

# **School of Electronics and Communication Engineering**

## **Second Year B. Tech. (ECE)**

### **Microcontrollers Course Code: ECE214A**

#### **Home Automation using Bluetooth**

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**In the Guidance**

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## **ACKNOWLEDGEMENT**

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## **Abstract**

Electronic devices and appliances have become very common in this recent year of technology especially with fast development in smartphones. In this case study, the design of Home Automation System compatibly with Local housing and good features for home automation via remote access are presented. Bluetooth Based Home Automation System Using Silicon labs C8051F340 and HC-05 Bluetooth modulus is design and implemented. In this research work a part of smart home technology which using Bluetooth in a mobile device is used, so it will cheap and efficient to use.

This case study describes about home automation system which would use to enable home lighting, fan, water pumping motor, television, AC and lamp using a smart phone application with Bluetooth wireless technology. The system included three main components: Silicon labs C8051F340 microcontroller for connecting the appliances, a Bluetooth module for signal transfer, and a smartphone with the Android application to control home appliances. Bluetooth communication technology and controlled system is that the operating range is low but it can control from anywhere inside of home, by using smart phone application we can control household appliances and provide security to decrepit peoples. The idea of case study is to control home appliances to avoid the dangerous of electric shock and convenience of decrepit and physically disable people, who can easily access and control the home appliances by staying at particular place and access them remotely without the help of other people. By using this system, our home automation works smartly by providing increased quality of life, and comforts to users.

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## 1. Introduction

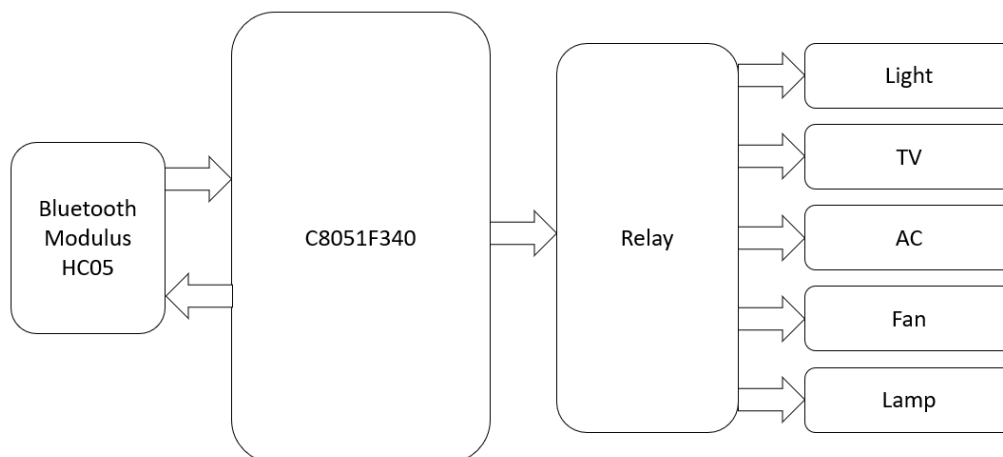
Wireless technologies are becoming more popular around the world and the consumers appreciate this wireless lifestyle which gives them relief of the well-known “cable chaos” that tends to grow under their desk. Now with the embedded Bluetooth technology, digital devices form a network in which the appliances and devices can communicate with each other. Today, home automation is one of the major applications of Bluetooth technology. Operating over unlicensed, globally available frequency of 2.4GHz, it can link digital devices within a range of 10m to 100m at the speed of up to 3Mbps depending on the Bluetooth device class. With this capability of Bluetooth; we propose a home automation system based on Bluetooth technology.

There are few issues involved when designing a home automation system. The system should be scalable so that new devices can easily be integrated into it. It should provide a user- friendly interface on the host side, so that the devices can be easily setup, monitored and controlled. This interface should also provide some diagnostic services so that if there is any problem with the system, it can be tracked down. Moreover, the overall system should be fast enough to realize the true power of wireless technology. Finally, the system should be cost effective in order to justify its application in home automation.

