Wireless Communication
(Mobile Operated Robotics)

Skyfi labs
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Roboversity

BRIEF DESCRIPTION OF ELECTRONIC COMPONENTS IN WIRELESS COMMUNICATION

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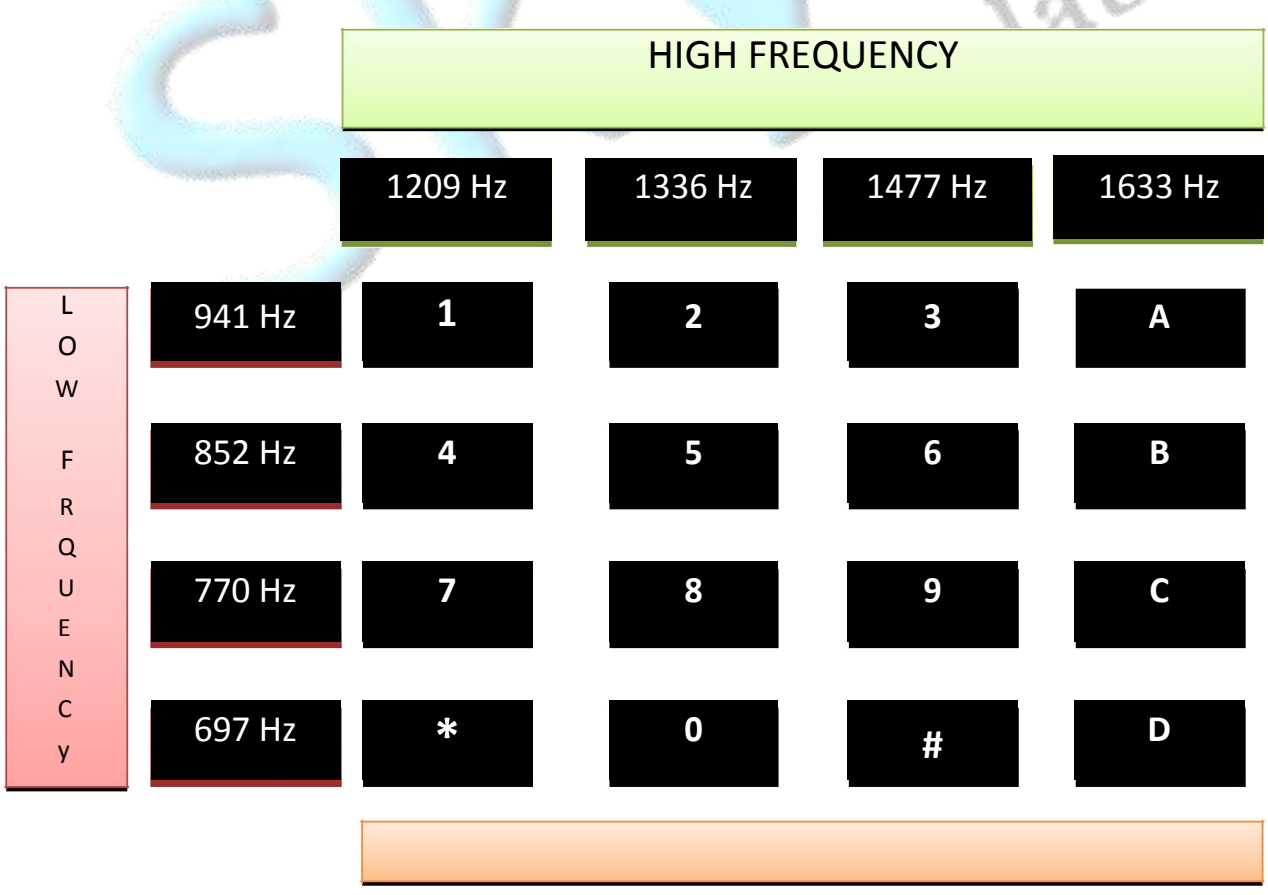
DTMF (Dual Tone Multi frequency):

