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Home Automation System for Specially Challenged and Senior Citizens

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ABSTRACT- Several people with certain disabilities or growing age feel cumbersome to operate basic electronic appliances like lights and fans and often have to depend on others for the same. The fundamental objective of this project is to design and build a low-cost Bluetooth based prototype of a Home-Automation System using an Android phone, to control home appliances. Smartphone affordability increases every year and smartphones have begun to play important roles in our daily lives due to their size and portability. Therefore an Android application has been developed to operate the Bluetooth module. In this project PIC16F887 IC, which is an 8-bit micro-controller and HC-05 Bluetooth module has been incorporated to achieve the rightful result.

Keyword: Micro-controller, Bluetooth, Android

1. INTRODUCTION

Home automation system makes the operations of various home appliances more convenient and saves energy. With the energy saving concept, home automation makes life very simple nowadays. It involves automatic controlling of all electrical or electronic devices in homes.

Home Automation System could be 'Wired' or 'Wireless'. In a Wired system, appliances are connected physically to a central server while in a Wireless system, central server is connected wirelessly to the appliances.

Home Appliances such as TV, DVD player, air conditioner, etc. come with their respective remote controls.

Installing a home automation system adds at least one more remote control.

Nowadays, people are inseparable with their smartphones. Google announced over 2 billion active users running on Android. Android has 75% of worldwide smartphone market.

So, an android application has been developed to operate the Bluetooth module and the appliances.

2. TECHNICAL TERMINOLOGY

2.1 Bluetooth

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz[]) from fixed and mobile devices, and building personal area networks

Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 30,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.

The Bluetooth SIG oversees development of the specification, manages the qualification program, and protects the trademarks. A manufacturer must meet Bluetooth SIG standards to market it as a Bluetooth device. A network of patents applies to the technology, which is licensed to individual qualifying devices.

2.2 Android

Android is a mobile operating system developed by Google, based on a modified version of the Linux kernel and other open source software and designed primarily for touchscreen mobile devices such as smartphones and tablets.

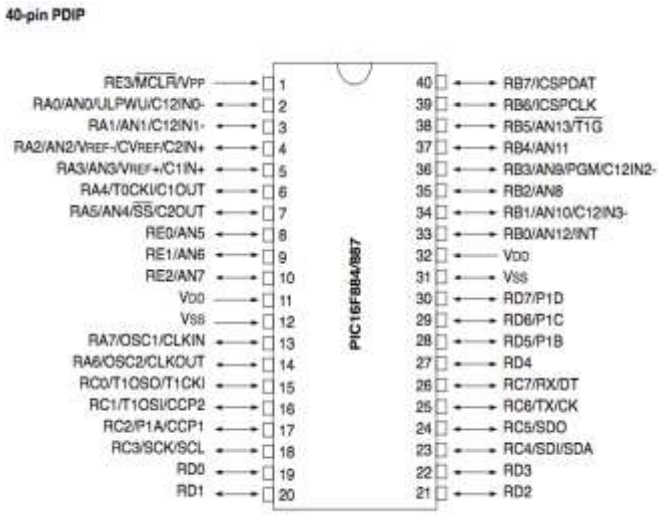
Initially developed by Android Inc., which Google bought in 2005, Android was unveiled in 2007, with the first commercial Android device launched in September 2008.

The core Android source code is known as Android Open Source Project (AOSP), and is primarily licensed under the Apache License.

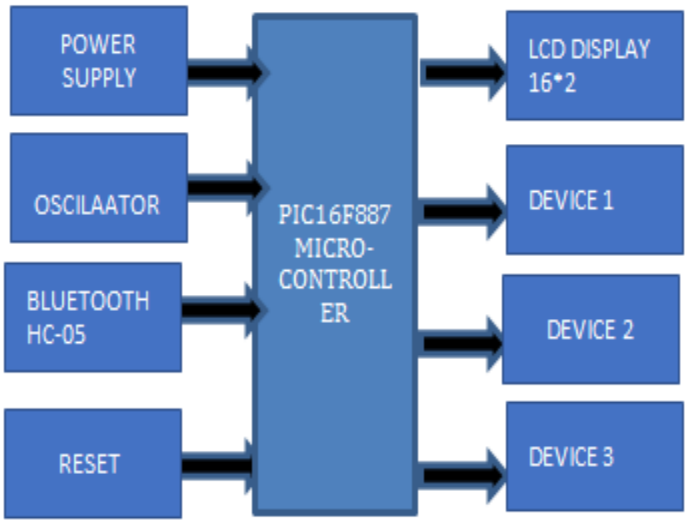
The main hardware platform for Android is ARM (the ARMv7 and ARMv8-A architectures), with x86 and x86-64 architectures also officially supported in later versions of Android.