By using home automation System, we can control household appliances. So, many manual actions are replaced by reducing human efforts and time saving. The design of Home Automation System which remains the existing electrical switches which status is synchronized in all the control system with low voltage activating method and that provides more safety for danger of electric shock and provide security to decrepit peoples. In this case study, Bluetooth based home automation system using android smart phones and Silicon labs C8051F340 microcontroller board is used. Such a system will enable users to have control over home lighting, fan, water pumping motor, television, AC and lamp in their home with Bluetooth. The main requirement for user is an Android smart phone, which is present in almost every person hand nowadays, and a control circuit. The control circuit consists of a Silicon labs C8051F340 microcontroller, which processes the user controls switching of devices. The microcontroller and the smart phone are connected with Bluetooth wireless technology because Bluetooth technology is low cost to use and secure wireless network. Remote operation is achieved by any smart phone/Tablet etc., with Android OS.

## 2. Hardware Design

### 2.1 System Block diagram



*Fig. 1 System Block Diagram*

### 2.2 Description

For this project of Smart Home Automation System, open-source android platform is used. Android application from any mobile devices connects to the Bluetooth module HC-05 and controls the home appliance devices such as rooms lighting, lamps, TV and AC. After that confirm message for Bluetooth connection is successful and then list on available devices in android application can control as remote devices. Block Diagram of the implemented project shown in Fig. 1. Our proposed project consists of the following three sections.

- (a) Input from Bluetooth module via android
- (b) Silicon Labs C8051F340 microcontroller processing
- (c) Output of process indication

First development of our project, all the component modules are made simulation by Proteus Design Suit version 8.0 simulator and check for the working output condition. Hardware components simulation of this project consists of Silicon labs C8051F340, Bluetooth module, motors and rooms lighting by android app control. The required DC power supply that to run the system can get from 9V battery or computer USB port and feeds the microcontroller and Bluetooth module. The Bluetooth module receives the signal sent from an android smart-phone, where the application software made by MIT app inventor is installed. The microcontroller, thereby, sends instruction, when executed codes in C language. The hardware of this project consists of Silicon labs C8051F340 and Bluetooth module. The Bluetooth module is connected with the C8051F340 board for the right connection with RX, TX, ground and power pins. Through the Bluetooth module for monitoring and controlling the particular rooms lighting and motors reaches the board and process accordingly and output of the Arduino goes to the

particular hardware components with control them. In this method, Bluetooth wireless connection is used, the user must be present within in range ( $< 10$  meters) to control the system. When user sends signal or data to the Arduino board then the corresponding pin of C8051F340 goes to high state and switches the home applicant hardware to open or close.

In this present project, Bluetooth module that has been set to slave mode is used to communicate the controller with the smart phone application. Application is created by App Inventor 2. App Inventor 2 is a visual, blocks language for building Android Apps. There are two main types of components in an app Inventor 2, visible and non-visible. Visible components of application are can see when the app is launched that includes buttons, text boxes, and labels. These are often referred to as the graphical user interface (GUI). Non-visible components are not seeing, so they are not part of the user interface. Instead, they provide access to the built-in functionality of the device. The non-visible components are the technology within the device they are little worker bees and they do jobs for control of the application. App Inventor 2 can easily create GUI interface for user friendly and block editor can make the relevant function of each button from application easily without writing coding.

The code for the android app made in MIT app inventor 2 is shown in fig. 3 and the build app figure is shown in fig. 4

The application installed in Smart phone and control the output pins of C8051F340 for rooms lighting and motors on-off by using relay switch. 5 V DC Relay units are connected to ULN2003A for switch control action of 220V AC home applicants has been achieved. Hardware for Relay Units to drive 220V AC lighting units, motors and other song amplifier unit for alarm system is not included and need to extend.

