A Novel Home Automation System using Bluetooth and Arduino

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Abstract: *The main objective of this article is to develop a Home Automation System using Android mobile with Bluetooth Module. Nowadays people are expecting to control the home appliances through remote control. This expectation is fulfilled by our advanced technology. In this article we are using Bluetooth and Android OS to develop a smart home. Modern Houses are expected to have centralized control system, instead of conventional switches which are fitted on walls. If the user wants to control the appliances, they have to move near the wall and control the switches. This method is inconvenient for the elderly and disabled people. So their difficulty to operate the appliances can be supported by the proposed home automation system which has a remote module to control the appliances. Remote controlled home automation system fulfills the needs of the people. Remote control operation is achieved by a smart phone or Tablet which is supported by Android OS. In the smart phone Android App with Bluetooth acts as a transmitter, which sends commands to the receiver Bluetooth module. In this article ARDUINO UNO controller board which contains an Atmega328p IC is used. The loads are interfaced to the Arduino controller using electromagnetic Relays.*

Keyword: *Home Automation System (HAS); Arduino; Bluetooth; AppInventor; Smart home;*

1. INTRODUCTION

This paper presents a wireless Home Automation System (HAS) using Android. This concept is designed to assist and provide support the needs of elderly persons in home. The idea of Home Automation reduces the manpower at home. This HAS is very useful to the disabled peoples. The automation process is completely controlled by Bluetooth and android OS. Nowadays, people are having a Smartphone with android application. This phone is used to control appliances using simple click and voice commands. Commands are passing through Bluetooth present in mobile. So you need not getup to switch on or off the devices.

Voice command is transmitted to the Bluetooth module through Android phone and graphical user interface (GUI) commands are transmitted to the Bluetooth module through Android App. At a time we give any one of the command to the Bluetooth module either voice or GUI command. This design is independent of conventional switches. The electrical appliances can be operated (On or OFF condition) without the need of a conventional switch. So this concept is cost effective, user friendly and also reduces wiring cost. It also saves the time for users.

2. LITERATURE SURVEY

This section provides the possible methods suggested by the researchers in the past in the field of home automation. Wook-SungYoo and Sameer Ahamed Shaik in their work have presented an application of home automation using Bluetooth [1].

Pooja N.Pamar et al. have presented a method to control the home appliances through Internet and Arduino controller [2]. While C S Tyagi et al. have developed a Home Automation method where appliances are controlled through voice commands using Arduino and Android OS [3]. Similarly the method suggested by Sriskanthan and Karande operated the Home appliances through a RS232 network using Bluetooth module [4].

Baris Yuksekkaya et al. have developed an Home appliances automation using GSM, Internet and speech. Microprocessor is used to process the signals from RF antenna [5]. Rajeev Piyare and Tazil M. have developed a Home appliances automation method using PC/Laptop or Android cell phone [6]. Sandeep Kumar and Mohammed A Qadeer developed a method using Bluetooth module [7]. H Kanma et al. developed a home appliances control system using Separate Bluetooth module without android OS [8].

S Tharishny et al. have developed using Bluetooth and Internet which supports password protection to control the appliances. The detailed survey on home controlled automation using GSM and Bluetooth considering parameters of efficiency, Android apps, Microcontrollers and Communications has provided

avenues to explore other alternative and efficient method for home appliance control system [10].

3. METHODOLOGY

In this paper home appliances are controlled by android mobile with Bluetooth module. The GUI commands are used to control the appliances. MIT App Inventor, an Android App creator tool is used for the design of the proposed HAS. The proposed method uses App inventor for controlling the home appliances through Bluetooth. This App inventor does not need any coding like Java or PHP. MIT app inventor contains blocks. We can drag and drop the desired blocks in the corresponding place. This App inventor needs internet connection during the creation of App [1]. Once App is created, the App can be used even in the off line mode. It is user-friendly compare to other Apps and eliminates the complicated java coding procedure. This App can be installed to Android phone/Tablet with Bluetooth module.
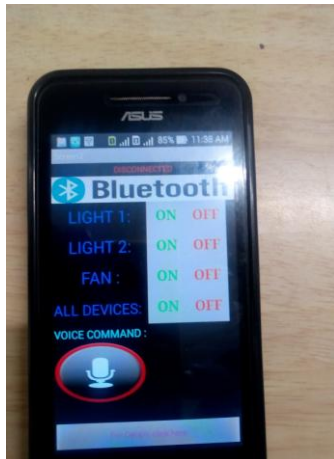

