

BLUETOOTH ENABLED ROBOT USING SMARTPHONE DURING DISASTER

Dr.M.AMANULLAH¹, R.LAVANYA²

¹ Department of Information Technology, Aalim Muhamed Salegh College of Engineering

m.amanullah@aalimec.ac.in

² Department of Information Technology, Aalim Muhamed Salegh College of Engineering

r.lavanya@aalimec.ac.in

Abstract- Internet of things is a new technology system that consists of a number of information technologies, and it's an important part of developing modern service industry. Android application, Smart phones are becoming each time more powerful and equipped with several accessories that are useful for Robots and it's an important part of developing modern service industry. Based on Internet of things, smartphone of Android system is connected with service oriented robots by wireless communication, where it is programmed based on TCP socket, thus, smart phone controlling service robot can be realized. This project describes how to control a robot using mobile through Bluetooth communication, some features about Bluetooth technology, components of the mobile and robot. The robot can be controlled by the system to sing, dance, and so on according to the command, and the characteristics are visual and portable, and the motion control of the robot can be realized well. The project proposed is mainly focused in life saving rescue and a technology that can help human in a trapped path.

Keywords- Bluetooth, smartphone, android, internet, communication.

1.INTRODUCTION

The project aims in designing a Robot that can be operated using Android mobile phone. The controlling of the Robot is done wirelessly through Android smart phone using the Bluetooth feature present in it. Here in the project the Android smart phone is used as a remote control for operating the Robot. The controlling device of the whole system is a Microcontroller .Bluetooth module, DC motors are interfaced to the Microcontroller. The data received by the Bluetooth module from Android smart phone is fed as input to the controller. The controller acts accordingly on the DC motors of the Robot. In achieving the task the controller is loaded with program written using Embedded 'C' language.

At present, the most common mobile development platforms are Symbian, iPhone and Android. As a result the open source code and high operational degree, the application scope of Android is usual in common use. A service robot was designed, which was invented for 60th anniversary celebration of Shandong University of Science and Technology, and there is an industrial computer in the Robot interior as its core, and it owns many functions such as personnel registration, face recognition, singing, dancing, expression performance, and so on.

At present, the robot is usually controlled by using the mouse, keyboard or voice. Although the control of the mouse and keyboard is precise, it is inconvenient to prepare special space for mouse and keyboard before the robot. In addition, although the control of voice is convenient, it needs special microphone and the recognition rate is not very high.

So, the intelligent mobile phone of Android system is used to control the service robot so that it can connect with mobile phones by wireless communication and can respond according to the will of people

So in effective area, we can send instructions in any position to control the robot without keyboard or voice.

2. INFORMATION ABOUT THE SYSTEM

There are many mechanisms and controllers that can control a robot and other remote controlled devices. But we have to create extra space for remotes and other controlling devices. If we develop such a kind of controlling device that can handle different devices such as T.V, robots, home electrical system etc. we don't have to create extra space for remotes. So android smartphone can be used as a controlling device with the help of proper android application. An robot is nothing but a manmade mechanical device for the well-being of mankind. So a robot can also be used for travelling purpose if equipped with proper electronic components.

The interaction of robot and android smartphone can be done with Bluetooth technology.

3. OVERVIEW OF THE SYSTEM

Our system aims to achieve the target to design a system that can provide following functionality-

a. Develop an android application that will act as a remote of a robot.

b. Develop a robot which will be helpful for travelling.

c. Here the focus is on the latest technology of android

and robot also called as mobot. An android

smartphone and the technology of android is vast and

can be used to interact with embedded system. Mobile,

robot and Bluetooth are the on-going

technologies which can be used for the benefit of mankind.

The system will consist of following four parts:

a. Bluetooth technology,

b. Android smartphone

c. Microcontroller and

d. DC motor.

Android smartphone will act as remote of the system,

Bluetooth will act as the connection link between robot and

android smartphone, microcontroller will act as the brain of

the robot, and DC motor will help us to move the robot.