### 2.3 Selection of Components and its specification

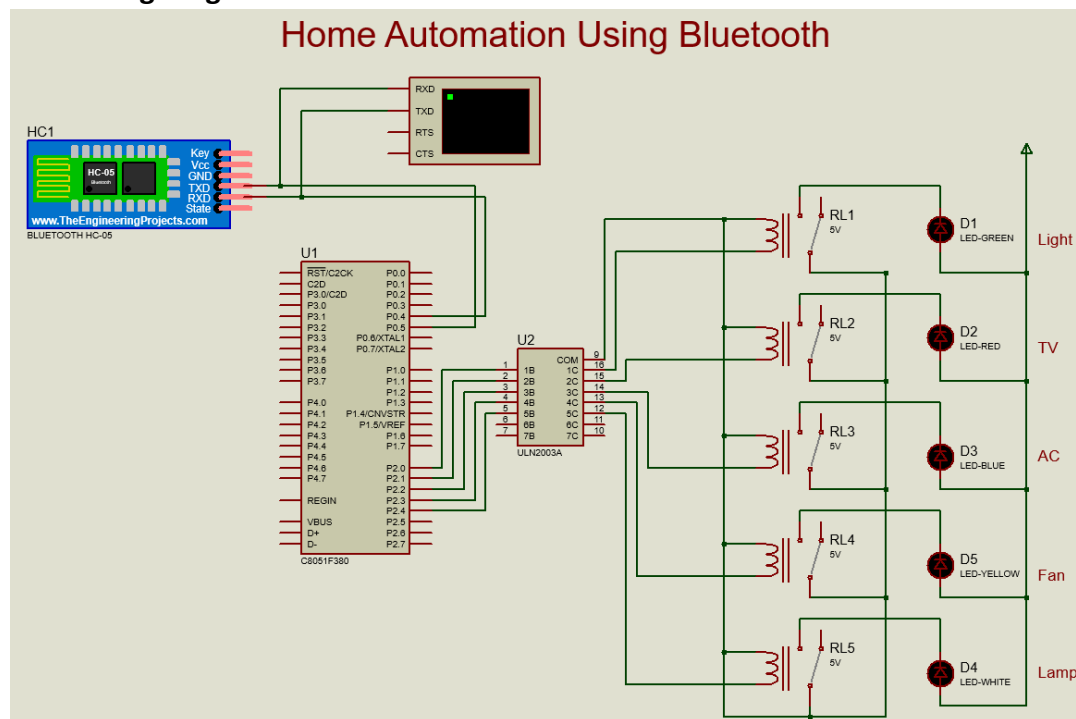
**C8051F340:** The C8051F340-GQ microcontroller (MCU) features an on-board universal serial bus (USB) 2.0 function controller with an integrated transceiver and on-chip clock recovery. The MCU includes a powerful 8051 core with 50 MHz performance along with 64 kB Flash, 4.25 kB RAM.

**ULN2003A:** ULN2003A IC is one of the most commonly used Motor driver IC. Usage of the ULN2003A is in driver circuits for relays, lamp and LED displays, stepper motors, logic buffers and line drivers.

**HC05 Bluetooth modulus:** HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

**Relay:** A relay is an electrically operated switch consisting of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals.

