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HOME AUTOMATION SYSTEM FOR HANDICAP AND OLD AGE PERSON

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Abstract

Automation is a demand in this era of information and communication technology where a smart control system is used to reduce or replace human operators in the industry, offices or homes to produce some goods or services. Home automation system is the subset of automation system that allows us to control household appliances like light, door, fan, air-conditioner etc. in an intelligent way. It also includes those of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, and the use of domestic robots. Home automation system provides home security and emergency systems to be activated while necessary. It helps handicapped and old aged people who will enable them to control home appliances and alert them in critical situations. It not only refers to reduce human efforts but also energy efficiency and time saving. There are different types of home automation systems in the market. They are generally proprietary and closed, expensive and not very customizable by the end user. To overcome this limitation, there are scopes of research in this area.

In this project work, a simple home automation device has been chosen to implement. It will sense the presence of human(s) by the motion sensor and according to its signal the electrical devices will be turned on/off. To do this, a simple PIR sensor has been used to detect the presence of humans. A program code was being downloaded into the microcontroller. When the PIR sensor gives an input signal to the microcontroller, the microcontroller then gives an output signal to the relay module which then turn on the light connected to it. If PIR sensor doesn't give any output signal which will be feed to the input of the microcontroller, then the relay has been turned off and so the light connected to it. This is a very simple project work which is very cost-effective and can be used in so many places where automatic power consumption control is the main concern.

Key words: *Home Automation System, Android, Microcontroller, Bluetooth, Mobile Phone, Appliance* -----

1. Introduction

Nowadays, people have smart phones with them all the time. So it makes sense to use these to control home appliances. Presented here is a home automation system using a simple Android app, which you can use to control electrical appliances with clicks or voice commands. 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. 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. 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. With enhancement in technology, automation has become a need whether it is home, office or some other place. At home we come across many appliances be it fan, AC, TV, lights, etc. What if we could operate all of them with the Android Phone you're holding in your hand. Home automation has made it possible to have what is often referred to as a 'smart home', a home that can detect and identify we, automatically adjust the lighting to our predefined taste, open doors automatically, play your favorite music, water your flowers in the morning, switch on the security lights at night and switch them off in the morning, heat water for bathe and tea, stream to you anywhere in the world via the internet a live video of what is happening in and around your house. It makes it possible to link lighting,

entertainment, security, telecommunications, heating, and air conditioning into one centrally controlled system. This allows you to make your house an active partner in managing your busy life.

2. Block Diagram

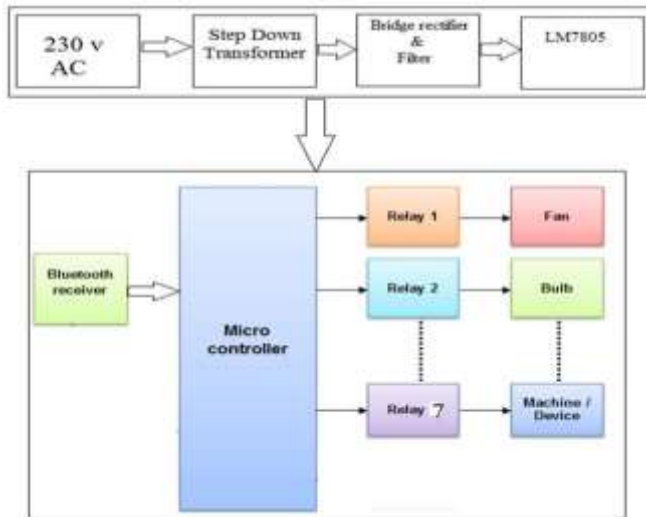


Fig.2 Block diagram of Electronic Home Appliances Controlled Using Android Phone

Description of Block Diagram

The above block diagram shows scrolling electronic appliances controlled using android phone by implement advanced techniques. Following components are used in scrolling electronic notice board system:

- Microcontroller 18F4620
- Bluetooth Model HC-0
- 7805 Voltage Regulator
- Electromagnetic Relay
- Relay Driver IC ULN2033
- Transformer
- 7805 Voltage Regulator
- Filter & Rectifier

A 230V supply is given to the transformer of rating (12-0-12) AC. It then given to rectifier which will convert ac supply into dc supply which then given to the voltage regulator of 78** family which will give 5V output voltage which is required to the microcontroller of 18F4620. A Crystal oscillator of 20 MHz is used in this circuit for generating clock signal for microcontroller. Bluetooth module's pins Rx and Tx are directly connected to the Tx and Rx pins of Microcontroller. For OFF or ON mechanism of home electronic appliances on AC mains we used seven relay of 5 volt. While to drive this relay, Relay driver IC ULN2003 is used.

3 PCB Fabrications

Printed circuit boards can be fabricated by:

- Using paints and acid resist inks
- Screen printing method
- Photographic method

First the copper clad sheet is cut according to the size. Then it is mechanically and chemically cleaned using thinner.

Using Paints And Acid Resist Inks

The required printed circuit layout is drawn on the cleaned PCB using paint. Wax coated eyebrow pencil and stencil correction fluid can be used. Commercially available —DALOL pen in which the acid resist ink is used can also be used for drawing the layout. After drying, it is etched in Ferric Chloride solution having specific gravity of 1.4. With this solution, complete etching with the exposed copper area will be over in around 20 minutes.

Screen Printing Method

This method is commonly used for mass production of PCBs.

a) Screen preparation

An epical monofilament nylon cloth named as belting cloth is used. For printed circuit boards, fine mesh cloth is used. Commercially available 300 mesh cloth is suitable. The screen cloth is uniformly stretched over a wooden frame and stapled. The screen is then cleaned.

b) Layout preparation

The required PCB layout is drawn on a tracing sheet using Indian ink for the actual size as it can be used as positive. Using lith film positive can be obtained through photographic process. Theist film is chosen for contrast. Drawing thin lines using Indian film is difficult. So using commercially available stickers, The PCB layout is drawn for *2 of *4 size. It is then reduced to actual size by process camera.

Preparation of light sensitive solution

After preparing the emulsion, take care that they are not exposed to bright light. It should be noted that even if properly stored, the solution would last only 3 to 4 days as a photographic emulsion. To dissolve PVA in water, first soak powder in water for about half an hour. Then heat the solution in a water bath with constant stirring till you get a uniform solution. Allow to cool down and then keep it in a bottle as a stock solution. This solution without other ingredients can be kept for a very long time. Same procedure is to be used for dissolving gelatin but it should be noted that the solution on cooling will solidify into a jelly form. The emulsion thus prepared should be uniformly and evenly coated on the screen. The solution should be evened out from inside to obtain a smooth even coating. The screen after coating should be allowed to dry in total darkness. When the screen is dry, expose it by putting it in firm contact with the positive, giving about ½ minute of rich sunlight or about 2 minutes of artificial light. After exposure, wash the screen immediately with cold water spray where PVA (208) or silicate is used. Till the design becomes clear, when PVA(173) or gelatin is used, hot water should be used to develop the screen. After the screen is developed, blot gently from sides with newsprint or blotting paper and allowed to dry before use. Five star film has a red color emulsion which has much better resistance to aggressive inks like PVC than it reveals. The film is ready sensitized on a very thin 0.002l clear polyester base. The film is used where sharpness required is very high. You have to store the film in dark. Cut the film about 1/2l bigger than the positive on all sides. Put the film in a contact box with positive.

