Android Based Smart Home Automation using Arduino

Tushar Chatur.R[1] , M. Prabu[2]

[1]*Student, Department of Electronics and Communication Engineering, Misrimal Navajee Munoth Jain Engineering College, Chennai.*
[2]*Assistant Professor, Department of Electronics and Communication Engineering, Misrimal Navajee Munoth Jain Engineering College, Chennai.*

Abstract:

In our path towards modernization, automation plays an important role. Home automation enables us to control any electrical appliances like fan, TV, lights, AC from any place in the world. People of the present generation have become much dependent on modern technology which has led to the idea of home Automation. This paper is about controlling home appliances smartly using Android enabled Smartphone. This project consists of an Arduino microcontroller, Bluetooth module and an Android Smartphone. The main objective of this project is to make this system affordable, smart, user-friendly.

Keywords

HAS, Arduino, Bluetooth, Android, temperature sensor, light sensor, PIR sensor.

1. INTRODUCTION

In the present century where people are finding new ways to modernize our day to day lives, automation has enabled us to connect ourselves with electrical devices in various ways. Home automation has made our lives simpler, efficient, and effortless. Home automation has enabled us to use all electrical devices at our fingertips. It comes in a very handy manner, especially when there are kids at home who often tend to leave appliances switched on after using them or when there's a pregnant woman at the home, keeping track of all the devices for her becomes difficult. Automation also enhances the security of the house especially with all the smart door sensors and motion detectors with which any burglary or break-in can be easily detected.

Today, Smart phones can be used as a medium of an interface for connecting to various controllers via Bluetooth or Wifi. Smart phones of the present generation run on android or ios operating systems that have certain applications which can be used to achieve this connection with electrical devices. These applications can either be created according to the need of the user or pre-developed apps can be used.

Generally, Bluetooth or Wifi mode of communication is used in home automation. Bluetooth is used for short range communications while wifi is used for long range communications. Wifi modules are much more preferred over Bluetooth because of its long range and security features.

2. RESEARCH METHODOLOGY
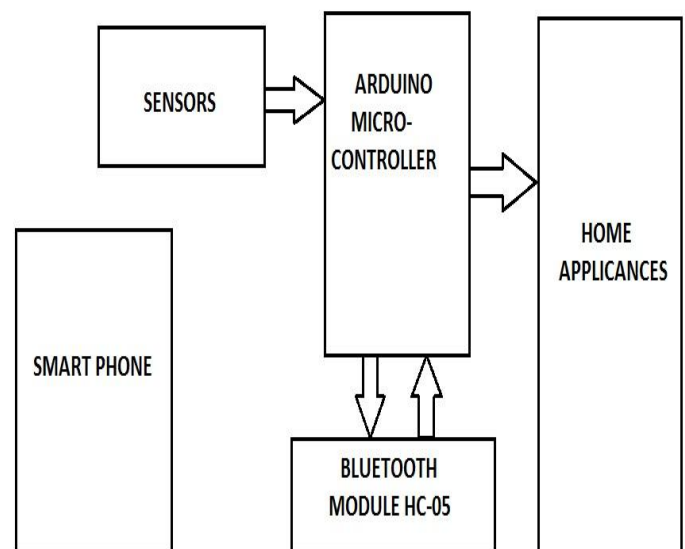
Fig .1.Block Diagram

3. COMPONENT DESCRIPTION

In this proposed methodology, there are three modules. The first module is about all electrical appliances and devices that need to be monitored and controlled like fan, light, AC, garage door etc. The Second module consists of a Bluetooth module to receive signals, microcontroller to execute commands and sensors. The third module is our smart phone through which we will give commands and monitor our devices.

3.1 ARDUINO MICRO-CONTROLLER

In this proposed idea, we have used an Arduino microcontroller. Arduino microcontroller is an open sourced PCB design which can be easily programmed by anyone. Arduino consists of ATMEGA 328 IC which is a 28 pin IC used to carry out all the execution part. It gets all the inputs, processes them and then returns the output.