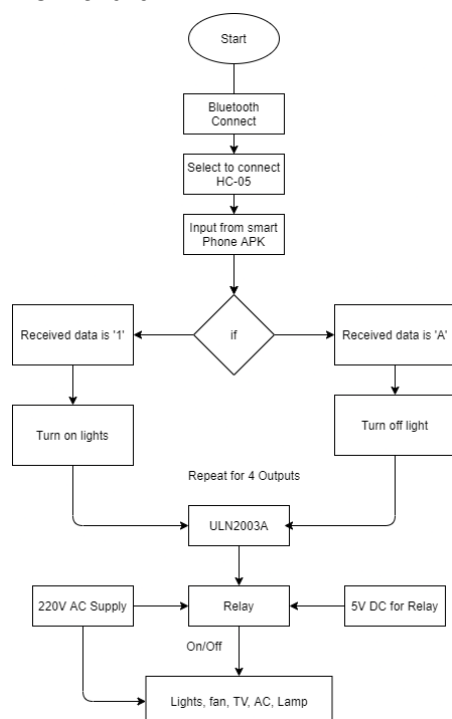
## 2.4 Interfacing Diagram



*Fig. 2 System Block Diagram*

### 3. Software Design

### 3.1 Flow chart





## 3.2 Embedded C code

```
#include "c8051f340.h" //Header file
#define SYSCLK 12000000
#define BR_UART0 9600

sbit Light=P2^0;
sbit TV=P2^1;
sbit Ac=P2^2;
sbit Fan=P2^3;
sbit Lamp=P2^4;

char str;           //setting a variable
char Charin=0;

void delay(int time)    // Delay
{
    unsigned int i,j;
    for(i=0;i<time;i++)
    for(j=0;j<1275;j++);
}

void main()
{
    SCON0=0x50;
    TMOD=0x20;        //Selecting Timer 1 in mode 2
    TH1= -(SYSCLK/BR_UART0/2/4);    //Setting baud rate as 9600
    TR1=1;            //Starting timer
    XBR0 = 0x01; //for TX and RX P0.4 and P0.5
    XBR1 = 0x40; // defining Xbar
    delay(50);

    while(1)
    {
        while(RI0==0); //If RI=0 then stay there when RI=1 then move on
        Charin=SBUF0; //we are moving Received data to SBUF
        str=Charin; //To see which character we received again are moving our data to SBUF
        while(TI0==0); //Now transferring data from Microcontroller to pins
        TI0=0;
        if(str=='A')
        {
            Light=1; //Light turns on
            delay(50);
        }
        else if(str=='1')
        {
            Light=0; //Light turns off
            delay(50);
        }
        else if(str=='B')
        {
            TV=1; //TV turns on
            delay(50);
        }
        else if(str=='2')
        {
            TV=0; //TV turns off
            delay(50);
        }
    }
}
```

```

    }

    else if(str=='C')
    {
        Ac=1;    //AC turns on
        delay(50);
    }

    else if(str=='3')
    {
        Ac=0;    //AC turns off
        delay(50);
    }
    else if(str=='D')
    {
        Fan=1;    //Fan turns on
        delay(50);
    }

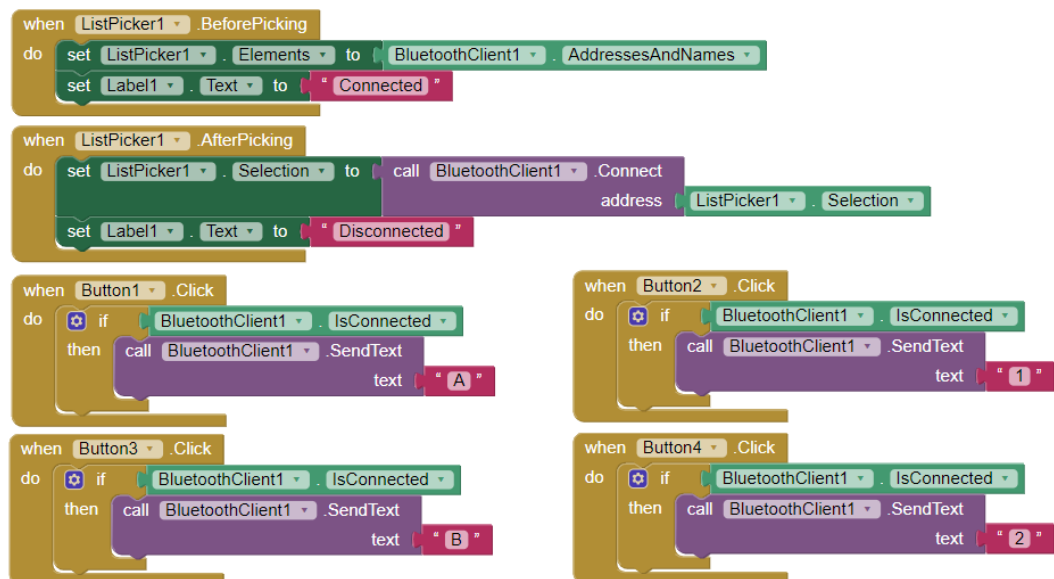
    else if(str=='4')
    {
        Fan=0;    //Fan turns off
        delay(50);
    }

    else if(str=='E')
    {
        Lamp=1; //Lamp turns on
        delay(50);
    }

    else if(str=='5')
    {
        Lamp=0; //Lamp turns off
        delay(50);
    }
    str=0;
}
}