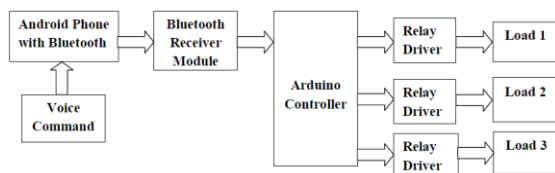*Figure 1 Mobile App*

4. BLOCK REPRSENTATION

Figure 2 Block representation of the proposed system

The block representation of the proposed automation system is given in Fig. 2. The input either a voice or GUI command but not both simultaneously is given to mobile phone using Android App. The received command is transmitted using the Bluetooth which is inbuilt in the mobile phone. The Bluetooth module HC-05 receives the command (in a coverage area of around 30 feet) and passes it to Arduino controller. Controller reads the command through a serial port. Arduino controller compares the command from android phone. If the command is matched, the corre-

sponding output pin goes high. The relay driver receives the signal from controller and activates the corresponding appliance (load).

5. HARDWARE IMPLEMENTATION

The hardware realization of the proposed home automation system is detailed below

4.1. Arduino Controller

An Arduino is an open source microcontroller development board which is shown in Fig 3. In this paper the Arduino Uno Board used consists of 14 digital input/output pins, 6 analog input/output pins and one serial port [2]. Embedded C is used to program the controller. The board operates between 5-10 Volts.
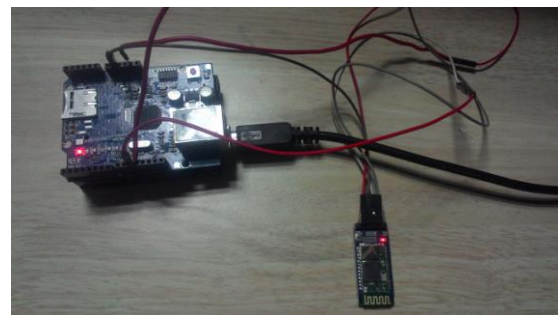

Figure 3 Arduino Controller

The programming software for this board is Arduino 1.6.8 or higher version. Programming is done using the computer which is fed to the Arduino board using an USB port. The output is viewed in serial monitor of Arduino software as shown in Fig 4. These boards are available commercially in pre-assembled form.
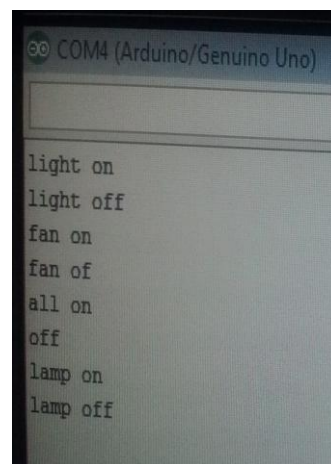

Figure 4 Serial Monitor

4.2. Flow chart for a Single appliance (on/off)

A basic flow diagram to represent the automation of a single home appliance to be in either ON or OFF condition is shown in Fig. 5.
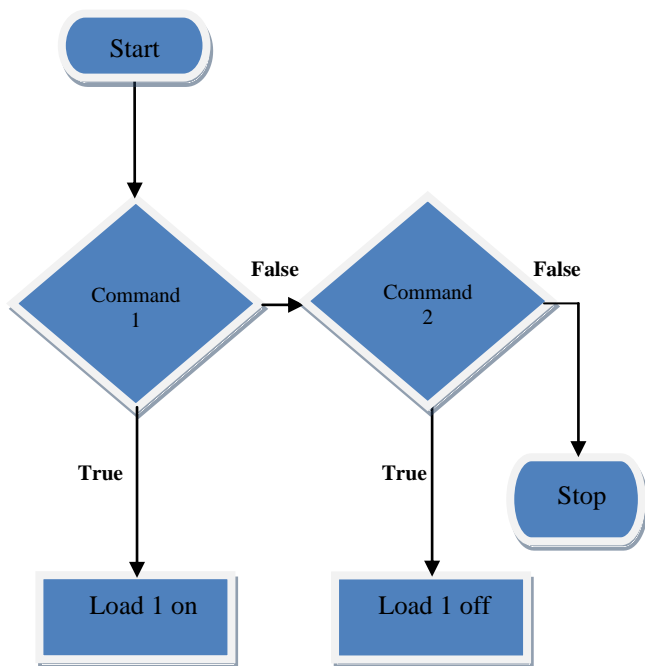
Figure 5 Flowchart for a single appliance (ON/OFF Condition)

