A Bluetooth Based Sophisticated Home Automation System Using Smartphone: An IOT Based Project

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Abstract: *This paper incorporates a low cost smart home automation system which is powered by Arduino(microcontroller).In this paper a Bluetooth module has been used to access the devices so as to eliminate the use of external computers.Using this system we can operate our everyday devices like fan,lights,DC servomotors etc.Here we have incorporated all the above mentioned devices in a single system and demonstrated the dependability,possibilities that could be achieved via this system.The system that we have designed is thoroughly tried and tested and it's capable of running and performing the desired task which includes regulating the operation of the lights , fans, motors attached to the system even controlling the intensity of light(using voltage regulations) and the speed of the fan .*

Keywords: Arduino; Bluetooth module; Home Automation; Smartphone

1. Introduction

The recent development of mobiles (smart phones), the demand is ever increasing and because of its' many-fold functionalities and most enhanced technologies, advanced mobiles applications are very much in demand. With the hustle and bustle of today's generation, sometimes it may the case that we forget to switch off various home appliances or not sure about whether the devices are off or on. Sometimes, it is also desirable for individuals to turn on or off few devices such as lights, fans etc. to get a comfortable, pleasant atmosphere immediately after going back home. Individual with physical disability may also wish to control the appliances by voice recognition system. With the familiarization of Smartphone, android app and other technologies, it is now possible to practically implement all the needed functions in a home automation system.

An internet based home automation system focuses on controlling home electronic devices irrespective of whether someone is inside or outside of the house. The words devices and appliances have been utilized in this paper interchangeably. Automation refers to devices are being controlled automatically.

The basic operation of a home automation system till now was focused on the task of turning ON/OFF different appliances either remotely or in close proximity. Technological enhancement has permitted to use Bluetooth or Wi-Fi technology to connect different appliances in a home automation system. In earlier days, Home Automation System was controlled Remotely Using telephone sets and telephone network. A wireless LAN based home automation system which transmits video data and can control variety of appliances wisely using TCP/IP technology along with anti-theft alarming system with DTMF technology were developed. Users can view the status of their family and home with this added functionality by accessing the network through its' own website. Researchers found an interesting idea of utilizing this mobile technology with the invention of mobile technology within the home automation system. A home automation system based on SMS (Short Message Service) technology was developed. Using a GSM modem and the modem as the interface between the user and the home automation system. Information was exchanged by SMS. The systems were precisely and quickly controlled by the microcontroller that has been incorporated in between the modem and sensors. Home automation control using remote, has thus been developed. But these technologies have their own merits and demerits. The main demerit of remote controlled system is that the range of operation is low and it cannot be controlled from outside. DTMF and mobile phone based system has eliminated this problem but there has been an additional increase of costing as modern DTMF based system requires two mobile handsets (one for receiving and one for calling) and there will be call charges imposed from the service provider for each call. Bluetooth and later on Wi-Fi technology have replaced the older technologies and occupied the market of home automation system as these two technologies has completely eliminated the drawbacks of the previous systems. Bluetooth technology is cost effective in comparison with the Wi-Fi based system as it works offline. But if we incorporate Bluetooth technology, the operating range of controlling various devices is wide (many ranges are available), yet it has it's limitation i.e. the system cannot be controlled from anywhere. Whereas, internet based system can be controlled form anywhere we want. Automation has become an integral part of our daily life. Not only the task of turning the devices ON/OFF but now various devices which are in close proximity can be controlled and regulated with the advancement of home automation technology.

2. System Design

Designer is therefore, capable of using his/her all focus on the main parts of the project without worrying about the side problems.
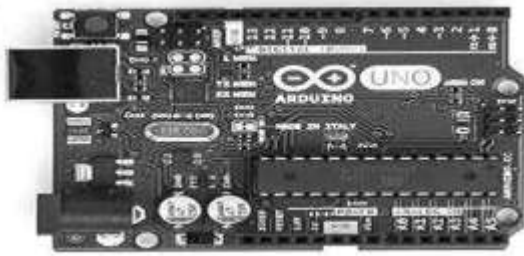
Figure 1: Arduino Uno

Fig. 1 shows an Arduino Uno microcontroller, having 14 digital input/output pins. The HC-05 Bluetooth Module has been used for wireless communication. The Bluetooth module can work in two modes: Master and Slave. HC-05 Bluetooth Module has six pins- V $_{cc}$, GND, RX, TX, Key, and LED.

As the connection of the Bluetooth module is established, it can communicate data. The module has a factory set pin of "1234" which is used to pair the module to a phone.Ardudoid is an app to control Arduino Uno to Android phone via the Bluetooth HC- 05 module.

The greatest advantage of Arduino is its ready to use feature. Arduino comes with the 5V regulator, a micro-controller, a serial communication interface. The designer just need to plug the Arduino microcontroller into USB port of the computer and that will serve the purpose of making a connection in between the Arduino and Computer to write program and upload it inside Arduino.