2.3 PIC16F887 MICROCONTROLLER

The powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into a 40-pin package. The PIC16F887 features 256 bytes of EEPROM data memory, self programming, an ICD, 2 Comparators, 14 channels of 10-bit Analog-to-Digital (A/D) converter, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface or the 2-wire Inter-Integrated Circuit bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances or consumer applications.



3. BLOCK DIAGRAM



4. Hardware Implementation

4.1 Schematic Diagram

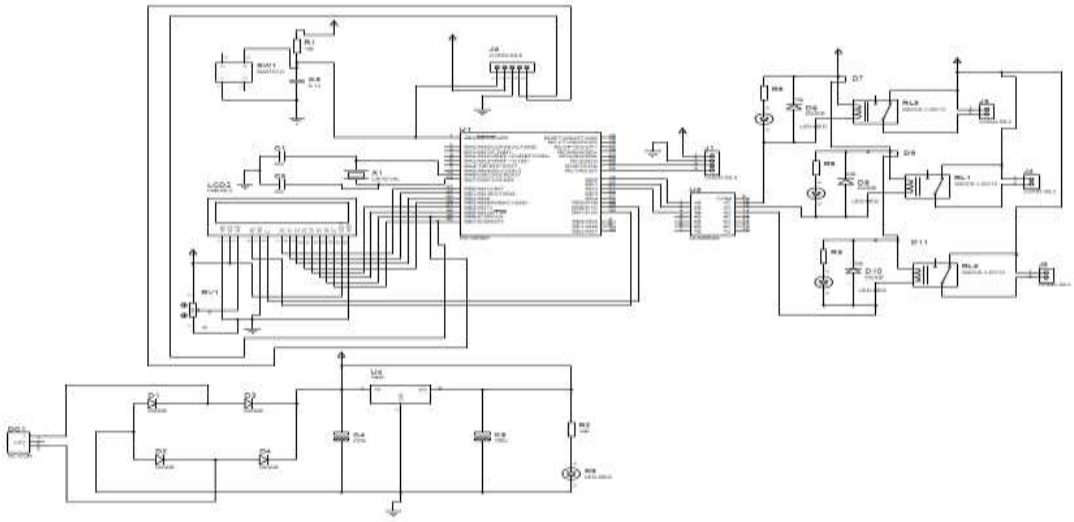


Fig: Schematic Diagram

4.2 COMPONENTS USED

- PIC16F887 Micro-Controller
- Crystal Oscillator
- LCD (LM016L)
- LM 305 IC
- Resistor
- Capacitor
- Switch
- Bluetooth Module (HC-05)
- Relay
- Bulb Fan
- Diodes (IN4007)

4.3 WORKING OF THE CIRCUIT

All the components are connected together to perform the required task. PCB has been designed by integrating several components.

These components need to be soldered well to ensure minimum error and proper functioning of the hardware. The figure given below shows the connection between PCB and home-appliances. The hardware can be divided into two parts, Input and Output.

The input part keeps listening until a Bluetooth connection is established and a command from the connected Android Smartphone is received.

The data received from the smartphone is then processed by the micro-controller. The home appliances are connected to the controller via relays. Relays are connected to isolate the low voltage (5V) circuit from the high voltage circuit (220V). Transistors are used to trigger the relay.

Whenever an appliance is turned on the LED corresponding to it glows to indicate that a particular device has been turned ON.