This report describes about the real time android

technology that can be used as an interaction between embedded system.

I. EXISTING SYSTEM

a) The existing system uses manual work for maintenance and cleaning.

b) Some shifting robots are used but not with the advanced technologies, which give easier usage.

c) The system acquires more time and more human effort.

II. PROPOSED SYSTEM

a) The proposed system is used to deliver high performance with low effort.

b) The process will be completed with short time.

c) It reduces human effort.

d) The robot uses Bluetooth communication for safer transmission of data using android

e) Increases efficiency of the maintenance.

III. WORKING OF THE PROPOSED SYSTEM

Our proposed system consists of following components:

- a) Android smartphone
- b) Bluetooth module
- c) Microcontroller
- d) DC Power supply
- e) motor driver
- f) DC motor

An Android smartphone will act as remote controlled device for movement of the robot. An Android application will be developed for the same. The application will support only the 2.2 and above versions of Android Operating System.

The Bluetooth module act as an interface between Smartphone and microcontroller. We use HC-05 bluetooth module for the system which is used either as master or slave .. the hardware features are Typical -80dBm sensitivity

Up to +4dBm RF transmit power

Low Power 1.8V Operation ,1.8 to 3.6V

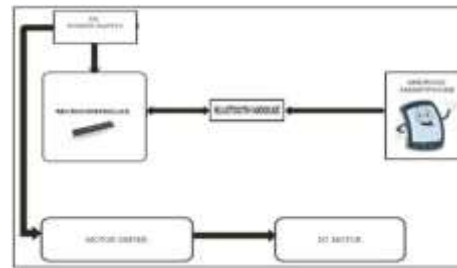
I/O

PIO control

With integrated antenna With edge connector

Microcontroller will act as the brain of the robot. The robot movement will be decided by the microcontroller. it will be programmed with the help of the Embedded C programming.

DC motors are widely used in system for travelling purpose because of their small size and high energy output. They are excellent for powering the drive wheels of a mobile robot as well as powering other mechanical assemblies.



The model represents a general idea how our robot will look like and its interfacing with the android smartphone.

Our robot will be made up of following components:

- a. Microcontroller
- b. DC motor
- c. PIR Sensor
- d. Ultrasonic sensor
- e. Bluetooth module
- f. Power supply

a) MICROCONTROLLER

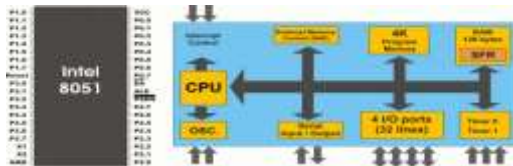
Microcontroller manufacturers have been competing for a long time for attracting choosy customers and every couple of days a new chip with a higher operating frequency, more memory and upgraded A/D converters appeared on the market.

However, most of them had the same or at least very similar architecture known in the world of microcontrollers as “8051 compatible”. What is all this about?

The whole story has its beginnings in the far 80s when Intel launched the first series of microcontrollers called the MCS 051. Even though these microcontrollers had quite modest features in comparison to the new ones, they conquered the world very soon and became a standard for what nowadays is called the microcontroller. The main reason for their great success and popularity is a skillfully chosen configuration which satisfies different needs of a large number of users allowing at the same time constant expansions (refers to the new types of microcontrollers). Besides, the software has been developed in great extend in the meantime, and it simply was not profitable to change anything in

the microcontroller's basic core. This is the reason for having a great number of various microcontrollers which basically are solely upgraded versions of the 8051 family. What makes this microcontroller so special and universal so that almost all manufacturers all over the world manufacture it today under different name?

As seen in figure above, the 8051 microcontroller has nothing impressive in appearance



- 4 Kb of ROM is not much at all.
- 128b of RAM (including SFRs) satisfies the user's basic needs.
- 4 ports having in total of 32 input/output lines are in most cases sufficient to make all necessary connections to peripheral environment.

