth Based Home Automation and Security System Using ARM9”, International Journal of Engineering Trends and Technology (IJETT) – Volume 4 Issue 9- Sep 2013.
- [8] Mohamed Salman, Jayavrinda Vrindavanam, - “Efficient Interactive Control System based on GSM”, International Journal of Latest Trends in Engineering and Technology (IJLTET), Vol. 3 Issue 2 November 2013.

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