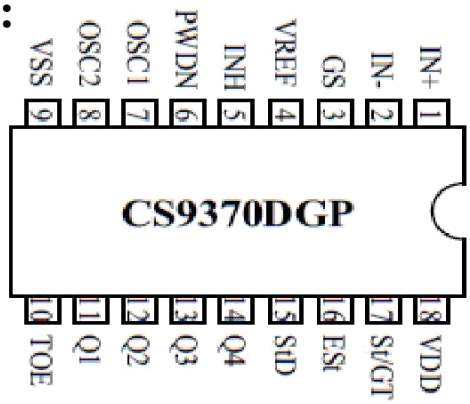
DTMF is a process used in the telephone system. While dialling the number to recognise the key on the phone's keypad, the key will generate two simultaneous tones, these tones are decoded by the DTMF decoder (Telephone exchange) and determine the key which was pressed.

There are sixteen DTMF signals in total, which are divided into two groups called high group frequencies and low group frequencies. The high groups frequencies are in the range between 1209Hz to 1633Hz and the low frequencies are in the range between 697Hz to 941 Hz. One key uses only one frequency from each group, so that the other frequency will not get interrupted when you press a particular key.

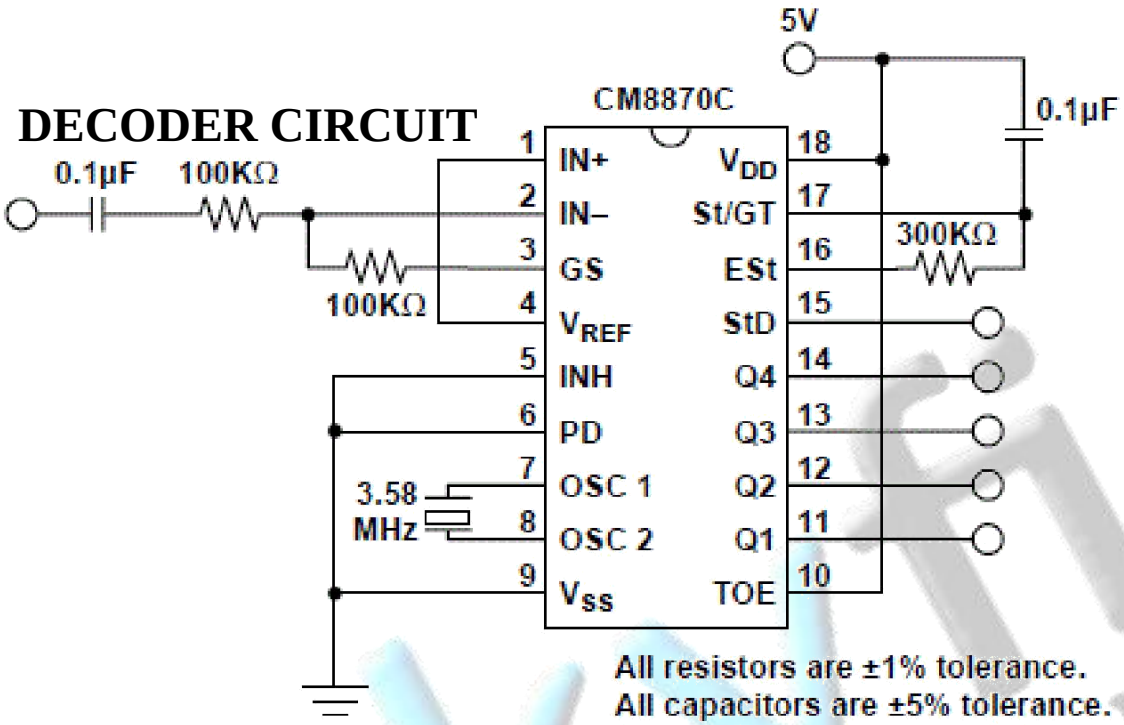
The following fig. shows the frequencies used for each signal:



DECODER IC:



Pin Function		
Name	**Function**	**Discription**
IN+	Non-inverting input	Connection to the front-end differential amplifier
IN–	Inverting input	Connection to the front-end differential amplifier
GS	Gain select	Gives access to output of front-end differential amplifier for connection of feedback resistor.
V_{REF}	Reference output Voltage (nominally $V_{DD}/2$)	May be used to bias the inputs at mid-rail.
INH	Inhibits detection of tones	Represents keys A, B, C, and D
OSC3	Digital buffered oscillator output	
PD	Power down	Logic high powers down the device and inhibits the oscillator.
OSC1	Clock input	3.579545MHz crystal connected between these pins completes internal oscillator
OSC2	Clock output	3.579545MHz crystal connected between these pins completes internal oscillator
V_{SS}	Negative power supply	Normally connected to OV
TOE	Three-state output enable (Input)	Logic high enables the outputs Q1-Q4. Internal pull-up.
Q_1 Q_2 Q_3 Q_4	Three-state ouputs	When enabled by TOE, provides the code corresponding to the last valid tone pair received. (See Figure 2).
StD	Delayed Steering output	Presents a logic high when a received tone pair has been registered and the output latch is updated. Returns to logic low shen the voltage on St/GT falls below V_{TSt}.
ESt	Early steering output	Presents logic high immediately when the digital algorithm detects a recongnizable tone pair (signal condition). Any momentary loss of signal condition will cause ESt to return a logic low.
St/Gt	Steering input/guard time output (bidirectional)	A voltage greater than V_{TSt} detected at St causes the device to register the dectected tone pair. The GT output acts to reset the external steering time constrant, and its state is a function of ESt and the voltage on St. (See Figure 2).
V_{DD}	Positve power supply	
IC	Internal connection	Must be tied to V_{SS} (for 8870 configuration only).



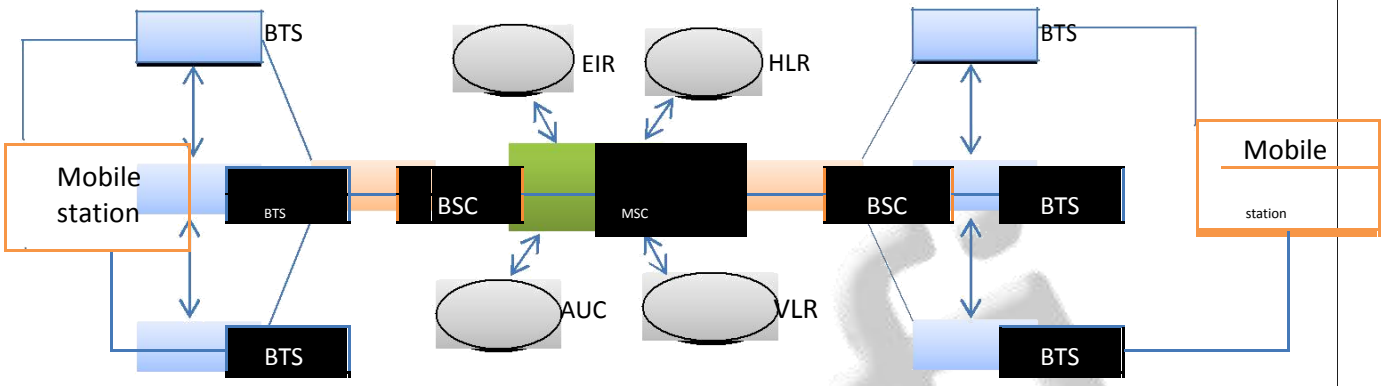
Working Principle:

DTMF keypads are present in all landline and mobile phones. Thus, DTMF technology is used in the telephone exchanges to identify the number dialed by the caller. A DTMF decoder circuit distinguishes the frequencies produced by the keypad and produces the binary sequence equivalent to the key pressed in a DTMF keypad. In the decoder circuit we useCS9370DGP IC asdecoder IC which decodes tones generated by the keypad. DTMF signal can be tapped directly from the microphone pin of a mobile phone device. Cut the microphone wire and you will get two wires. The one wire is the DTMF input other is the ground to the circuit. The signals from the microphone wire are processed by the DTMF decoder IC which generates the equivalent binary sequence as parallel outputs - Q1, Q2, Q3, and Q4.