The whole configuration is obviously thought of as to satisfy the needs of most programmers working on development of automation devices. One of its advantages is that nothing is missing and nothing is too much. In other words, it is created exactly in accordance to the average user's taste and needs. Another advantages are RAM organization, the operation of Central Processor Unit (CPU) and ports which completely use all recourses and enable further upgrade.

1.1 Pinout Description

Pins 1-8: Each of these pins can be configured as an input or an output.

Pin 9: One on this pin disables the microcontroller and clears the contents of most registers. In other words, the positive voltage on this pin resets the microcontroller. By applying logic zero to this pin, the program starts execution from the beginning.

Pins 10-17: Similar to port 1, each of these pins can serve as general input or output. Besides, all of them have alternative functions:

Pin 10: \overline{RXD} asynchronous communication input or Serial synchronous communication output.

Pin 11: \overline{TXD} asynchronous communication output or Serial synchronous communication clock output.

Pin 12: $\overline{INT0}$ 0 input.

Pin 13: $\overline{INT1}$ 1 input.

Pin 14: $T0$ 0 clock input.

Pin 15: $T1$ 1 clock input.

Pin 16: \overline{WR} external (additional) RAM.

Pin 17: \overline{RD} external RAM.

Pins 18, 19: $\overline{K1}$ and $\overline{K2}$ oscillator input and output. A quartz crystal which specifies operating frequency is usually connected to these pins. Instead of it, miniature ceramics resonators can also be used for frequency stability. Later versions of microcontrollers operate at a frequency of 0 Hz up to over 50 Hz.

Pin 20: GND

Pins 21-28: Port 2 is no intention to use

external memory then these port pins are configured as general inputs/outputs. In case external memory is used, the higher address byte, i.e. addresses A8-A15 will appear on this port. Even though memory with capacity of 64Kb is not used, which means that not all eight port bits are used for its addressing, the rest of them are not available as inputs/outputs.

Pin 29: \overline{PSEN} External ROM is used for storing program then a logic zero (0) appears on it every time the microcontroller reads a byte from memory.

Pin 30: \overline{ALE} Reading from external memory, the microcontroller puts the lower address byte (A0-A7) on P0 and activates the ALE output. After receiving signal from the ALE pin, the external register (usually 74HCT373 or 74HCT375 add-on chip) memorizes the state of P0 and uses it as a memory chip address. Immediately after that, the ALU pin is returned its previous logic state and P0 is now used as a Data Bus. As seen, port data multiplexing is performed by means of only one additional (and cheap) integrated circuit. In other words, this port is used for both data and address transmission.

Pin 31: By applying logic zero to this pin, P2 and P3 are used for data and address transmission with no regard to whether there is internal memory or not. It means that even there is a program written to the microcontroller, it will not be executed. Instead, the program written to external ROM will be executed. By applying logic one to the EA pin, the microcontroller will use both memories, first internal then external (if exists).

Pins 32-39: Similar to P2, if external memory is not used, these pins can be used as general inputs/outputs. Otherwise, P0 is configured as address output (A0-A7) when the ALE pin is driven high (1) or as data output (Data Bus) when the ALE pin is driven low (0).

Pin 40: V_{CC} power supply.

supply voltage over a pull-up resistor of high resistance.

Port 0

The P0 port is characterized by two functions. If external memory is used then the lower address byte (addresses A0-A7) is applied on it. Otherwise, all bits of this port are configured as inputs/outputs.

The other function is expressed when it is configured as an output. Unlike other ports consisting of pins with built-in pull-up resistor connected by its end to 5 V power supply, pins of this port have this resistor left out. This apparently small difference has its consequences:

If any pin of this port is configured as an input then it acts as if it “floats”. Such an input has unlimited input resistance and in determined potential

When the pin is configured as an output, it acts as an “open drain”. By applying logic 0 to a port bit, the appropriate pin will be connected to ground (0V). By applying logic 1, the external output will keep on “floating”. In order to apply logic 1 (5V) on this output pin, it is necessary to built in an external pull-up resistor.