Fig .2. Arduino board

Arduino has a total of 32Kb of flash program memory and has a 2Kb of SRAM and 1Kb of EEPROM. It has a total of 23 pins for all I/O operations. Arduino works on 5V and has an operating temperature range of around -45° C to 80° C. Arduino can take both Analog as well as Digital inputs. The analog input pins varies from A0 to A5 totally consisting of 6 pins. There are 14 digital I/O pins of which 6 pins can provide PWM outputs. Here we are using analog pins to get the input data from the sensors and digital pins are connected to the devices.

Arduino can be programmed using the Arduino IDE software. This software is available on the official website of Arduino. One of the main reasons for why Arduino is highly recommended and widely used because of the user friendly language that can be used program it. This language is similar to C language. All the operations and functions of the pins are defined with the help of this software. Once all the operations are defined then this code is burned to the Arduino board.

3.2 BLUETOOTH DEVICE

In the modern world, wireless communications have made communications much faster, secure, and simpler. As compared to previous times they consume very less space and energy. There are two modes of wireless communications which are widely used these days are wifi and Bluetooth. Bluetooth was found in the early 90's and is still widely used today. On the other hand, WIFI being found around 10 years later has still found its use in various technological applications. Both the models have their own advantages and disadvantages.

Bluetooth is generally used for short range communications of about 10m to 400m and places where the connection is needed only between 2 devices. Wifi covers a very large area from meters to kilometers and can be used to connect multiple devices. We have used Bluetooth as a mode of communication in this project.

The module used is HC-05 Bluetooth module. It works on Bluetooth serial-port protocol. HC-05 is MASTER/SLAVE module and by default, it works as a SLAVE. Here MASTER means host and SLAVE means device. HC-05 works in the 2.4 GHz band and default serial communications takes place at 9600 baud rate. HC-05 covers a range of around 10m.

Fig .3. HC-05 Bluetooth module

From figure.3. We can notice there are 6 pins in this module. Each pin serves a different purpose. 1st pin state helps us to define the state of the module i.e. whether the module is paired with some device or not. 2nd and 3rd pin are RX and TX pins which are used for UART interface communications. The 4th pin is used for grounding. The 5th pin is used to provide input volt which has an operating voltage range of about 3.3V-5V.

Table -1: Some of the basic AT commands

Name of the command	Command	Response
Test	AT	OK
Reset	AT+RESET	OK
Get the soft version	AT+VERSION ? +	+VERSION: <parameter>OK
Restore default status	AT+ORGL	OK
Get module Bluetooth address	AT+ADDR?	+ADDR:<parameter>OK
Set/ inquire device's name	AT+NAME=<parameter>	OK
	AT+NAME?	+NAME:<parameter>OK

3.3 SENSORS

Sensors have been in use since people started experimenting and discovering various new things. Sensors help us to record, analyze and understand everything happening around us. There are many types of sensors available to us and each sensor being used for a specific purpose. In this proposal, I have used 3 basic sensors and they are temperature sensor, light sensor and PIR or motion sensor.

3.3.1 Light Sensor

The light sensor used here is called Light Dependent Resistor (LDR) or a Photoresistor. This sensor is kind of a variable resistor whose value depends on the intensity of light. The sensor is made of semiconductors. If the intensity of light falling on the LDR is low then the resistance is very high in terms of Mega ohms, thus conduction decreases. If the intensity of the light is very high then the resistance decreases and conduction increases.

3.3.2 TEMPERATURE SENSOR

Temperature sensors are normally used to read surrounding temperature conditions. In this proposal, we have used an LM35 temperature sensor. It is a temperature sensor which provides an output as an analog value. This sensor can sense the temperature in the range of -55° C to 150° C. the output voltage is linearly proportional to the temperature value at $10mV/C^o$ providing a total output voltage in the range of -550mV to 1500mV.This sensed analog value is later converted into a digital form using A/D converter. ATMEGA 328 has one inbuilt A/D converter.

3.3.3 MOTION SENSORS

Motion sensors are used to detect the presence of any living being. This type of sensor is used mainly for security enhancement and motion detection. In this proposal, we have used a Passive infrared sensor (PIR). This sensor uses infrared beams to detect the presence of an object. PIR measures the IR beams emitted by objects to identify their presence. This sensor only detects IR beams and not the heat emitted by objects.

