Smart Home Using Android Mobile via Bluetooth

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Abstract—Today’s home require sophistication control in its different gadgets which are basically electronic appliances. Modern houses are gradually shifting from physical switches on wall to centralized control system, involving wireless controlled switches. Conventional wall switches located in different parts of the home makes it difficult for the user to go near them to operate. Even more it’s more difficult for the elderly or physically handicapped people to do so. There is possibility of forgetting to off the appliances while leaving the home. This problem can be solved by integrating home appliances with smart phone connectivity using Arduino platform. Smart phones are already features perfect & can be made to communicate to any other devices with a connectivity options like Bluetooth. It is preferable to use Bluetooth because nowadays people have their smart phones with them all the time.

Index Terms—Smart home, smart phone, Bluetooth, arduino, home appliances

I. INTRODUCTION

As per Census 2011, in India, out of the 121 Cr population, about 2.68 Cr persons are ‘disabled’ which is 2.21% of the total population. And 10.39 Cr persons are ‘old age’ which is 8.6% of the total population [2]. Most of the Elderly and disabled population of India spend their time in home. Smart Home Using Android Mobile using Bluetooth will increase their living standard in home.

21st century, Smart Phone can be a great tool to enhance human comfort and life style [3]. India currently has in between 300-400 million smart phone users. In order to improve the standard living in home Smart phone will play very important role Smart home system becoming popular now days & enter quickly in this emerging market [1]. Smart home is a technique or controlling a process by electronic devices with reduces human involvement to a minimum [8]. This paper presents a possible solution whereby the user control devices and electronic home appliances by using their existing smart phones, where control is communicated to the arduino from a mobile phone through its Bluetooth interface. Bluetooth is a short-range wireless communication technology. Bluetooth works over 2.4 GHz frequency range up to the range of 100m with 1 Mbps speed [8]. It is preferable to use Bluetooth because nowadays people have their smart phones with them all the time, since the smart phones have Bluetooth facility in them, thus it’s better to use Bluetooth rather than RF remotes or IR remotes.

II. PROPOSED WORK

2.1. Block diagram

![Block Diagram of System](image)

Fig 1. Block Diagram of System

When android mobile is connected to Bluetooth module via Bluetooth, then with the help of MAX-232 serial communication in between arduino and mobile will be done. With the help of Bluetooth Controller application, can control appliances. When arduino get signal, it gives to relay to turn on/off the load or home appliances such as Fan, TV, Tube light, Music System. A relay allows you to turn ON/OFF a load using voltage and/or current much higher than what arduino could handle. Relay provides complete isolation between the low voltage circuit on arduino side and the high voltage side controlling the load. Motion sensor will be useful to turn off the appliances automatically when there is no motion in the home, in case anybody forgot to switch off the any home appliance before left the house. It saves...
electricity. It will make more economical to this project. In this, fan speed controlled with the help of DC motor. DC motor is connected to fan regulator, for fan speed increment it rotates clockwise and for fan speed decrement it rotates anti clockwise.

2.2. Flow Chart:

START

CONNECTION BETWEEN SMART PHONE AND ARDUINO Via BLUETOOTH

INITIALIZE SERIAL COMMUNICATION

CONTROLL THE LOAD FROM APPLICATION

RELAY

Load 1

Load 2

Load 3

CLOSE APPLICATION

DISCONNECT CONNECTION BETWEEN SMART PHONE AND ARDUINO

Fig.2. Flow Chart of smart home system

The Flow Chart of this Smart Home System is shown in Fig. 2. First start the system then connection between mobile and arduino via Bluetooth, then initialize the serial communication with the help of MAX-232. The signal has to send Bluetooth module. This Bluetooth module receives the command from the android application i.e. Bluetooth controller app. Then serial communication takes place between arduino and Bluetooth, then control the load from application, this signal will gives to relay and load will be controlled i.e. the load will turn on/off. And after that, close the application i.e. disconnected the application.

III. FLOW OF HARDWARE

The home automation circuit is built around an Arduino Uno board, Bluetooth module, HC-05 and a 3-channel relay board. The number of channels depends on the number of appliances you wish to control. Arduino Uno is powered with a 12V DC adaptor/power source.

The relay module and Bluetooth module can be in turn powered using a board power supply of Arduino Uno. In this circuit pin 0 of the Arduino is connected to pin TX of the Bluetooth. Pins GND and VCC of the Bluetooth module are connected to GND and +3.3V of Arduino board respectively. Pins 8, 9, 10 are connected to the three relays of the relay board. Pins Vin & GND of the relay board are connected to pins Vin and GND of the Arduino board respectively. Vin is usually used to give input power but since we are supplying 12V to Arduino using an adaptor. We can use Vin pin on Arduino to power the 12V relay module.

Fig.3. Circuit diagram of smart home system
First, pairing between mobile application i.e. Bluetooth controller and Bluetooth module. This needs password for pairing (e.g.1234). After pairing mobile device gets connected with Bluetooth module and with the help of Bluetooth controller application can control home appliances. The signal has to send Bluetooth module. This Bluetooth module receives the command from the Android application i.e. Bluetooth controller application received signal then transmit to the Arduino after that the arduino gives its output to the relay driver circuit, if the given signal is to turn ON the device, then relay gets energized i.e. normally open and it will turn ON the device. All the devices connected to main power supply. A relay allows you to turn ON or turn OFF a load using voltage and/or current much higher than what Arduino could handle. Relay provides complete isolation between the low voltage circuit on Arduino side and the high voltage side controlling load. It gets activated using 5V from arduino which in turn controls electrical appliances like fans, lights etc. Here motion sensor is used for the purpose of to save electricity in case when anybody forgot to switch off the appliances before left the house. Pin 7 of the arduino connected to motion sensor, if there is no motion detected in the house in 3 minutes then it will switch off the appliances automatically. In this project, fan speed controlled with the help of DC motor, L293D motor driver IC is connected between arduino and motor. Pins 2, 3 of arduino are connected to pins In1, In2 of the motor driver IC. For fan speed increment it rotates clockwise and for speed decrement it rotates anticlockwise with the help of DC motor.