OUTPUT:

Key	Q4	Q3	Q2	Q1
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	1	0	1	0
*	1	0	1	1
#	1	1	0	0
A	1	1	0	1
B	1	1	1	0
C	1	1	1	1
D	0	0	0	0

WIRELESS MOBILE COMMUNICATION:



BTS (Base Transceiver station) MSC (Mobile switching centre) BSC (Base Station Controller)
AuC (Authentication centre) HLR (Home location register) VLR (Visitor Location Register)
EIR (Equipment identity register)

In wireless communication, we have three different types of technologies as mentioned below.

->Time Division Multiple Access (TDMA)

->Frequency Division Multiple Access (FDMA)

->Code Division Multiple Access (CDMA)

Time Division Multiple Access (TDMA):

The Time division multiple access was used in the first generation (1G). In TDMA the bandwidth is just have one channel that is timeshared between different stations. Each station is allocated a time slot during which it can send data and each station transmits its data in is assigned time slot.

Frequency Division Multiple Access(FDMA):

The Frequency Division Multiple Access is a technology using in 2G and 2.5G.In FDMA the total bandwidth is divided into frequency band. Each station is allocated a band to send its data in allocated frequency and also uses a band pass filter to confine the transmitter and receiver frequencies.

Code Division Multiple Access (CDMA):

The Code Division Multiple Access is using in 3G technology. In CDMA one channel carries all transmissions simultaneously and using a unique code for each transmitted signal, the mobile and base station are able to distinguish between signals transmitted simultaneously over the same frequency allocation. CDMA can also be combined with FDMA and TDMA technologies to increase system capacity.

Overview Of wireless Communication:

In Mobile communication system a mobile phone with a SIM is called **Mobile Station** (MS).

A cell site is formed to cover the particular area is called **Base Transceiver Station** (BTS) which serves the MS in its coverage area.

Many Base Transceiver stations are controlled by a station called **Base Station Controller** (BSC).

The Heart of the Wireless communication is **Mobile Switching Centre**(MSC). The MSC handles the communication such as switching the calls, transfer the calls, calls setup and also it will handle the handoffs as well as coordinates with other MSCs.

HLR (Home location register) :

Home Location Register is the database of all the subscribers. HLR maintains the data related to subscribers such as location of the subscriber, roaming information and details related to subscriber.

VLR (Visitor Location Register):

Visitor Location Register has the same information which is present in Home Location Register. The VLR gives the information to the MSCs when the subscriber is within the visitor location (Roaming).

Types of Wireless communication

1. Radio Frequency
2. Mobile communication
3. Infrared
4. Bluetooth
5. Wi-Fi
6. ZigBee
7. WiMAX

Radio Frequency:

Radio Frequency is a combination of Very high frequency and ultra-high frequency. In radio frequency mostly used in AM, FM, TV broadcasting.

Infrared:

Infrared wireless is a wireless technology used to transfer a data through infrared radiation.

Bluetooth:

Bluetooth is a technology used for data communication that uses a short range radio links. By using this we can transfer data with a speed up to 1 Mbps.

Wi-Fi:

Wireless Fidelity allows for wireless Internet connection through a wireless router. By using Wi-Fi we can achieve high data rates.

Zigbee:

Zigbee is a wireless technology designed for a small, low power device for data transfer. This technology is mostly used in home appliances

WiMAX:

Worldwide Interoperability for Microwave Access is a telecommunication protocol that provides fixed and fully mobile internet

HEADSET:

- A headset includes an input that receives an audio signal from electronic equipment like mobile phone and earpieces having electro-acoustic speakers for converting the electrical signals to audible sound.
- The headset includes a microphone that receives ambient sound and converts the ambient sound to a sound.
- In addition, the headset also includes a processing circuit that receives the audio signals from the electronic equipment and converts into audible sound.