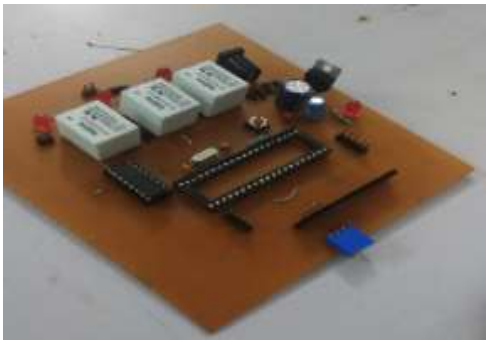
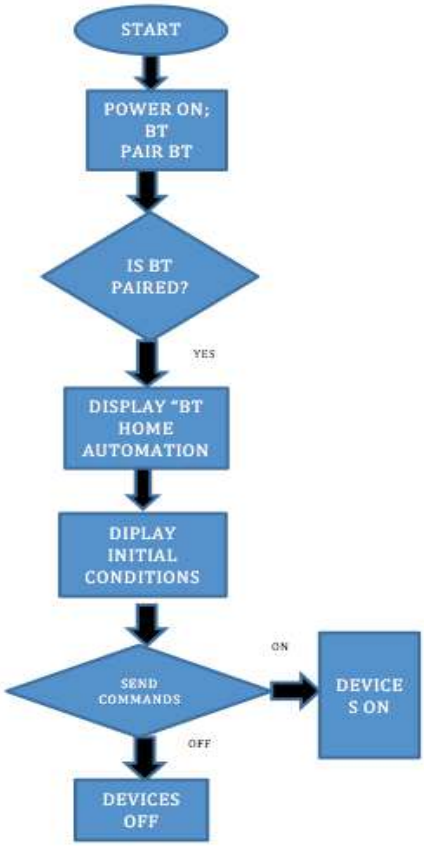


Fig: *PCB*

5. SOFTWARE IMPLEMENTATION

5.1 FLOW CHART



5.2 MPLAB IDE

Software used in this project was MPLAB IDE v8.70.

MPLAB is a proprietary freeware integrated development environment for the development of embedded applications on PIC developed by Microchip Technology.

Programming was done in embedded C language under the library <pic.h>.

Program was burned into the microcontroller using the PicKit 2 connector.

Various features of pic microcontroller were used like UASRT, timers, delay, LCD interfacing.

5.3 Embedded C

Programming for the project was done in embedded C language. Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. Embedded C includes extra features over C, such as fixed-point types, multiple memory areas, and I/O register mapping.

Header files used were <pic.h> and <string.h>. Various features of microcontroller were used like relays, transmitter receiver, LCD interfacing, Bluetooth interfacing,

Timer and delay functions were used according to the requirement of the circuit. Delay is used to suspend the functioning of the program for the short interval of time. Timer is used to count sync with microcontroller for the given interval of time i.e. 256 for 8-bit counter and 65535 for 16-bit counter.

Fig: Screenshot of MPLAB IDE

5.4 PIC Kit2

It is used to burn code from our computer to the microcontroller. PicKit is a family of programmers for PIC microcontrollers made by Microchip Technology. They are used to program and debug microcontrollers, as well as program EEPROM. PicKit 2 has a separate programmer/debugger unit which plugs into the board carrying the chip to be programmed. The PicKit 2 uses an internal PIC18F2550 with Full Speed USB. The latest PicKit 2 firmware allows the user to program and debug most of the 8 and 16 bit PIC microcontrollers. The Microchip version of PicKit 2 has a standard 128 KB memory. 256 KB memory can be achieved by modifying the hardware or from third party clones.

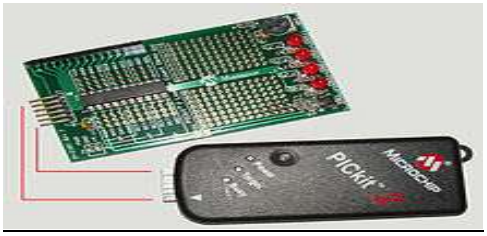


Fig: *PIC Kit2 Connector*

5.5 Android Application

An android application was used for using the Bluetooth module named as Bluetooth Terminal HC-05. It is one-of-a-kind App that gives you compatibility with all microcontrollers. All you need is a HC-05 serial adapter connection with serial ports of the controllers. It can control any Micro-controller that uses a Bluetooth Module HC 05 or HC 06 through your smart phone. This app can send and receive commands via Bluetooth so you can debug your hardware problems easily.

Its features are: -

- Separate panels for sending and receiving data.
- Custom your own buttons for frequent sending of same data.
- Monitoring receiving data as HEX or ASCII.
- Sending Data as ASCII or HEX.

Fig: Screenshot of the Android App

6. CONCLUSION

This project was created in order to make usage of electric appliances easy for old and specially challenged people.

Due to tremendous growth in technology and advancements in wireless communication, smart way of living has turned out to be a major part in the present era of human life. We have proposed a smart home automation system, which is operated with the help of android smart phone by using Bluetooth Technology and home appliances will be controlled through pic microcontroller using relays. Work is implemented in real time and appliances are controlled according to the commands from android mobile from Bluetooth controlling app.

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