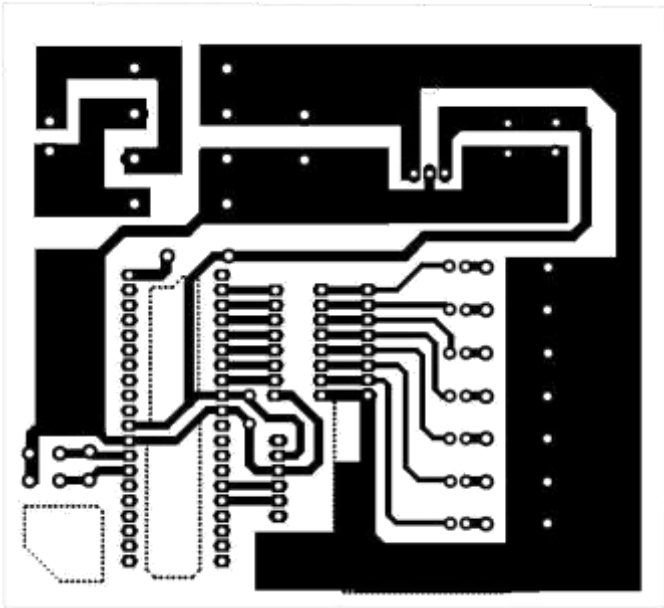


Fig. 3 (A) PCB Design for Bluetooth app controlling.

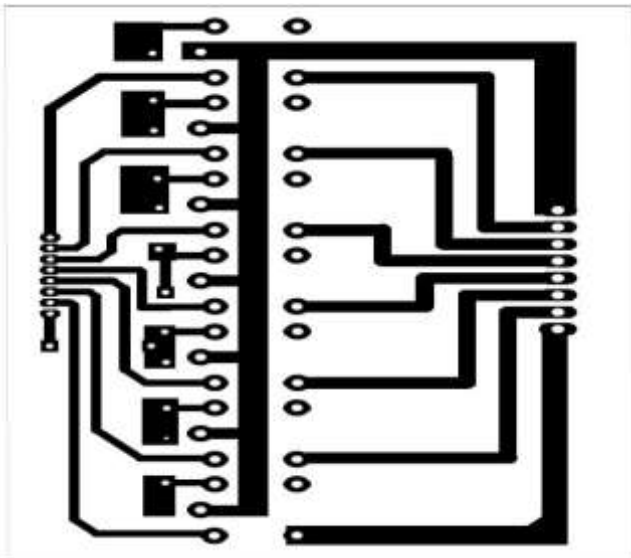


Fig 3 (B) PCB Design for Relay

3.1 Drilling:

If you have fiberglass (FR4) board, you must use tungsten carbide drill bits. Fiberglass at normal high-speed steel (HSS) bits very rapidly, although HSS drills are all right for odd larger sizes (>2 mm). Carbide drill bits are expensive and the thin ones snap very easily. When using carbide drill bits below 1 mm, you must use a good vertical drill stand—you will break drill very quickly without one. Carbide drill bits are available as straight-shank or thick (sometimes called ‘turbo’) shank. In straight shank, the whole bit is the diameter of the hole, and in thick shank, a standard-size (typically about 3.5 mm) shank tapers down to the hole size. The straight-shank drills are usually preferred because they break less easily and are usually cheaper. The longer thin section provides more flexibility. Small drills for PCB use usually come with either a set of collets of various sizes or a 3-jaw chuck. Sometimes the 3-jaw chuck is an optional extra and is worth getting for the time it saves on changing collets.

3.2 Cutting:

A small guillotine is the easiest way to cut fiberglass laminate. Ordinary saws (band saws, jigsaws, and hacksaws) will be blunted quickly unless these are carbide-tipped, and the dust can cause skin irritation. A carbide tile-saw blade in a jigsaw might be worth a try. It’s also easy to accidentally scratch through the protective film when sawing, causing photo resist scratches and broken tracks on the finished board. A sheet-metal guillotine is also excellent for cutting boards, provided the blade is fairly sharp. To make cut-outs, drill a series of small holes, punch out the blank, and file to size. Alternatively, use a fretsaw or small hacksaw, but be prepared to replace blades often. With practice it’s possible to do corner cut outs with a guillotine but you have to be very care that you don’t over-cut.