1.2 Input/Output Ports (I/O Ports)

All 8051 microcontrollers have 4 I/O ports each comprising 8 bits which can be configured as inputs or outputs. Accordingly, in total of 32 input/output pins enabling the microcontroller to be connected to peripheral devices are available for use.

Pin configuration, i.e. whether it is to be configured as an input (1) or an output (0), depends on its logic state. In order to configure a microcontroller pin as an output, it is necessary to apply a logic zero (0) to appropriate I/O port bit. In this case, voltage level on appropriate pin will be 0.

Similarly, in order to configure a microcontroller pin as an input, it is necessary to apply a logic one (1) to appropriate port. In this case, voltage level on appropriate pin will be 5V (as is the case with any TTL input). This may seem confusing but don't loose your patience. It all becomes clear after studying simple electronic circuits connected to an I/O pin.

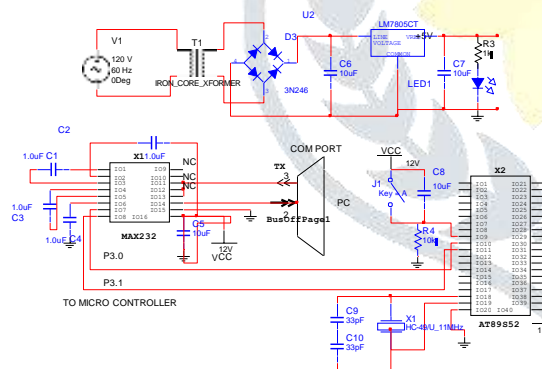


FIG 1.1 BLOCK DIAGRAM OF PWER SUPPLY AND 8051

Input/Output (I/O) pin

Figure above illustrates a simplified schematic of all circuits within the microcontroler connected to one of its pins. It refers to all the pins except those of the P0 port which do not have pull-up resistors built-in.

Output pin

A logic zero (0) is applied to a bit of the P register. The output FE transistor is turned on, thus connecting the appropriate pin to ground.

Input pin

A logic one (1) is applied to a bit of the P register. The output FE transistor is turned off and the appropriate pin remains connected to the power

Port 1

P1 is a true I/O port, because it doesn't have any alternative functions as is the case with P0, but can be configured as general I/O only. It has a pull-up resistor built-in and is completely compatible with TTL circuits.

Port 2

P2 acts similarly to P0 when external memory is used. Pins of this port occupy addresses intended for external memory chip. This time it is about the higher address byte with addresses A8-A15. When no memory is added, this port can be used as a general input/output port showing features similar to P1.

Port 3

All port pins can be used as general I/O, but they also have an alternative function. In order to use these alternative functions, a logic one (1) must be applied to appropriate bit of the P3 register. In terms of hardware, this port is similar to P0, with

the difference that its pins have a pull-up resistor built-in.

1.3 Pin's Current limitations

When configured as outputs (logic zero (0)), single port pins can receive a current of 10mA. If all 8 bits of a port are active, a total current must be limited to 15mA (port P0: 26mA). If all ports (32 bits) are active, total maximum current must be limited to 71mA. When these pins are configured as inputs (logic 1), built-in pull-up resistors provide very weak current, but strong enough to activate up to 4 TTL inputs of LS series.

1.4 Memory Organization

The 8051 has two types of memory and these are Program Memory and Data Memory. Program Memory (ROM) is used to permanently save the program being executed, while Data Memory (RAM) is used for temporarily storing data and intermediate results created and used during the operation of the microcontroller. Depending on the model in use (we are still talking about the 8051 microcontroller family in general) at most a few Kb of ROM and 128 or 256 bytes of RAM is used.

