

# SMART HUB FOR DOMESTIC EQUIPMENTS

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**Abstract:** Home automation systems have gained popularity in recent years, paralleling the advances in the concept of the Internet of Things. The current project presents the implementation of an inexpensive home automation system, within the framework of assistive technology. The system implementation is based on the Arduino microcontroller, with Bluetooth communications capability, and it is designed for use by the elderly and people with disabilities. The system is user-friendly, with an intuitive interface implemented on an Android- based smart phone. Demonstrations show that the system facilitates control of home appliances, lights, heating, cooling systems and security devices by the intended users.

**Keywords:** Home Automation, Arduino microcontroller, Bluetooth.

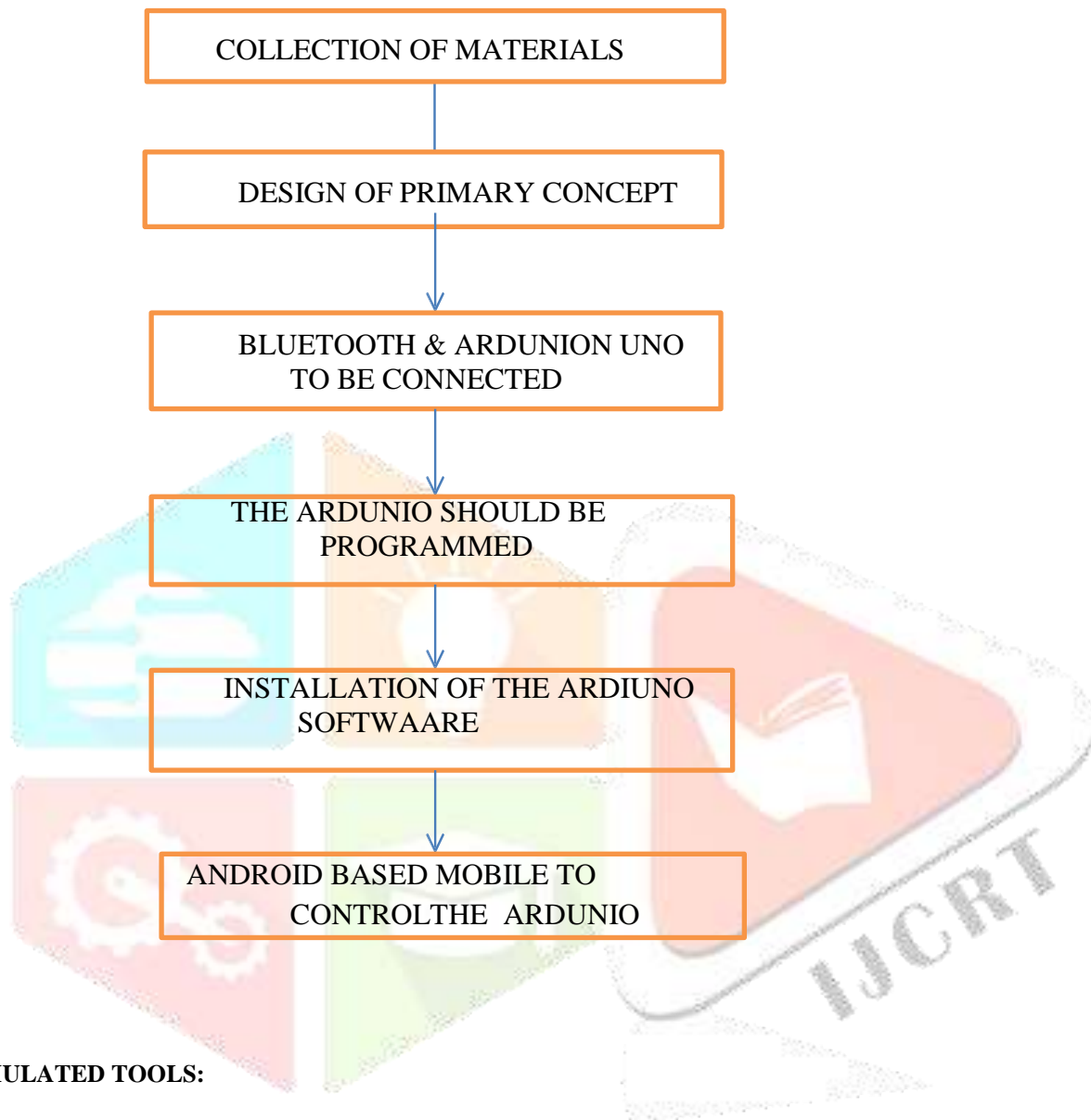
## 1.INTRODUCTION:

The widespread use of home automation can be seen in cold cities such as Milwaukee, where people set the heating of the house to go off when they leave and switch on the heater 15 minutes before they return. The system is known as HVAC and is the best option for home automation.

