# Home Automation Using Android and Bluetooth

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Abstract: ***This project aims at achieving automation using the widely used mobile operating system ANDROID i.e. android operating system. The electrical and home appliances can be controlled using the android mobile phones and Bluetooth Wireless Communication Protocol even if you are out of your house and you forgot to switch off the appliances. many electrical and home appliances like light, fan, refrigerators e.t.c can be controlled using the android operating system. this can also be implemented at workplaces. Home automation is the residential extension of building automation. It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.***

**Keywords:** Bluetooth sheild, Aurdino With Atmega328, ARMController, AOS

## 1. Introduction

Android is the customizable, easy-to-use operating system that powers more than a billion devices across the globe – from phones and tablets to watches, TV, cars and more to come. Android is built on the open Linux Kernel. Furthermore, it utilizes a custom virtual machine that was designed to optimize memory and hardware resources in a mobile environment.

Android is open source; it can be liberally extended to incorporate new cutting edge technologies as they emerge. The platform will continue to evolve as the developer community works together to build innovative mobile applications[1]. Android breaks down the barriers to building new and innovative applications. Android provides access to a wide range of useful libraries and tools that can be used to build rich applications.

Google's argument is that Android is open because the code is opened to all, because Google doesn't charge for the platform, and because developers have access to it all. The only restriction is on Google services, for which the company demands that phone makers conform to certain specifications. Google's take on Android is that they make it as open as possible.

### 1.1 Theme of the Project

To control the electrical and home appliances using the android operating system and Bluetooth application. Home appliances are controlled by using Bluetooth,Arduino controller board, relays.

### 1.2Literature Survey

### 1.2.1 Development

Google provides major updates, incremental in nature, to Android every six to nine months, which most devices are capable of receiving over the air. The latest major update is Android 4.4 Kit Kat. Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high-tech devices[2] Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users[3].

### 1.2.2 Licensing

Even though the software is open-source, device manufacturers cannot use Google's Android trademark unless Google certifies that the device complies with their Compatibility Definition Document (CDD). Devices must also meet this definition to be eligible to license Google's closed-source applications, including Google Play. In recent versions of Android, Google has also stopped maintaining the open source versions of certain stock Android apps (including Calendar, Music, and Search), in favor of moving further enhancements and primary development to closed-source variants such as Google Calendar and Google Play Music. At the same time, Google Play Services inherits and introduces development APIs which are also proprietary.

Typically Google collaborates with a hardware manufacturer to produce a "flagship" device (part of the Google Nexus series) featuring the new version of Android, then makes the source code available after that device has been released.

### 1.2.3 Memory efficiency

Android takes an interesting approach. Instead of serializing your entire process image, you essentially serialize only the critical parts of your application. In general, the parts of your application the system serializes is the state information and navigation information. If the system agrees to parcel up your state information, then it can just recreate your Views and reset their state to how they were when your process was killed to reclaim memory. It's a pretty good compromise because it forces good application design and prevents thrashing. Android memory management unit plays vital role in great success of android among other operating systems. Android contains modified Linux kernel[4]. for handling low memory scenarios and other issues. This report gives brief details on both linux, android memory management systems.

### 1.2.4 Android is Open Source

Android is open because the code is opened to all, because Google doesn't charge for the platform, and because developers have access to it all. The only restriction is on Google services, for which the company demands that phone makers conform to certain specifications.

Google's take on Android is that they make it as open as possible. Dianne Hackborn, a tech lead on Android at Google who has worked on Android since its early days, recently commented at length on Android development, openness.

### 1.2.5 Android Market

Android market share varies by location. In July 2012, Android's market share in the United States was 52%, and rose to 90% in China. During the third quarter of 2012, Android's worldwide Smartphone market share was 75%, with 750 million devices activated in total and 1.5 million activations per day. As of March 2013, Android's share of the global Smartphone market, led by Samsung products, was 64%. The Kantar market research company reported that Google's platform accounted for over 70% of all Smartphone device sales in China during this period and that Samsung's loyalty rate in Britain (59%) is second to that of Apple (79%). As of November 2013, Android's share of the Smartphone market is said to have reached 80%. Indeed, during August, September, and October 2013, no less than 261.1 million Smartphone were sold overall, with about 211 million Smartphone running Google's operating system[5].

### 1.2.6 Privacy of the software

Android applications run in a sandbox, an isolated area of the system that does not have access to the rest of the system's resources, unless access permissions are explicitly granted by the user when the application is installed. Before installing an application, the Play Store displays all required permissions: a game may need to enable vibration or save data to an SD card, for example, but should not need to read SMS messages or access the phonebook. After reviewing these permissions, the user can choose to accept or refuse them, installing the application only if they accept. The sandboxing and permissions system lessens the impact of vulnerabilities and bugs in applications, but developer confusion and limited documentation has resulted in applications routinely requesting unnecessary permissions, reducing its effectiveness.