All 8051 microcontrollers have a 16-bit addressing bus and are capable of addressing 64 kb memory. It is neither a mistake nor a big ambition of engineers who were working on basic core development. It is a matter of smart memory organization which makes these microcontrollers a real "programmers' goody"

b) HC 05 BLUETOOTH MODEL

HC serial Bluetooth products consist of Bluetooth serial interface module and Bluetooth adapter, such as

(1) Bluetooth serial interface module:

Industrial level: HC-03, HC-04(HC-04-M, HC-04-S)

Civil level: HC-05, HC-06(HC-06-M, HC-06-S)

HC-05-D, HC-06-D (with baseboard, for test and evaluation)

(2) Bluetooth adapter:

HC-M4 HC-M6

This document mainly introduces Bluetooth serial module. Bluetooth serial module is used for converting serial port to Bluetooth. These modules have two modes: master and

slaver device. The device named after even number is defined to be master or slaver when out of factory and can't be changed to the other mode. But for the device named after odd number, users can set the work mode (master or slaver) of the device by AT commands.

HC-04 specifically includes:

Master device: HC-04-M, M=master

Slave device: HC-04-S, S=slaver

The default situation of HC-04 is slavemode. If you need master mode, please state it clearly or place an order for HC-04-M directly. The naming rule of HC-06 is same. When HC-03 and HC-05 are out of factory, one part of parameters are set for activating the device. The work mode is not set, since user can set the mode of HC-03, HC-05 as they want.

The main function of Bluetooth serial module is replacing the serial port line, such as:

1. There are two MCUs want to communicate with each other. One connects to Bluetooth master device while the other one connects to slave device. Their connection can be built once the pair is made. This Bluetooth connection is equivalently linked to a serial port line connection including RXD, TXD signals. And they can use the Bluetooth serial module to communicate with each other.

2. When MCU has Bluetooth slave module, it can communicate with Bluetooth adapter of computers and smart phones. Then there is a virtual communicable serial port line between MCU and computer or smart phone.

3. The Bluetooth devices in the market mostly are slave devices, such as Bluetooth printer, Bluetooth GPS. So, we can use master module to make pair and communicate with them. Bluetooth Serial module's operation doesn't need drive, and can communicate with the other Bluetooth device who has the serial. But communication between two Bluetooth modules requires at least two conditions:

(1) The communication must be between master and slave.

(2) The password must be correct.

However, the two conditions are not sufficient conditions. There are also some other conditions basing on different device model. Detailed information is provided in the following chapters. In the following chapters, we will repeatedly refer to Linvor's (Formerly known as Guangzhou HC Information Technology Co., Ltd.) material and photos.

2.1 Selection of the Module

The Bluetooth serial module named even number is compatible with each other; The slave module is also compatible with each other. In other word, the function of HC-04 and HC-06, HC-03 and HC-05 are mutually compatible with each other. HC-04 and HC-06 are former version that user can't reset the work mode (master or slave). And only a few AT commands and functions can be used, like reset the name of Bluetooth (only the slaver), reset the password, reset the baud rate and check the version number. The command set of HC-03 and HC-05 are more flexible than HC-04 and HC-06's. Generally, the Bluetooth of HC-03/HC-05 is recommended for the user.

2.2 Information of Package

The PIN definitions of HC-03, HC-04, HC-05 and HC-06 are kind of different, but the package size is the same: 28mm * 15mm * 2.35mm. The following figure 1 is a picture of HC-06 and its main PINs. Figure 2 is a picture of HC-05 and its main PINs. Figure 3 is a comparative picture with one coin. Figure 4 is their package size information. When user designs the circuit, you can visit the website of Guangzhou HC Information Technology Co.,

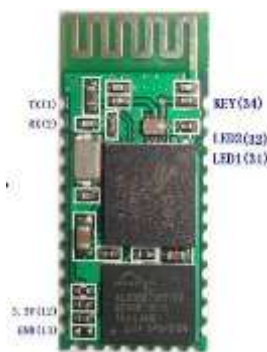


FIG 2.1 HC5 BLUETOOTH MODEL

2.3 AT command test

This chapter introduces some common commands in use. The detail introduction about HC-05 command is in HC-0305 AT command set.

