# Home Automation via Bluetooth using Android Application

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## Abstract

*The past decade has seen great improvement in the field of consumer electronics. Various "brilliant" appliances such as mobile phone, air conditioners, home security devices, etc., are set to realize the advancement of a smart home. In today's world, each and every people have smart phones with them at every moment of time. So it makes sense to use these to control home appliances. In home automation system by using a simple Android app, one can control any home appliances with single clicks. Commands are sent via Bluetooth to Arduino Uno. So you need not get up to switch on or switch off the device while watching a movie or doing some work. These appliances have already given rise to a Personal Area Network in home environment, where all these appliances can be interconnected and monitored using a single controller. Home automation is all about introducing a computerized or automatic control to certain electronics and electrical systems in any building. This paper represents the design and implementation of reliable, compact and low cost android based smart phone home automation system. In this case password protection is also being used to only allow authorized users from accessing the appliances at home.*

## 1. Introduction

In spite of the fact that home automation today is not a new thing but most advanced home automation systems in existence today require a big and high priced change of infrastructure. This means that it often is not feasible to install a home automation system in an existing building. In the smart phone application the user can select actions what should happen with electrical and/or electronic devices in the network. Some issues also arrived while designing home automation system like the system should be scalable so as to integrate new devices easily, it should provide user friendly interface and more importantly the system should be cost effective. Before this automation many studies were carried out like telephone and PIC based remote control automation proposed by Yavuz and Hasan to control home appliances like air
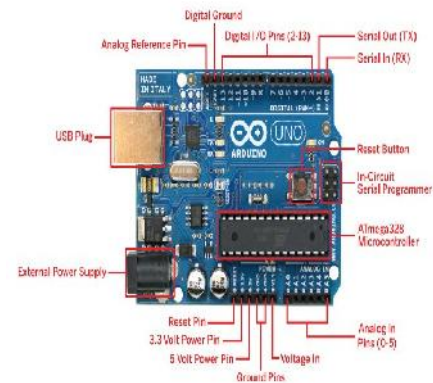
conditioner and computer by telephone, Java based home automation system by Al-Ali and Al-Rousan without highlighting the low levels details of peripherals to be attached, home automation system by Sriskanthan that control home appliances from PC using Bluetooth which cannot be controlled by cell phone, and many more.

In this paper we present a very low cost cell phone based, reliable and flexible home automation system. Appliances are connected to the microcontroller where a Bluetooth module is also implemented. The communication between the cell phone and microcontroller is wireless. Further devices can also be connected into the system with little modification.

### 1.1 Arduino Board

Arduino Uno is a microcontroller board based on the AT mega 328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. By associating it to a computer with a USB cable or power with an AC-to-DC adapter or battery it get started. We can tinker with UNO without worrying too much about doing something wrong. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.6.12 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. At present Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.

### Programming

The Arduino Uno is programmable device which can be programmed with the (Arduino Software (IDE 1.6.12)). Select "Arduino Uno from the Tools > Board menu.

The ATmega 328P on the Arduino Uno is programmed with a boot loader that allows to upload the new code to it without the use of an external hardware program. It communicates using the original STK500 protocol. ISO can bypass the boot loader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instruction for details.
The ATmega16U2 firmware source code is available in the Arduino repository and is loaded with a DFU boot loader, which can be activated by:
- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resting the 8U2.
- On Rev2 or laser boards: there is a resistor that pulls the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

*Power to Arduino*

The Arduino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and VIN pin headers of the POWER connector. The Arduino Board can be operated on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If voltage supply is more than 12V, the voltage regulator gets overheated and damages the board. The recommended range is 7 to 12 volts.
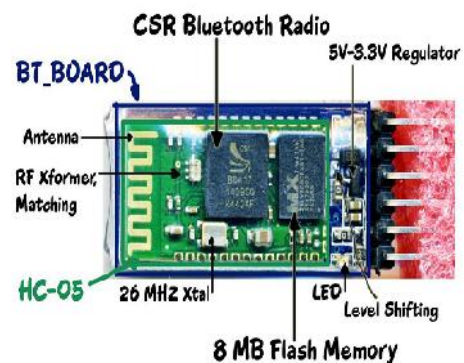
The power pins are as follows:
- VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). If supplying voltage through this pin, or, if supplying voltage via the power jack, then accessing is done through this pin.
- 5V: This pin outputs a regulated on the board. The Arduino Uno board supplies powers either from the USB connector (5V), or the VIN pin of the board (7-12V).
- Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- 3V3: A 3.3-volt supply generated by the on-board regulator maximum current draw is 50Ma.
- GND: Ground pins.
- IOREF: This pin on the Arduino board provides the voltage reference with which the microcontroller operates. A proper configuration mod shield can read the IOREF pin voltage and then select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