3.3 Soldering:

Soldering is the process of joining metals using lower melting point metal to melt or alloy with the joining surfaces.

- **Solder**

It is the joining material that melts below 427C. Soldering joints in electronic circuits will establish strong electrical connections between component leads. Popularly used solders are alloys of tin and lead that melts below the melting point of tin.

- **Flux**

In order to make the surface accept the solder readily, the component terminals should be free from oxides and other obstructing films. The leads should be cleaned chemically or by abrasion using blades or knives. A small amount of lead coating can be done on the clean portion of the leads using soldering iron. This process is called Tinning. Zinc chloride or Ammonium chloride separately or in combination is used as fluxes. These are available petroleum jelly as paste flux. The residues which remain after soldering may be washed out with more water accompanied by brushing.

- **Soldering**

The soldering operation in which soldering gun is used to melt the solder and join the components on the PCB. It is the tool used to melt the solder and apply it at the joints in the circuit. It operates on 230V supply. The iron bit at the tip gets heated within few minutes. 50W, 25V soldering irons are commonly used for soldering purposes.

- **Microcontroller PIC18F4620:**

The PIC18F4620 microcontroller chip is a product of Microchip that is built on ready for PIC board. This feature is almost for all modern modules of microcontrollers, high quality, wide range of applications; low power consumption, low industry and different values are practical method which is the applications for controlling different processes. The preference of the price and the easy usability of inspector are an important factor.

- **Memory of PIC18F4620:**

The PIC18F4620 contains three types of memory: ROM, RAM and EEPROM. All of them will be separately discussed since each has specific functions, features and organization.

- **ROM Memory**

ROM memory is used to permanently save the program for being executed. This is why it is often called —program

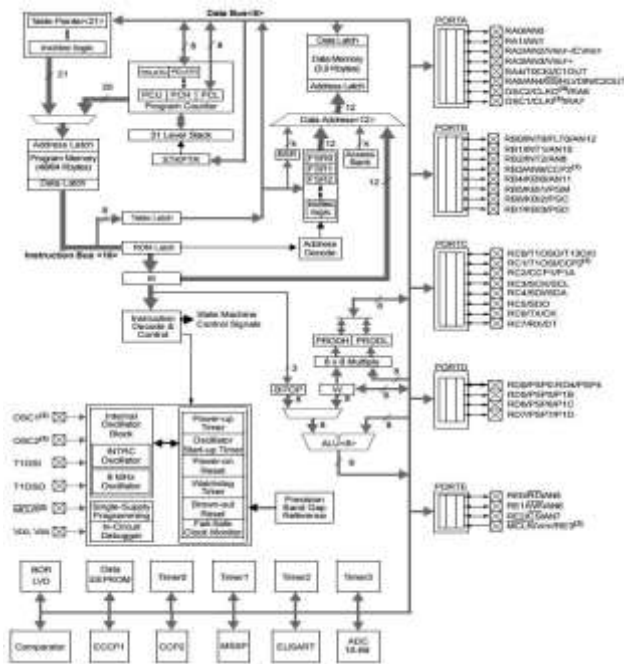
memory. The PIC18F4620 has 8Kb of ROM (in total of 8192 locations). Since this ROM is made with FLASH technology, its contents can be changed by providing a special programming voltage (13 V).

EEPROM Memory

Similar to program memory, the contents of EEPROM are permanently saved, even the power goes off. However, unlike ROM, the contents of the EEPROM can be changed during operation of the microcontroller. That is why this memory (256 locations) is a perfect one for permanently saving results which are created and used during the operation.

RAM Memory

Ram Memory is the third and the most complex part of microcontroller memory. In this case, it consists of two parts: general-purpose registers and special-function registers (SFR). Even though both groups of registers are cleared when power goes off and they are manufactured in the same way and acted in the similar way, their functions do not have many things in common. Different processes in industry, machine control devices, measurement of different values etc. Some of its main features are listed below.