2.4.1 Enter to AT mode:

Way1: Supply power to module and input high level to PIN34 at the same time, the module will enter to AT mode with the baud rate-38400.

Way2: In the first step, supply power to module; In the second step, input high level to PIN34. Then the module will enter to AT mode with the baud rate-9600. Way1 is recommended.

Command structure: all command should end up with "\r\n" (Hex: 0X0D X0A) as the terminator. If the serial helper is installed, user just need enter "ENTER" key at the end of command.

Reset the master-slave role command:

AT+ROLE=0 -----Set the module to be slave mode. The default mode is slave.

AT+ROLE=1 -----Set the module to be master mode.

2.4.2 Set memory command:

AT+CMODE=1

Set the module to make pair with the other random Bluetooth module (Not specified address). The default is this mode.

AT+CMODE=1

Set the module to make pair with the other Bluetooth module (specified address). If set the module to make pair with random one first, then set the module to make pair with the Bluetooth module has specified address. Then the module will search the last paired module until the module is found.

2.4.3 Reset the password command

AT+PSWD=XXXX

Set the module pair password. The password must be 4-bits.

2.4.4 Reset the baud rate

AT+UART== <Param>,<Param2>,<Param3>.

More information is provided at HC-0305 command set

c) PIR SENSOR

The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin.

3.1 Features

- _Single bit output
- _Small size makes it easy to conceal
- _Compatible with all Parallax microcontrollers

3.3V & 5V operation with <100uA currentdraw

3.2 Application IdeasAlarm Systems
Halloween Props

Quick Start Circuit

Note: The sensor is active high when the jumper(shown in the upper left) is in either position.

3.3 Connecting and Testing

Connect the 3-pin header to your circuitso that the minus (-) pin connects to ground or Vss, the plus (+) pin connects to Vdd and the

OUT pin connects to your microcontroller’s I/O pin. One easy way to do this would be to use a standard servo/LCD extension cable, available separately from Parallax (#805-00002).

This cable makes it easy to plug sensor into the servo headers on our Board Of Education or Professional Development Board. If you use the Board Of Education, be sure the servo voltage jumper (located between the 2 servo header blocks) is in the Vdd position, not Vin. If you do not have this jumper on your board you should manually connect to Vdd through the breadboard. You may also plug the sensordirectly into the edge of the breadboard and connect the signals from there. Remember the position of the pins when you plug the sensor into the breadboard.

3.5 Sensitivity

The PIR Sensor has a range of approximately 20 feet. This can vary with environmental conditions. The sensor is designed to adjust to slowly changing conditions that would happen normally as the day progresses and the environmental conditions change, but responds by making its output high when sudden changes occur, such as when there is motion.



FIG:3.1PIR SENSOR AND BLOCK DIAGRAM

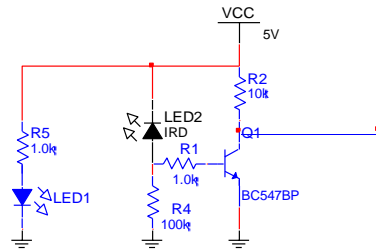


FIG:3.2 PIR SENSOR CIRCUIT

d) UltrasonicSensor

The Parallax ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards). It is very easy to connect to microcontrollers such as the BASIC Stamp®, SX or Propeller chip, requiring only one I/O pin. The (PING))) sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated.