4.0 Android Smartphone

Smart phones are widely popular these days because they are easy to operate. This phone provides many features which were not available few years ago. We are going to use some of these features to give commands and monitor electrical appliance conditions. Bluetooth feature of the smart phone is used to connect with the Arduino board for interfacing.

4. WORKING PROCEDURE

Initially, we need to install Bluetooth control application on our smart phone from the pre-developed apps store or we can design our own app too. Then we connect it to our HC-05 Bluetooth module and decide our commands.
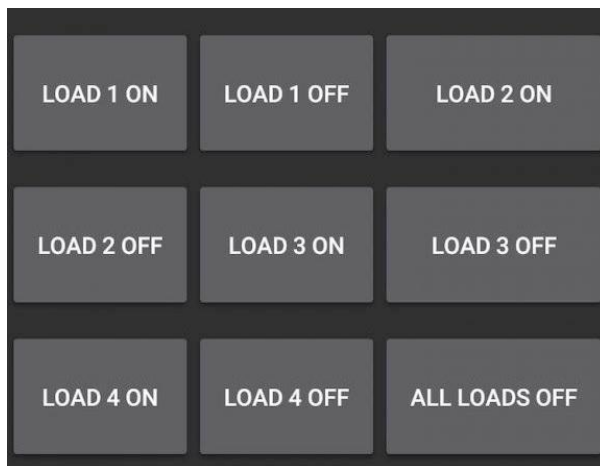
Fig .4. Bluetooth application screenshot

The sensors which are connected to our Arduino board senses surrounding data and provide the input. In the next step, this data is processed by Arduino board and sends commands to switch on or off a particular device or whether to increase or decrease the speed of fan and intensity of light bulb. Bluetooth module is connected to our smart phone via Bluetooth which is used to communicate with Arduino board.

The main purpose to use a PIR sensor is to detect in which part of the room is a person sitting and to only switch on devices near them keeping rest of the devices switched off. This sensor is useful in those places where false roofs are installed so that only particular lights are switched on.

Here, Bluetooth module acts as a master controller, for example, if there is no one present in a room and the temperature is very high, you can still switch off the fan using your smart phone. The advantage of keeping sensors is that if you are sitting in a room and the room temperature decreases, if you want to switch off the fan, you don't need to use your Smartphone for that, the sensor will automatically give the command to switch off the fan. This saves time and electricity.

5. CONCLUSIONS

The main aim of this proposal is to help physically challenged and old people for their day to day activities. This project not only achieves the target of modernizing homes but also helps us to save energy and time as well. Here I have used all the products that are low cost, simple to handle and are easily available. This project is just a prototype and further improvements can be made for industrial applications.

6. FUTURE DEVELOPMENTS

- WIFI module can be used instead of Bluetooth to increase range.
- With wifi modules, appliances can be monitored and controlled over the internet.
- More sophisticated devices can be connected and used.

REFERENCES

1. Shiu Kumar, Seong Ro Lee, "Android based smart home system with control via Bluetooth and internet connectivity", in IEEE 18th International Symposium on Consumer Electronics, 2014, pp. 1-2.
2. R. Piyare and M. Tazil, "Bluetooth based home automation system using cell phone", in IEEE 15th International Symposium on Consumer Electronics, Singapore, 2011, pp. 192-195.
3. Aadel Howedi, Ali Jwadi, "Design and Implementation prototype of a smart house system at low cost and multi-functional ", in Future technologies conference, 2016, pp. 876-884.

4. Kashif Nisar, Ag. Asri Ag. Ibrahim, Lifen Wu, Abzetdin Adamov, M. Jamal Deen, "Smart home for elderly living using wireless sensor networks and an Android networks", IEEE 10th Internation conference on Application of Information and Communicational Technologies, 2016, pp.1-8.

5. N. Srikanthan and Tan Karand, "Bluetooth based Home Automation system", Journal of Microprocessors and Microsystems, vol.26, pp. 281-289, 2002.