<table>
<thead>
<tr>
<th>m1</th>
<th>m2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

The program which is written to the arduino communicates with Bluetooth module serially to receive the commands.

IV. ANDROID APPLICATION DEVELOPMENT AND ARDUINO PROGRAMMING

4.1 Android application development

Android application development is the process by which new applications are created for devices running the Android operating system. Smart home Bluetooth controller apps written using the Android software development kit (SDK). The android SDK provides tools for code compilation and packaging data and resources files into an archive file ‘.apk’ extension called as an Android package. Android devices used the ‘.apk’ file to install the application. The amalgamation of the android development environment with the Bluetooth wireless technology is known by Android’s support for the Bluetooth network stack, which permits a device to wirelessly exchange data with another Bluetooth device. The application framework enables access to the Bluetooth functionality using the Android Bluetooth API’s (Application Programming Interface). These API’s allow wireless applications to connect to the other Bluetooth devices for point to point and multipoint wireless features.

4.2 Arduino programming

The Arduino uno is programmed using IDE developed by the Arduino Company. The programming of the IDE is based on the C/C++ language. A program written with the IDE for Arduino is called Sketch. User-written code only requires two basic function, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board’s firmware.

A minimal Arduino C/C++ program consists of only two functions:

Setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables; input and output pin modes, and other libraries needed in the sketch.

Loop(): After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

The program uses the functions pinMode(), digitalWrite(), and delay(), which are provided by the internal libraries included in the IDE. .
Fig. 4. Bluetooth controller app of smart home system

Fig. 5. Working code

V. EXPERIMENTAL RESULTS

5.1 Experimental Setup:

After the connection of the system we check the conditions as follows.

<table>
<thead>
<tr>
<th>Test</th>
<th>Start Up and Shut Down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precondition</td>
<td>Smart Phone loaded with Home auto motion software and arduino loaded with program</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Power up Home automation setup</td>
</tr>
<tr>
<td>2. Connect Smart Phone with Home automation Set up via Bluetooth</td>
</tr>
<tr>
<td>3. It will ask for password to connect with smart phone</td>
</tr>
<tr>
<td>4. Enter wrong password and check for connection</td>
</tr>
<tr>
<td>5. Enter correct password and check for connection</td>
</tr>
<tr>
<td>6. Open home automation application from smart phone and Operate load through smart phone</td>
</tr>
<tr>
<td>7. Close home automation application</td>
</tr>
<tr>
<td>8. Disconnect Bluetooth connection from home automation setup</td>
</tr>
<tr>
<td>9. Power off Home automation setup</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Acceptance criteria</th>
<th>Acceptance criteria fulfilled?</th>
</tr>
</thead>
</table>
1. connecting smart phone with home automation set up via Bluetooth it should ask for password
   - ✗ YES ☐ NO

2. after entering correct password only home automation setup has to accept connection
   - ✗ YES ☐ NO

3. operation of load should be done by using home automation software from smart phone
   - ✗ YES ☐ NO

4. smart phone should disconnect from Home automation set up after turning off Bluetooth
   - ✗ YES ☐ NO

Test: Functional Check of Home automation set up

Precondition: Smart Phone loaded with Home auto motion software and arduino loaded with program

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Acceptance criteria</th>
<th>Acceptance criteria fulfilled?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press “Device 1 ON” tab from Home automation application</td>
<td>Device 1 should On</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “Device 1 OFF” tab from Home automation application</td>
<td>Device 1 should OFF</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “Device 2 ON” tab from Home automation application</td>
<td>Device 2 should On</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “Device 2 OFF” tab from Home automation application</td>
<td>Device 2 should OFF</td>
<td>✗ YES ☐ NO</td>
</tr>
</tbody>
</table>

Test: Functional Check of Home automation set up

Precondition: Smart Phone loaded with Home auto motion software and arduino loaded with program

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Acceptance criteria</th>
<th>Acceptance criteria fulfilled?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press “Device 3 ON” tab from Home automation application</td>
<td>Device 3 should On</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “Device 3 OFF” tab from Home automation application</td>
<td>Device 3 should OFF</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “FAN INCRIMENT” tab from Home automation application</td>
<td>Fan speed should increase with respect to increment button</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “FAN Decrement” tab from Home automation application</td>
<td>Fan speed should decrease with respect to decrement button</td>
<td>✗ YES ☐ NO</td>
</tr>
<tr>
<td>Press “FAN stop” tab from Home automation application</td>
<td>Fan should stop</td>
<td>✗ YES ☐ NO</td>
</tr>
</tbody>
</table>

Table No.1. Results and conditions

VI. CONCLUSION

We have developed the low cost Home automation system which improve living standard of human being using smart phone and arduino. We able to operate various kind of house hold equipment’s using smart phone. It comes very handy with physically challenged peoples and old aged while operating house hold equipment by sitting anywhere in home.
ACKNOWLEDGEMENT

We would like to sincerely thank our Guide Dr. M.S. Chavan for his constant encouragement and support throughout my paper work. They always ensure that my work is being held in proper direction and always guided me in planning work at each stage of my work. We take this opportunity to express sincere appreciation and deep sense of encouragement, which had a great influence in bringing this project to success. We remain ever indebted to him for the keen interest shown and moral support offered all through pursuance of this work.

REFERENCES