In an era with wireless technology such as Bluetooth, WiFi, Zigbee, and GSM, users want home appliances to be connected wirelessly. Each of these wireless technologies has its own connotation and stipulation. This project lucratively uses Bluetooth with an available frequency of 2400 Hz, a range of 100 meters, and a speed of approximately 3 Mbps.

There are a few concerns to be addressed when designing a home automation system. The system should be designed in a manner that integrates new devices, so that these devices should not be a problem at a later stage. On the host side, the system should be comprehensible, so that the devices can be monitored and controlled easily. In case of any problems in the future, the interface of the system should provide diagnostic services. As a final point, the system should be money-spinning so that it can be extensively used by any person in the market.

## I. PROJECT FLOW



### ACCMULATED TOOLS:

1. Arduino-Uno
2. Android based mobile phone
3. Bluetooth module(HC-05)
4. An Android application (through which the Arduino is controlled via Bluetooth)
5. Resistors
6. Bulbs
7. Step down transformer
8. Opto couplers
9. Diodes

### ARDUINO UNO :

Arduino Uno is a microcontroller board based on the Atmega 328. It has a ceramic resonator that is 16MHz, fourteen digital input/output pins (six of which can be used as PWM outputs), a reset button, a USB connection, a power jack and six analog inputs. It is an 8-bit microcontroller based on RISC architecture. The Arduino does not use a RC oscillator, but rather a crystal oscillator because of the quality factor (Q). The quality factor for a crystal oscillator is of the order 100,000 whereas the quality factor for an RC oscillator is of the order 100.

Mode of Operation	Slave
Default Baud Rate	9600
Default Pin Code	1234
Security Features	Authentication and Encryption
Frequency	2.4GHz ISM Band
Port	Serial port
Working Temperature Centigrade	-20~+75

#### ANDROID :

Android operating system is primarily designed for smart phones and tablets. Android applications are written in Java programming language using the Android software development kit (SDK) and run in virtual machines. The ATmega328P Microcontroller is connected by HC-05 Bluetooth Module using wireless technique to the Bluetooth Controller Android application, and the Input/output ports of the embedded system board are connected to home appliances. Android is the base of the application software, which has the largest base of Smartphone.

#### HC-05-Bluetooth :

The standard feature for cellular phones is a Bluetooth technology which can be used in wireless connection for cellular phones and home appliances. Bluetooth technology gives an efficient method for controlling home automation. It is a low priced and a teable technology. The Arduino Bluetooth board is used in the system. The cell phone is used python program to supply the user interface. The band frequency of working is over 2.4 GHz ISM with a range of 10 m and 1 Mbps speed. This module HC-05 provides a good wireless transmission & a well receiving serial data; it can be used to provide a connection between MCU and PC for the data transferring purpose.

The I/O ports of the Bluetooth board and relays are used to connect the devices which be controlled. The Bluetooth simply is password protected. A Bluetooth device has the ability to scan and detect other devices easily. It has the ability of checking whether devices are working properly or not.

A quality factor is defined as:

$$Q = f / BW$$

Where  $f$  is the resonant frequency and BW is the bandwidth.

After the application is installed on the mobile phone and the Bluetooth module is connected to the Arduino Uno, the connection is to be tested to make sure that the phone is interacting with the Arduino Uno via the Bluetooth module (HC-06).

The steps to test the connection are as follows:

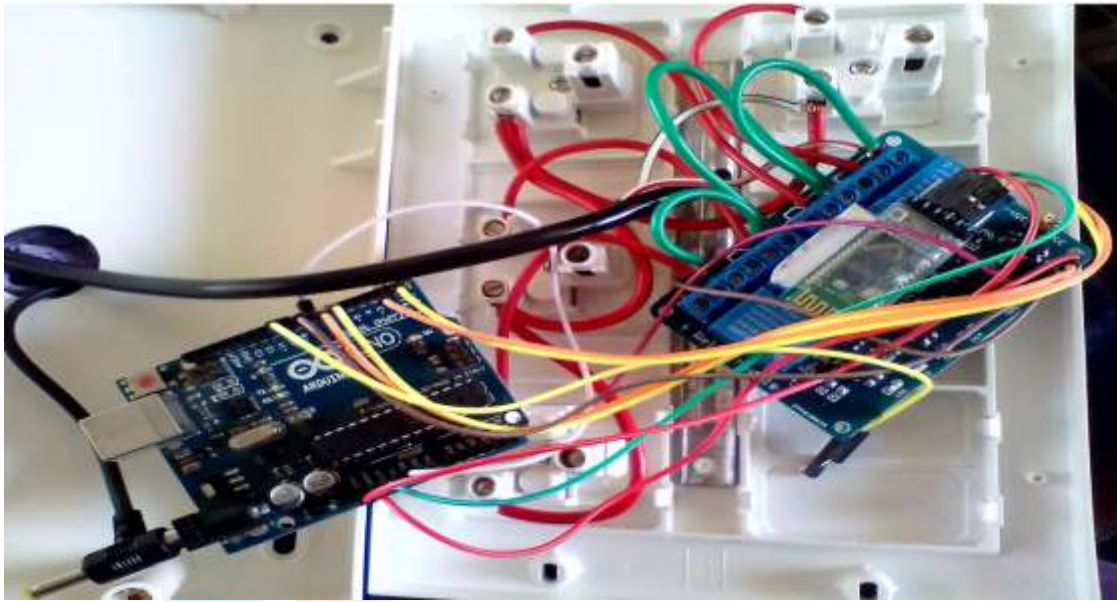
1. Open the application installed on the mobile phone.
2. With the help of the application, search for the Bluetooth devices.
3. Connect to the Bluetooth module (HC-05).
4. If the blinking of the light stops in the Bluetooth module, then it is working correctly, and the connection is established. If the light continues to blink, the connection needs to be checked. After all the connections are done, the home appliances should be connected to the Arduino. The positive end of the home appliance has to be connected to the anode port of the optocoupler and negative end of the appliance has to be connected to the power source using wires. Using different optocouplers and Arduino ports, the connections is made for other appliances. Finally, with the help of a Bluetooth connected Android phone, all of the appliances in the residence are controlled wirelessly.

**Theory** The home automation system allows people to control home appliances by using a smart phone application. It is obligatory to look on hardware and user's smart phone software for developing a home automation system. The product can deal with many home appliances such as lights, door lock...etc.

**3.1 Bluetooth Wireless Technology** Bluetooth is designed as a short range, low energy, low cost wireless connectivity that uses radio technology. Bluetooth devices work with 2.4 GHz frequency. A channel hopping technique is used to divide the 2.4 GHz band into 79 channels. In this technique the data is separates into smaller pieces called packets. The data packets exchanges between the transmitter and receiver at one frequency, then at another frequency the transmitter and receiver exchange another packet. This process will be continue by repetition until all data is transmitted. The channels changes every 625 microseconds. As a rule it performs 1600 times per second BWT devices use seventy-nine 1-megahertz frequencies in the ISM band The ISM frequency bands, having a range of 2.4 GHz and 2.483 GHz in the radio spectrum, has been reserved for industrial, scientific and medical purposes

#### **SYSTEM DESIGN:**

There are two types of communication involved in this project: wired and wireless communication. The communication between the Bluetooth module, or HC-05, and the Android based mobile phone will help connect to the controller wirelessly. In contrast, wired communication is the communication between the controller and the appliances.



### Implementation of the Hardware:

This section describes the overall hardware needed to design this project. The system is designed using the Arduino Uno Board, the Bluetooth module(HC-05), opto couplers, an Android mobile phone, and an Android application to control the Arduino board . It also uses various electronic components implicated. The system is integrated using Arduino Uno board, a HC-05 Bluetooth module, relays modules, an android device, and other electronic components. The system architecture of the proposed system which indicates the connection between the Arduino card and the peripheral devices which is Fan, Bulb, Heater and DC Motor. A connection between the Arduino Uno and the Bluetooth module is vital in order to enable the android to control the Arduino Uno .The VCC and GND pins of the Bluetooth module are connected to the VCC and GND port in the Arduino-Uno board respectively. Then connect the receiver of the Bluetooth module to the transmitter of the Arduino-Uno board and the transmitter of the Bluetooth module to the receiver of the Arduino-Uno board.

### PROGRAM FLOW CHART:

The software is written in C-language for android applications and the flowchart. At first checks if Bluetooth is already enabled on the phone, then the device will run. The software will check the devices stored in the phones memory, also it stores the addresses of all the controller modules connected to Arduino, then the home appliance is chosen for the application. At last the signal sends to Arduino to connect it.

### CONCLUSION:

In this paper we have launched design and implementation of a inexpensive, stretchy and wireless solution to the home automation. The system is secured for access from any user or intruder. The users are expected to acquire pairing password for the Arduino BT and the cell phone to access the home appliances.

This 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.

The full functionality of the home automation system was tested and the wireless communication between the cell phone and Arduino BT was found to be limited to <50m in a concreted building and maximum of 100m range was reported to be applicable in an open range. Right now the OS cell phones only support Python scripts. For future work it is recommended to develop the GUI application for the cell phone to be written in Java so that it can be supported by most of the cell phones available nowadays.

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