Another advantage of Arduino is that, the Arduino website is a well-designed, easy to use tool which serves as an Encyclopedia to the novice designers in this domain. The language of Arduino is of a higher level programming language formed by blending it with C language. It's a user friendly language and is easy to understand and use. Arduino also gives designers flexibility to use the readymade programs by downloading them from the Arduino official website and then transferring them inside Arduino ,for making clones of already designed and implemented systems according to the need of the user.Advantage of Arduino also include automatic unit conversion capability. That's why, during debugging we don't have to worry about the units conversions.
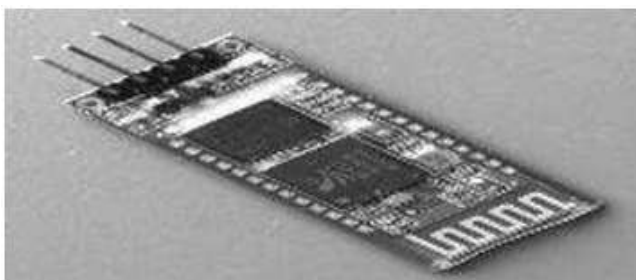

Figure 2: Bluetooth Module

Fig. 2 represents the figure of the Bluetooth module utilized in this project. If the module is set to the slave mode, it cannot initiate a connection to another Bluetooth devices rather than the intended Smartphone, but can accept connections. When it is in master mode, the module caninitiate a connection to other devices. The module contains 2 parts, the back plane and the main Bluetooth board.

The implemented system operates in slave mode. The system can thus be connected to Arduino with mobile smart-phone directly.

A number of LEDs along with one servomotor and a dc motor connected can be accessed and controlled via smart-phone with fast response. Various signals can be generated by Arduino and the intensity of the LEDs, Position of DC Servo motor and the speed of DC motor can be controlled.
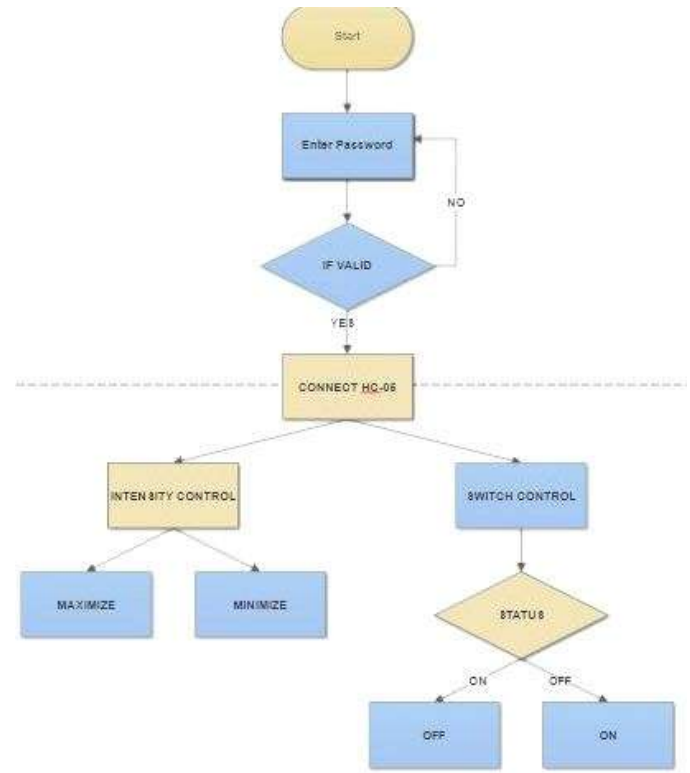
Figure 3: Flowchart of the system

Relay-A relay can be defined as an electrically operated switching system. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.

3. Methodology

The system mainly consists of two hardware components: the cell phone and the Arduino board. An off-the-shelf Arduino is an 8-bit microcontroller board based on the ATmega168 and the HC-05 Bluetooth module is used. It supports wireless serial communication over Bluetooth. Programming can be done in the Arduino BT board wirelessly over the Bluetooth connection using the microcontroller's C language. The packets sent from the cell phone are picked up by the Arduino board. These packets having the appliance status commands are pipelined through microcontroller. Home appliances are then connected to the digital ports of the Arduino board via relays to provide sufficiently high voltage and current compatibility. For test purposes, 20W, 230V lamps have been used.

4. Results

In this project implementation of a wireless and cheap solution to the home automation is introduced. First the bluetooth of the mobile smart phone is connected to the HC-05 module of the Arduino. The app is then opened and the connection is established. As the switch on option is clicked the output bulb connected to the Arduino is switched on. Accordingly as the switch off option is selected the output blub is turned off.

Figure 5: App screen from where the appliances are controlled

5. Conclusion

In this paper implementation of a wireless and cheap solution to the home automation is introduced. The system is secured for access from any user or intruder. The pairing password for the Arduino BT and the cell phone to access the home appliances adds a protection from unauthorized users. This system can be used as a test bed for any appliances that requires on-off switching applications without any internet connection.

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