The PIC18F4620 Basic Feature:

- Only 35 instructions to learn
- All single-cycle instructions except branches
- Operating frequency 0-20 MHz
- Precision internal oscillator
- Factory calibrated
- Software selectable frequency range of 8 MHz to 31 KHz
- Power supply voltage 2.0-5.5 V
- Consumption: 220 μA (2.0 V, 4 MHz), 11 μA (2.0 V, 32 KHz) 50 nA
- Power-Saving Sleep Mode
- Brown-out Reset (BOR) with software control option

3.4 Bluetooth Model HC-05

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH(Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

3.5 HC-05 Hardware features

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control

3.6 HC-05 Software features

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has. Supported baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800.
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately.
- When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:100001 as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

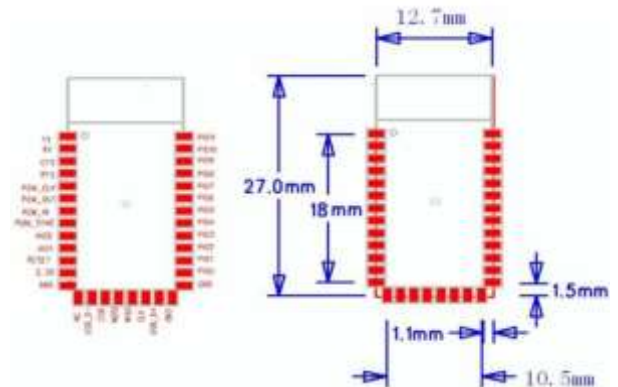


Fig 3.6 Hardware of HC-05 Bluetooth model

3.7 Voltage Regulator 7805:

7805 is a voltage regulator integrated circuit. It is a member of 78xx series of fixed linear voltage regulator ICs. The voltage source in a circuit may have fluctuations and would not give the fixed voltage output. The voltage regulator IC maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage it is designed to provide. 7805 provides +5V regulated power supply. Capacitors of suitable values can be connected at input and output pins depending upon the respective voltage levels.

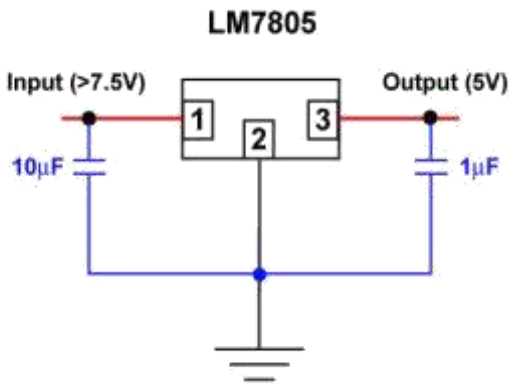


Fig 3.2.6. (b) Transformer

3.7 Relay:

Relays are defined as remote controlled electrical switches that are controlled by another switch e.g. - a horn switch. Relays allow a small current flow in a circuit to control a higher current circuit. The relay used here is a Single Pole Double Throw (SPDT) relay whose magnetizing coil terminals operate on 5V DC **3.2.5 Relay Driver IC ULN2033**

An integrated circuit (IC), sometimes called a *chip* or microchip, is a semiconductor wafer on which thousands or millions of tiny resistors, capacitors, and transistors are fabricated. An IC can function as an amplifier, oscillator, timer, counter, computer memory, or microprocessor. A particular IC is categorized as either linear (analog) or digital, depending on its intended application. Linear ICs have continuously variable output (theoretically capable of attaining an infinite number of states) that depends on the input signal level. As the term implies, the output signal level is a linear function of the input signal level. Ideally, when the instantaneous output is graphed against the instantaneous input, the plot appears as a straight line. Linear ICs are used as audio-frequency (AF) and radio-frequency (RF) amplifiers. The operational amplifier (op amp) is a common device in these applications. Digital ICs operate at only a few defined levels or states, rather than over a continuous range of signal amplitudes. These devices are used in computers, computer networks, modems, and frequency counters. The fundamental building blocks of digital ICs are logic gates, which work with binary data, **3.2.6**