FIG:4.1 ULTRASONIC SENSOR

4.1 Features

- Range: 2 cm to 3 m (0.8 in to 3.3
- Burst indicator LED shows sensor activity
- Bidirectional TTL pulse interface on a single I/O pin can communicate with 5 V TTL or 3.3 V CMOS microcontrollers
- Input trigger: positive TTL pulse, 2 μs min, 5 μs typ. Echo pulse:positive TTL pulse, 115 μs minimum to 18.5 ms maximum.
- RoHS Compliant

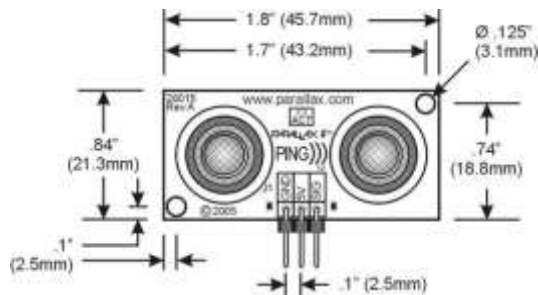
4.2 Key Specifications

- Supply voltage: +5 VDC
- Supply current: 30 mA type; 35 mA max
- Communication: Positive TTL pulse
- Package: 3-pin SIP, 0.1” spacing (ground, power, signal)

Operating temperature: 0 – 70° C.
 Size: 22 mm H x 46 mm W x 16 mm D(0.84 in x 1.8 in x 0.6 in)
 Weight: 9 g (0.32 oz)

4.3 Pin Definitions

sensor has a male 3-pin header used to supply ground, power (+5 VDC) and signal. The header may be plugged directly into a solderless breadboard, or into a standard 3-wire extension cable (Parallax part #805-000012).



4.4 Practical Considerations for Use Object Positioning

The PING))) sensor cannot accurately measure the distance to an object that: a) is more than 3 meters away, b) that has its reflective surface at a shallow angle so that sound will not be reflected back towards the sensor, or c) is too small to reflect enough sound back to the sensor. In addition, if your PING))) sensor is mounted low on your device, you may detect sound reflecting off of the floor.

e) POWER SUPPLY:

A **power supply** (sometimes known as a **power supply unit** or **PSU**) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

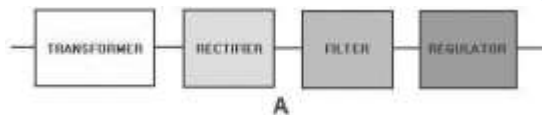


FIG:5.1 A) BLOCK DIAGRAM OF A BASIC POWER SUPPLY

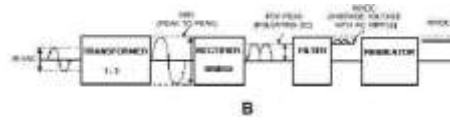


FIG:5.2 B) BLOCK DIAGRAM OF A BASIC POWER SUPPLY

The RECTIFIER section converts the alternating current input signal to a pulsating direct current. However, as you proceed in this chapter you will learn that pulsating dc is not desirable. For this reason a FILTER section is used to convert pulsating dc to a purer, more desirable form of dc voltage.

Figure 5.1A.—Block diagram of a basic power supply. The final section, the REGULATOR, does just what the name implies. It maintains the output of the power supply at a constant level in spite of large changes in load current or input line voltages. Now that you know what each section does, let's trace an ac signal through the power supply. At this point you need to see how this signal is altered within each section of the power supply. Later on in the chapter you will see how these changes take place. In view B of figure 4-1, an input signal of 115 volts ac is applied to the primary of the transformer. The transformer is a step-up transformer with a turns ratio of 1:3. You can calculate the output for this transformer by multiplying the input voltage by the ratio of turns in the primary to the ratio of turns in the secondary; therefore, 115 volts ac $\times 3 = 345$ volts ac (peak-to-peak) at the output. Because each diode in the rectifier section conducts for 180 degrees of the 360-degree input, the output of the rectifier will be one-half, or approximately 173 volts of pulsating dc. The filter section, a network of resistors, capacitors, or inductors, controls the rise and fall time of the varying signal; consequently, the signal remains at a more constant dc level. You will see the filter process more clearly in the discussion of the actual filter circuits. The output of the filter is a signal of 110 volts dc, with ac ripple riding on the dc. The reason for the lower voltage (average voltage) will be explained later in this chapter. The regulator maintains its output at a constant 110-volt dc level, which is used by the electronic equipment (more commonly called the load).