```

### 3.3 MIT App inventor 2 code



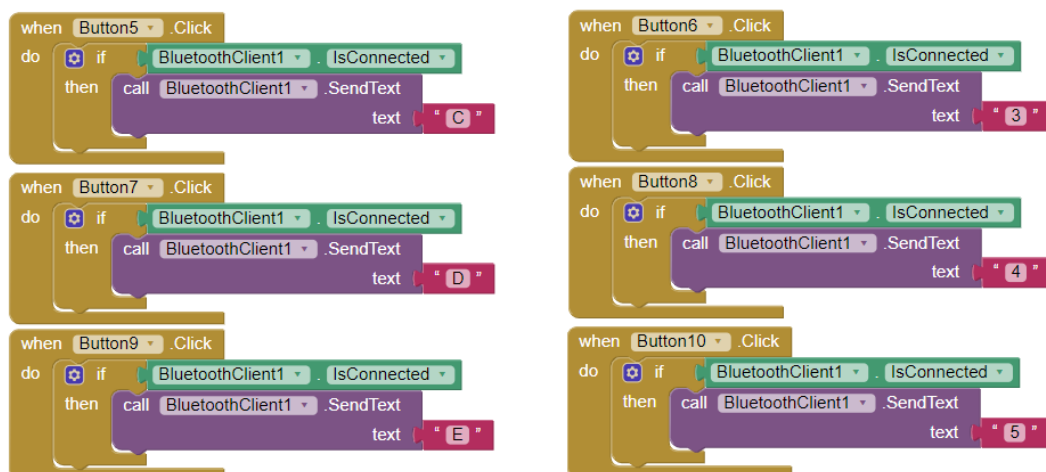


Fig. 3 MIT App Inventor code

### 3.4 Finished app design



## 4. Conclusion

This project is also a cost-effective project with a simple and easy to use interface for decrepit and physically disables peoples. By using this method, home appliances can be controlled to avoid the dangerous of electric shock and convenience for users. With few additions and modifications, this project can be making commercial scale products for Home Automation System. In future we can add temperature sensors so that it can monitor some surrounding temperature parameters around the house and we can improve the communication using Internet web base technology. This project can also promote with wireless camera, in order to incorporate other security features of Smart Home Automation System. In terms of upgrading security in the home, doors

and windows are also mounted by setting alarm in case of any kind of thief or sabotage.

## 5. Reference

- [1]<https://components101.com/wireless/hc-05-bluetooth-module>
- [2]<https://www.silabs.com/documents/public/data-sheets/C8051F34x.pdf>
- [3]<https://circuitdigest.com/microcontroller-projects/bluetooth-controlled-home-automation-using-8051>
- [4][https://www.researchgate.net/publication/332835074\\_Research\\_Paper\\_On\\_Home\\_Automation\\_Using\\_Arduino](https://www.researchgate.net/publication/332835074_Research_Paper_On_Home_Automation_Using_Arduino)

## 6. Data sheet

<https://www.silabs.com/documents/public/data-sheets/C8051F34x.pdf>

Referred page no.: 149,205,206,207,210,211,212,214