3.8 Transformer

Electrical power transformer is a static device which transforms electrical energy from one circuit to another without any direct electrical connection and with the help of mutual induction between two windings. It transforms power from one circuit to another without changing its frequency but may be in different voltage level. The working principle of transformer is very simple. It depends upon Faraday's law of electromagnetic induction. Actually, mutual induction between two or more winding is responsible for transformation action in an electrical transformer. A transformer is an electrical device that transfers electrical energy between two or more circuit through electromagnetic induction. Electromagnetic induction produce an electromotive force across a conductor which is exposed to time varying magnetic field. Commonly, transformers are used to increase or decrease the voltage of alternative current in electrical power application Fig 3.2.6. (b) Transformer.

3.9 Rectifier & Filter

Most of the apparatus we use are AC devices. They require AC power for their operation. We do not have many devices which work on DC supplies. But with the advancement of electronics the DC is gaining its importance as these this devices give an efficient method for AC to DC conversion. Earlier, we used synchronous converter but the conversion process is quite loss and inefficient. But now electronic devices such as diodes are used for conversion AC to DC. We require DC supply for DC devices Such as computer, battery charger, Etc. All this is possible with the advancement of semiconductor technology A transformer is used in order to step down the voltage to a desired level at the output a load is connected which consumes power. Bridge rectifier circuit and waveform (rectified). When the upper end of the secondary of transformer is positive, the diode D_1 and D_3 are forward biased and current flows through them. Current enters through D_1 and leaves D_3 to the other terminal similarly, during another half cycle, D_2 and D_4 are forward biased, current enters through D_2 and leaves through D_4 to the source.. To get a regulated DC voltage at the output we have to use a voltage regulator after filtering operation Rectifier is an electronic device which is used for converting an alternating (AC) voltage or current into a unidirectional (DC) voltage or current. The step down transformer is used to reduce the ac mains voltage to an adequately small value. The turn ratio of the transformer is adjusted to obtain a stepped down ac voltage. This voltage is convert into a pulsating dc voltage by the rectifier used are half wave rectifier, full wave rectifier or bridge rectifier.

3.10 Filter

A Filter is a device which removes the a.c component of rectifier output but allows the d.c component to reach the load. We have seen that the ripple content in the rectified output of half wave rectifier is 121% or that of full-wave or bridge rectifier or bridge rectifier is 48% such high percentages of ripples is not acceptable for most of the applications. Ripples can be removed by one of the following methods of filtering.

A capacitor, in parallel to the load, provides an easier by –pass for the ripples voltage though it due to low impedance. At ripple frequency and leave the D.C. to appear at the load. An inductor, in series with the load, prevents the passage of the ripple current (due to high impedance at ripple

frequency) while allowing the d.c (due to low resistance to d.c)

Filtering is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output. Filtering significantly increases the average DC voltage to almost the peak value ($1.4 \times \text{RMS value}$).

4. Software Used

4.1 Android Studio Software

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development.

• Features

New features are expected to be rolled out with each release of android studio. The following features are provided in the current stable version:

- Gradle-based build support
- Android-specific refactoring and quick fixes
- Lint tools to catch performance, usability, version compatibility and other problems
- Pro Guard integration and app-signing capabilities
- Template-based wizards to create common Android designs and components

4.2 Eagle Software

EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer aided manufacturing (CAM) features. EAGLE stands for Easily Applicable Graphical Layout Editor (German: Einfach Anzuwendender Grafischer Layout-Editor) and is developed by CadSoft Computer GmbH. In this software we have designed motor bridge circuit and main PCB of our project. This designing software was the different types of circuit can be designed. In this we can draw all actual connect which we are going to executed in main circuit.