f) DC MOTOR

This kit allows controlling the speed of a DC motor in both the forward and reverse direction. The range of control is from fully OFF to fully ON in both directions. Normally, switches are used to change the direction of

rotation of a DC motor. Change the polarity of the applied voltage and the motor spins the other way! However this has the disadvantage that a DPDT switch has to be added to change the polarity of the applied voltage. Now you have two things to control the motor – a direction switch as well as the speed control. Also, it is not a good idea to suddenly reverse the voltage on a DC motor while it is spinning. It can cause a current surge that can burn out the speed controller. Not to mention any mechanical stress it can cause as well.

This kit overcomes both these problems. The direction and speed is controlled using a single potentiometer. Turning the pot in one direction causes the motor to start spinning. Turning the pot in the other direction causes the motor to spin in the opposite direction. The center position on the pot is OFF, forcing the motor to slow and stop before changing direction.

6.1 SPECIFICATIONS

Voltage: The kit and motor use the same power supply. Since the maximum operating voltage of the LM324 is 32VDC then this is also the maximum voltage available to run the motor.

Current: The IRFZ44 MOSFET can handle 49A; the IRF4905 can handle 74A. However the PCB tracks that run from the MOSFET pins to the screw terminal block can only handle around 5A. This can be increased by soldering wire links across the PCB tracks. If you do then check that the MOSFETs don't get too hot – if so then bigger heatsinks will be required.

6.2 SPEED CONTROL OF DC MOTORS

Basically, there are three ways to vary the speed of DC motors:

1. With the use of mechanical gears to achieve the desired speed. This method is generally beyond the capability of most hobbyist home workshops.
2. Reducing the motor voltage with a series resistor. However this is inefficient (energy wasted in resistor) and reduces torque. The current drawn by the motor increases as the load on the motor increases. More current means a larger voltage drop across the series resistor and therefore less voltage to the motor. The motor now tries to draw even more current, resulting in the motor "stalling".
3. By applying the full supply voltage to the motor in bursts or pulses, eliminating the series dropping effect. This is called **pulse width modulation (PWM)**

and is the method used in this kit. Short pulses means the motor runs slowly; longer pulses make the motor run faster.

ANDRIOD

Android is an [operating system](#) based on the [Linux kernel](#),^[12] and designed primarily for [touchscreen](#) mobile devices such as [smart phones](#) and [tablet computers](#). Initially developed by Android, Inc., which [Google](#) backed financially and later bought in 2005,^[13] Android was unveiled in 2007 along with the founding of the [Open Handset Alliance](#)—a consortium of [hardware](#), software, and telecommunication companies devoted to advancing [open standards](#) for mobile devices.^[14] The first publicly available smartphone running Android, the [HTC Dream](#), was released on October 22, 2008.

The [user interface](#) of Android is based on [direct manipulation](#), using touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching and reverse pinching to manipulate on-screen objects. , for example adjusting the screen from portrait to landscape depending on how the device is oriented. Android allows users to customize their home screens with shortcuts to applications and [widgets](#), which allow users to display live content, such as emails and weather information, directly on the home screen. Applications can further send notifications to the user to inform them of relevant information, such as new emails and text messa

CONCLUSION

The proposed system shows how the android smartphone can be used as remote controller for robot and various embedded technologies with the help of the Bluetooth technology. The proposed system also shows that how a robot can be used for travelling purpose. The operating system of smartphone is Android, and it can develop effective remote control program and by using WiFi wireless network, the communication between smartphone and robot can be realized, which makes it simple and convenient to control robot.

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