### 1.2.7 Advantages

1) The open-source nature of Android allows security contractors to take existing devices and adapt them for highly secure uses.
2) The source code for Android is available under free and open-source software licenses.
3) Bluetooth controlled industrial devices using Android mobile is automatic versatile system.
4) Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users or bring Android to devices which were officially, released running other operating systems. The operating system's success has made it a target for patent litigation as part of the so-called " smartphone wars" between technology companies[6].

## 2. ARM – Basic Hardware

The ARM architecture is the primary hardware environment for most mobile device operating systems such as Android, iOS, Windows Phone, Windows RT, and Bada, Blackberry OS/Blackberry 10, Firefox OS, MeeGo, Tizen, Ubuntu Touch, Sailfish and web OS. There is support for x86 from android-x86 project and Google TV uses a special x86 version of Android.

**Figure 1:** ARM Desktop Operating System

The market defining ARM[7] Cortex®-A 32-bit and 64-bit processors are at the heart of the mobile application processors. ARM Mali™ graphics and video processors are delivering the most power efficient and visually stunning user experiences on the latest high resolution displays. ARM big. LITTLE™ technology enables maximum processing performance whilst maximizing the battery life, bringing the most energy efficient mobile devices to the market today.Under the hood you will find ARM Cortex-R real time processors enabling the LTE-Advanced mobile internet and ARM Cortex-M deeply embedded ultra-low energy processors are powering applications such as WiFi, Bluetooth LE and touch screen controllers.

ARM licenses its market leading mobile IP to the world's leading semiconductor companies. ARM's business model drives diversity in products spanning all markets; from high end premium devices, mid-tier mainstream, emerging entry level as well as the new and fast emerging wearable segment. Since the majority of smartphone, tablets and wearables run on the ARM architecture it brings the most widely adopted standard in processors maximizing software compatibility across all major mobile operating systems such as Android™, Android Wear, Chrome OS, Windows Phone and Firefox OS to name but a few.

## 3. System Modelling

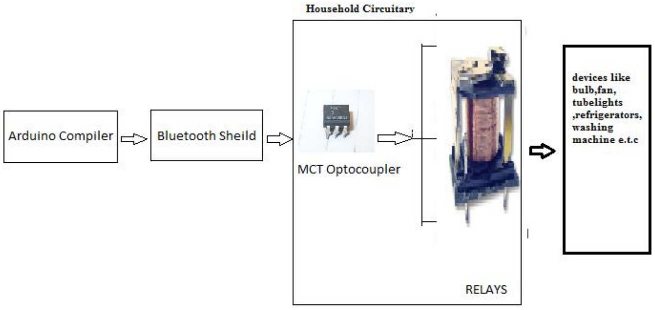


**Figure 2:** System Modelling Block Diagram

The concept of the project is simple whenever bluetooth connection is established the transmitter and receiver device are ready to perform according to the commands of the user .microcontroller receives the command through the RX pin and matches with the given programming code of the compiler and passes the appropriate command to the optocoupler.

Project is divided into following parts

- Android Mobile(Android Operating System)
- Arduino Controller Board and compiler
- Bluetooth Shield
- Relays
- MCT 6 Optocoupler

### 3.1 Android Mobile( Operating System)(AOS)

**Figure 3:** Andoid Mobile

Android is an intent based operating system. What this means from a user's perspective is a richer more deeply integrated experience. If I am browsing the web and click on a link to a product on Amazon.com, the context will switch and the product will be opened in the Amazon app. On iOS, clicking that link would just result in the link being opened in the browser (often times losing the context of the originating application). Android allows apps to have a deeper and more natural hook into the operating system and user experience. For example, in the coming years, when Google Voice finally gets a true VOIP client, it will be able to seamlessly replace the default calling application.

**Bluetooth low energy** (**Bluetooth LE**, **BLE**, marketed as **Bluetooth Smart[8]**) is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, beacons[9] security, and home entertainment industries[10] Compared to Classic Bluetooth, Bluetooth Smart is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range.When the Bluetooth is activated on the mobile it will get connected to the relay switch.

### 3.2 Arduino with ATMEGA328

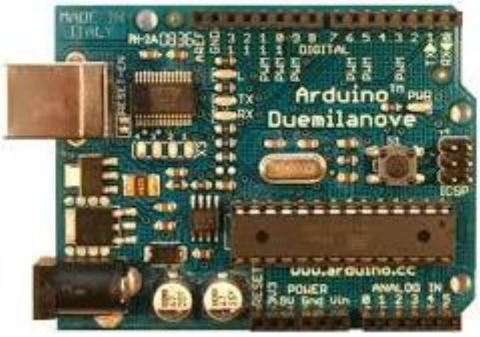


**Figure 4:** Arduino Controller

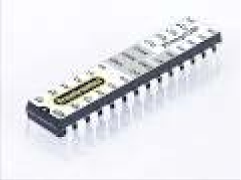


**Figure 5:** ATMEGA 328

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital devices and interactive objects that can sense and control the physical world [11]. In this project the microcontroller used for programming is the arduino compiler whose coding is done in embedded C programming language.