## 1.2 Bluetooth Module

Bluetooth is a wireless communication technology used for exchange of data over short distances. It is found in many devices ranging from mobile phone and computers. Bluetooth is a combination of both hardware and software. It is intended to create a personal area networks (PAN) over short range It uses a radio technology called frequency hopping spread spectrum. Bluetooth adaptive frequency hopping (AFH) was designed to decrease the interference between wireless technologies which shares 2.4GHz spectrum. This adaptive hopping among 79 frequencies at 1 MHz intervals gives high degree interference immunity. Thus the Bluetooth divides the data that need to be transmitted into packets and each packet are transmitted on one of 70 designated Bluetooth channels. The bandwidth of each channel is 1 MHz. It is a packet based protocol with a master slave structure. Each member can communicate with up to 7 Slaves in a Piconet. The range of Bluetooth depends upon the class of radio using.
- Class 3 radios have range up to meter or 3 feet.
- Class 2 radios have range of 10 meters or 33 feet.

- Class 1 radios have range of 100 meters or 300 feet.

The most commonly used radio in class 2. This new wireless technology connects devices such as mobile phones, hands free headsets, MP3 players, PDAs, digital cameras, wireless game controllers, computers and printers. By embedding Bluetooth chips and receivers into devices, the need for cables is eliminated.

*Advantages*
The biggest advantage of using this technology is that there are no cables or wires required for the transfer of data over short ranges. Bluetooth technology consumes less power when compared with other wireless communication technologies. For example Bluetooth technology using class 2 radio uses power of 2.5 mW. As it is using frequency hopping spread spectrum radio technology there is less prone to interference of data if the other device also operates in the same frequency range. Bluetooth doesn't require clear line of sight between the synced devices. Other favorite advantages of Bluetooth include the ability to transmit both data and voice communication and the ability to send to more than one device at a time. Other advantages include:

- Automatic setup of devices.
- Economic wireless solution for data and voice.
- Low consumption of power which ensures that battery operated will last much longer between charges.
- Global acceptances with users being able to connect to other Bluetooth enabled devices almost everywhere in the world.
- It can pass through walls.
- It has range better than infrared communication.
- It uses FHSS and hence data communication is more secure.
- Bluetooth devices are available at very cheap coast.
- It creates ad-hoc connection immediately without any wires. Connection establishment is very quick. User only needs to pair the Bluetooth PAN connection between two devices.
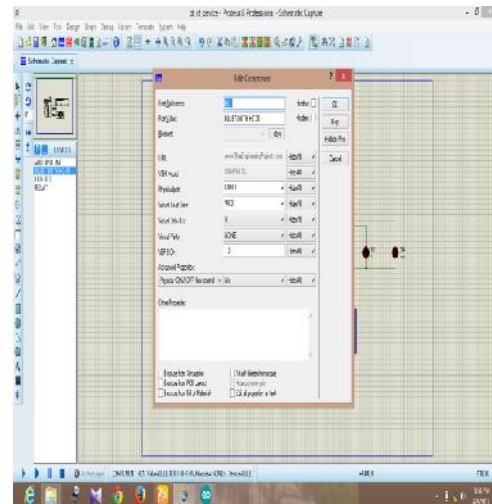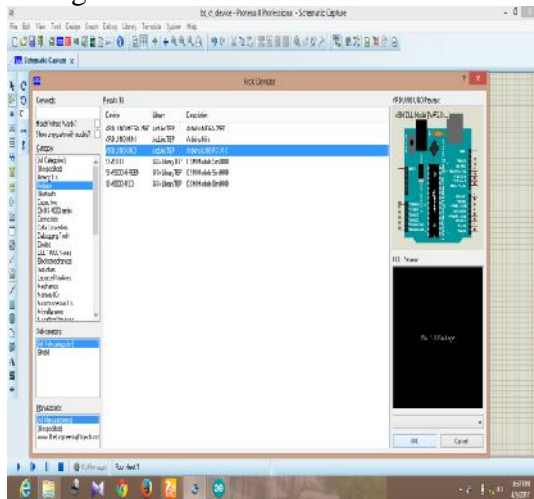
## 2. Literature Survey
Here is presented a design of home automation using android ADK, which is based on a standalone embedded system board Android ADK (Accessory Development Kit) using Arduino Uno. It can control the appliances directly from the android phone by sending a signal through Bluetooth. There are other model in which a model of Home Automation Systems (HAS). It can control the overall appliances in a room. In this project of "Home automation using Arduino Uno" the system interface is established through Bluetooth. Users can control and monitor home appliances simply by an Android application installed on mobile phone. It is irrespective of their location with relatively low cost design, user-friendly interface. With the further improvement in the app one can introduce a smart home system which could supervise household appliances remotely and realize real-time monitoring of home appliances status through mobile phone. The project describes the Arduino Uno and android based home automation system for easy and conveniently control home appliances. Bluetooth, Arduino Uno, 5v relay module are the available feature. Based on all the system surveyed, is identified as ideal system for home automation using Smartphone.
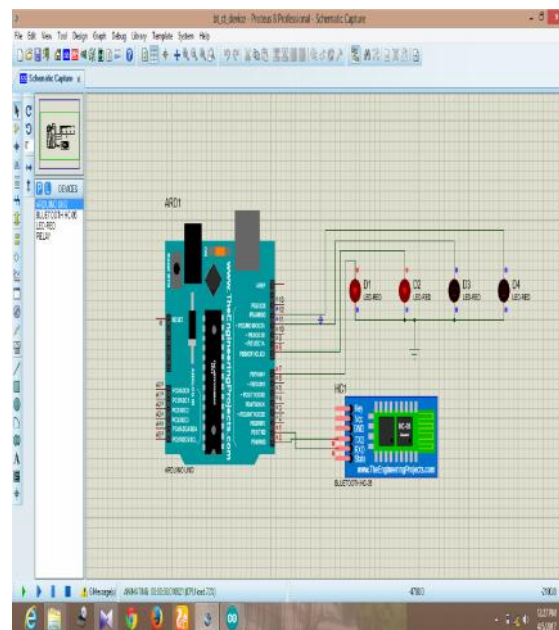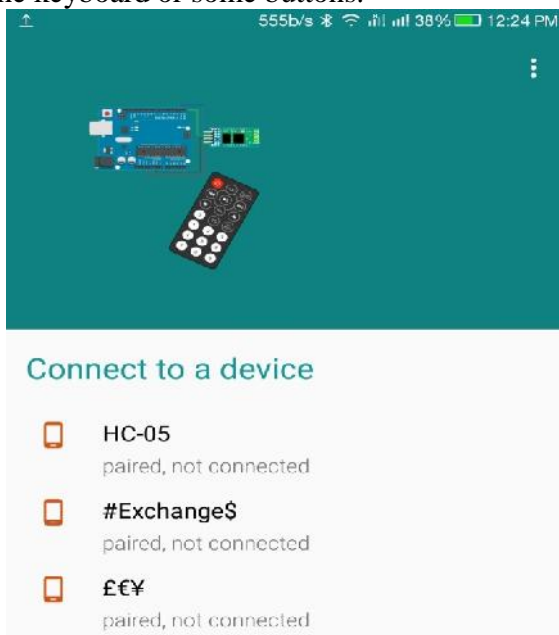
### 3. Software Implementation

Open Arduino IDE and compile the program (sketch). Upload the sketch (homcautomation.ino) to Arduino board. Switch on the power supply to Arduino by connecting it to 12V power source. Pair Bluetooth module with the Android phone. Type password '1234' (default password) of the Bluetooth module. Click Bluetooth image on the app to connect it with the Bluetooth module. It automatically connects and displays as connected in the app. The screenshot of the app is shown in the figure.



### 4. Result and Discussion

After the construction and testing part comes the result. After testing several times results were accurate. By touching a particular icon one was able to turn ON or OFF the desired appliance according to its previous state. Android device is a remote control for any microcontroller with a Bluetooth module. Run the app, search for your Bluetooth module and connect. Once the Bluetooth is connected, one will be able to send its own instructions to the Arduino board using the keyboard or some buttons.

## 5. Conclusion

This project gives us an idea of programming an Arduino Uno, Bluetooth module. This project has based on designing and implementation to control the home appliances using automated system. Electrical appliances like fan, bulb, TV are common in all houses. But turning it ON or OFF repeatedly gives a lot of pain. It includes going to the physical switch and turning it OFF. By using this project, one can save time and energy by just clicking the icon on smartphone to turn an appliance ON or OFF. Also by this project, important work will not be disturbed. This project can be used anywhere either at home or office. Since the app is made by an amateur team, this App can be modified and extended to show much more details in the App. Through the app one can easily control the appliances of a house. And instead of Bluetooth technology one can use the Wi-Fi technology to increase the range and speed. Motion sensors can be used to automatically turn on or off any electrical devices. The app can be notified by implementing speech recognition voice control to control the appliances with voice commands. This makes the system more secure.

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