4.3. Relay Driver

In this paper a relay driver is used for controlling the load like on/off operation [3]. Relay driver consist of NPN transistor and electromagnetic relay. When the output of Arduino controller goes high, corresponding relay is switched on and turns on the load. If the output of the controller is low, corresponding relay is switch off and turns off the load. This process takes place according to the given input using a GUI or voice command. Relay driver board is shown in Figure 6. Generally relay driver switches DC and AC voltage. The input of 230V AC is given to relay common (COM) pin. Initially relay COM and Normally Closed (NC) is shorted. When the relay is turned on COM is connected to normally open (NO) pin of relay. The load is connected to NO pin of relay. So the load is turned on now. When the relay is turned off, COM is back to NC. So the load is turned off.

4.4. Bluetooth Module

In this paper, a HC-05 Bluetooth module which has an operating frequency of 2.4 to 2.485GHz and a coverage region of 30 feet is used [4-5]. Initially a password enabled method is used to pair the Bluetooth module with a mobile phone. After the password 1234 is given, the HC-05 module is paired with Android mobile phone. While receiving voice command as shown in Fig 7. After which the command can be sent to HC-05 Bluetooth module through a mobile phone [6]. After receiving the voice command as shown in Fig 8.

The output of Bluetooth module is taken from the receiver terminal which is further given to Arduino controller [7-8]. The controller checks the output command and turns on the corresponding port [9-10]. HC-05 Bluetooth module is shown in Fig 9.
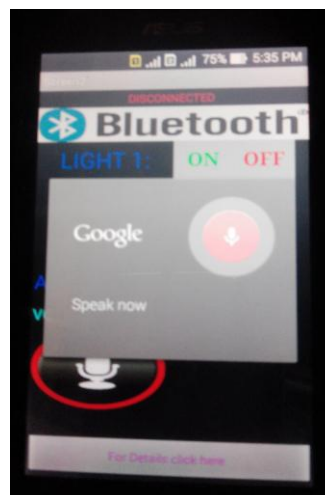

Figure 6 Relay driver

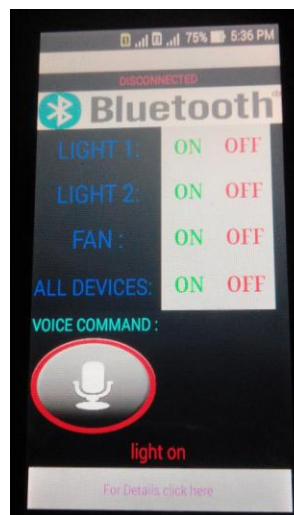*Figure 7 While receiving voice command*

Figure 8 After receiving voice command

In this article only four home appliances are automated completely by a centralized module. The proposed HAS can also be extended to eight appliances using Android Phone.

Figure 9 HC-05 Bluetooth Module

6. CONCLUSION

The proposed work has developed a Home Automation using Bluetooth, Android and Arduino. This is a cost-effective, low maintenance and user friendly automation system to help the elderly and differently abled people. Main motive of this paper is to have a centralized control system to operate the appliances through a Android phone. It also saves the time for operating appliances to the consumers. In conventional switches needs more wires for connecting load. But in proposed system, the need for wire is drastically reduced. The appliances in the home can be controlled and its status (ON or OFF condition) can be monitored from a remote location. The idea proposed in this article can also be extended for the automation of industries, malls and hospitals.

7. ACKNOWLEDGEMENTS

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