The high-performance Atmel 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts,serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts

The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE)[12] based on the Processing project

Arduino boards are available commercially in preassembled form, or as do-it-yourself kits. The hardware design specifications are openly available, allowing the Arduino boards to be manufactured by anyone. Adafruit Industries estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced[13] and in 2013 that 700,000 official boards were in users' hands[14].

### 3.3 Switching Relay

**Figure 6:** Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching.

In this project the relay have been used to control the 230V power supply of household when connected with the Bluetooth app.

### 3.4 Bluetooth shield

The Bluetooth Shield integrates a Serial Bluetooth module. It can be easily used with Arduino for transparent wireless serial communication.

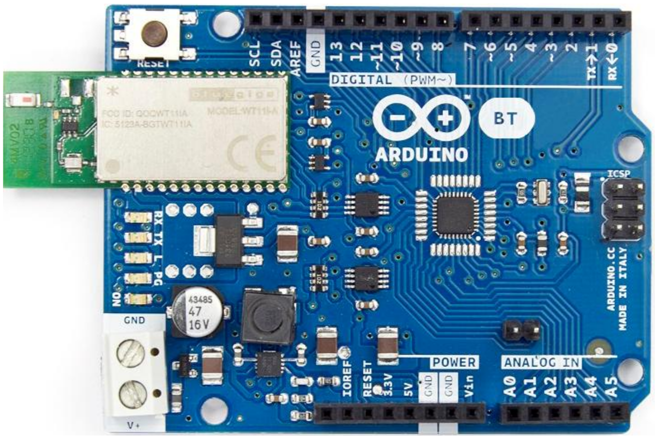


**Figure 7:** Arduino Bluetooth front

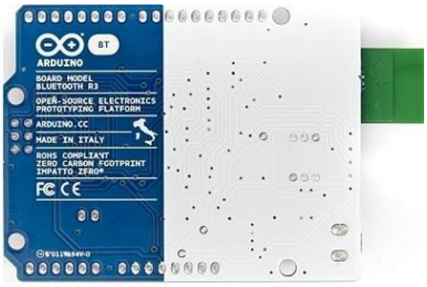
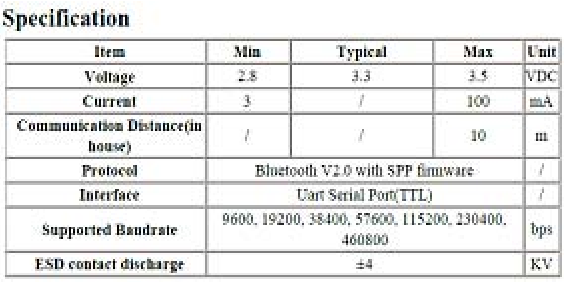


**Figure 8:** Arduino bluetooth back



Specification

| Item | Min | Typical | Max | Unit |
|---|---|---|---|---|
| Voltage | 2.8 | 3.3 | 3.5 | VDC |
| Current | 3 | / | 100 | mA |
| Communication Distance(in house) | / | / | 10 | m |
| Protocol | Bluetooth V2.0 with SPP firmware | | | / |
| Interface | Uart Serial Port(TTL) | | | / |
| Supported Baudrate | 9600, 19200, 38400, 57600, 115200, 230400, 460800 | | | bps |
| ESD contact discharge | ±4 | | | KV |

### 3.5 MCT Optocoupler

**Figure 9:** Optocoupler

It is a small device that allows the transmission of a signal between parts of a circuit while keeping those two parts electrically isolated. Inside our typical optocoupler are two things – an LED and a phototransistor. When a current runs through the LED, it switches on – at which point the phototransitor detects the light and allows another current to flow through it. And then when the LED is off, current cannot flow through the phototransistor. All the while the two currents are completely electrically isolated (when operated within their stated parameters . The MCT6 is especially designed for driving medium-speed logic, where it may be used to eliminate troublesome ground loop and noise problems.

## 4. Conclusions

“Bluetooth controlled industrial devices using Android mobile” was a project based on microcontroller, due to which hardware requirement is reduced. Embarking of this project has helped us in developing a team spirit, patience and time management necessary for today's technical professionals. Hence we can conclude that the required goals and objectives of our project have been achieved.

It provides the flexibility & system reliability with low cost as well as less maintenance. It provides remote access to the system to deliver service at any time of the day. With this system, we can control as well as monitor the devices at

remote location. This project can also be used for following applications:
1) Industrial automation
2) Farm Automation

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