4.3 Micro-C-PRO for PIC

The micro PRO for PIC is a powerful, feature-rich development tool for PIC microcontrollers. It is designed to provide the programmer with the easiest possible solution to developing applications for embedded systems, without compromising performance or control. PIC and C fit together well: PIC is the most popular 8-bit chip in the world, used in a wide variety of applications, and C, prized for its efficiency, is the natural choice for developing embedded systems. mikroC PRO for PIC provides a successful match featuring highly advanced IDE, ANSI compliant compiler, broad set of hardware libraries, comprehensive documentation, and plenty of ready-to-run examples.

In this software we have done a program for PCB circuit. This is advanced version of c pro and version is 7.0.1 in this

software we have to know actual or special function resistance (SFR) i.e. $\text{ADcon}=0*0.08$.

Features

- Micro PRO for PIC allows you to quickly develop and deploy complex applications: Monitor your program structure, variables, and functions in the Code Explorer.
- Generate commented, human-readable assembly, and standard HEX compatible with all programmers.
 - Inspect program flow and debug executable logic with the integrated Software Simulator.
- Generate COFF(Common Object File Format) file for software and hardware debugging under Microchip's MPLAB software.
 - Active Comments enable you to make your comments alive and interactive.
- Get detailed reports and graphs: RAM and ROM map, code statistics, assembly listing, calling tree, and more.

4.4 Working Hardware

Electronic Appliances Controlled Using Android Phone working is so simple to understand and it is mentioned below:

- A 230V supply is given hardware this 230v supply get step down to 12v by using of step down transformer
- 12v supply from transformer is given to 7805 voltage regulator.
- 7805 voltage regulator regulate 5v supply required microcontroller.
- After that this 5v supply is feed to bridge rectifier and filter.
- By using of rectifier ac supply is converted into dc and for conversion of pulsating dc to pure dc ceramic capacitor will used as filter.
- This 5v dc is given to HC-05 and microcontroller.
- The required programming make and it is stored into 16F4630 microcontroller.
- Heart of this project is android app due to that the operation proceeding forward.
- By using of Android app based on Bluetooth module HC-05 command gives.
- While through relay and driver IC operate relay mechanism which associated with home appliances.
- The working of hardware is shown in below fig.

5. Results and Discussions



Fig. 5 All device ON Results and Discussion

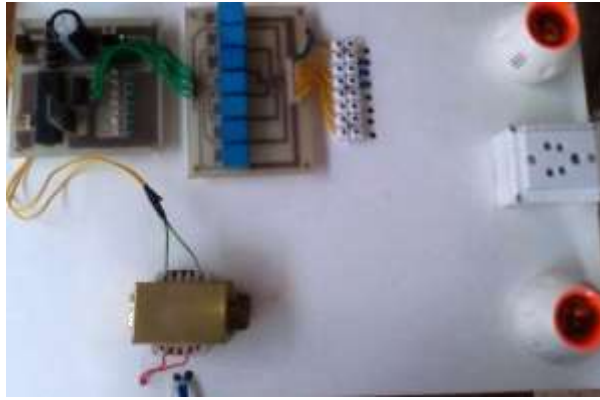


Fig. 5 (a) Assembly of all equipment

At home, we generally operate (switch on/off) all the electrical and electronics appliances such as fan, light, cooler, air conditioner, and so on through switches of the regular switch board. This manual switching of any home appliance is an inconvenient method for physically disabled or elders or even for normal young guys when frequent switching operation is required. Thus, this conventional manual switching method has to be overcome by an easier method of switching. This can be done using an advanced switching method like a remote control for electronic home appliances.

As compared between traditional method of controlling electronic home appliances and using android phone so by using android phone controlling is more suitable because of following mentioned benefits.

- Security
- Energy Efficiency
- Savings
- Convenience
- Comfort
- Peace of Mind

6 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.

7. Future Scope:

The future work includes addition of security system, automatic door locks, temperature system, so that they can be controlled by a handheld mobile device. By using of this system we are able to save electricity hence where availability of electronics component there we used this application with some addition feature to easy utilization.

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