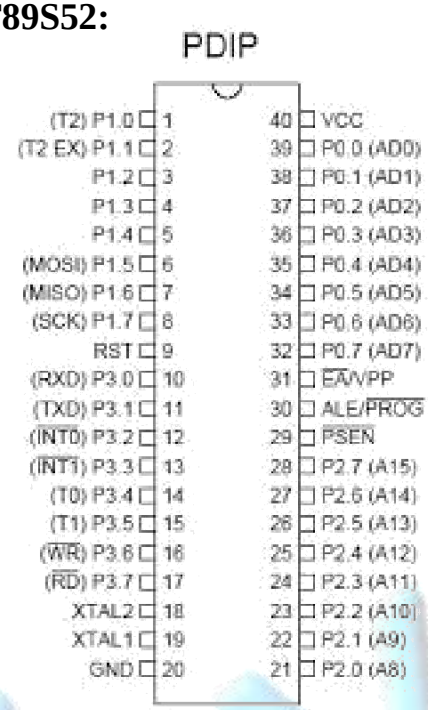
MICRO CONTROLLER:

The Skyfi Labs Development Board uses AT89S52 microcontroller which comes under 8051 family. It is equipped with a 8kB flash memory and 256 bytes of data RAM.

FEATURES OF AT89S52:

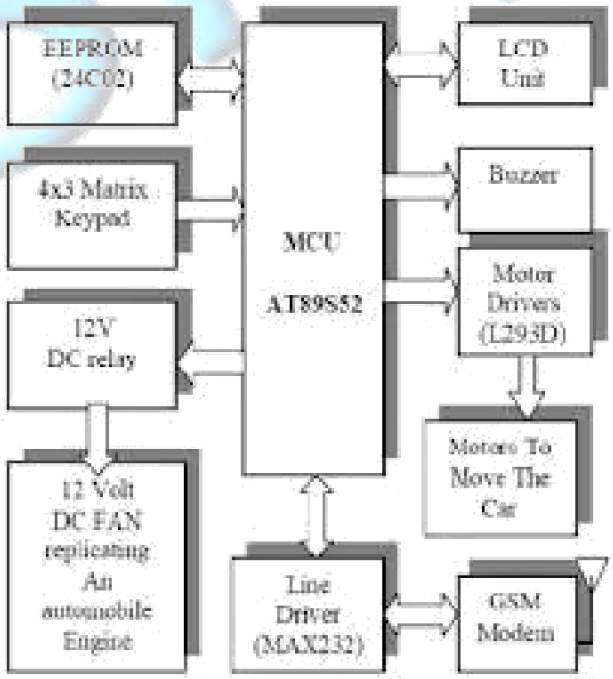
- 4.0V to 5.5V Operating Range.
- Fully Static Operation: 0 Hz to 33 MHz.
- Three-level Program Memory Lock.
- 256 x 8-bit Internal RAM.
- 32 Programmable I/O Lines.
- Three 16-bit Timer/Counters.
- Eight Interrupt Sources.
- Full Duplex UART Serial Channel.
- Low-power Idle and Power-down Modes.
- Interrupt Recovery from Power-down Mode.
- Watchdog Timer.
- Dual Data Pointer.
- Power-off Flag.
- Fast Programming Time.
- Flexible ISP Programming.

PIN DIAGRAM OF AT89S52:



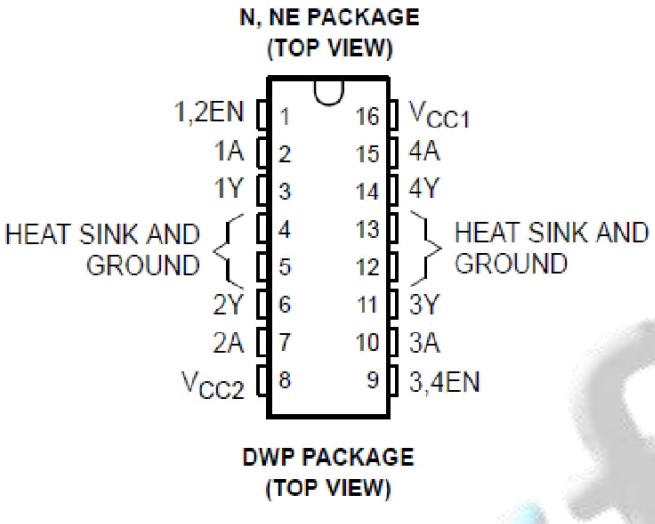
In Skyfi Labs' development board, thePort1 Lower has been used for input (connected to comparator) and Port2 Lower for output (connected to motor driver).

BLOCK DIAGRAM:

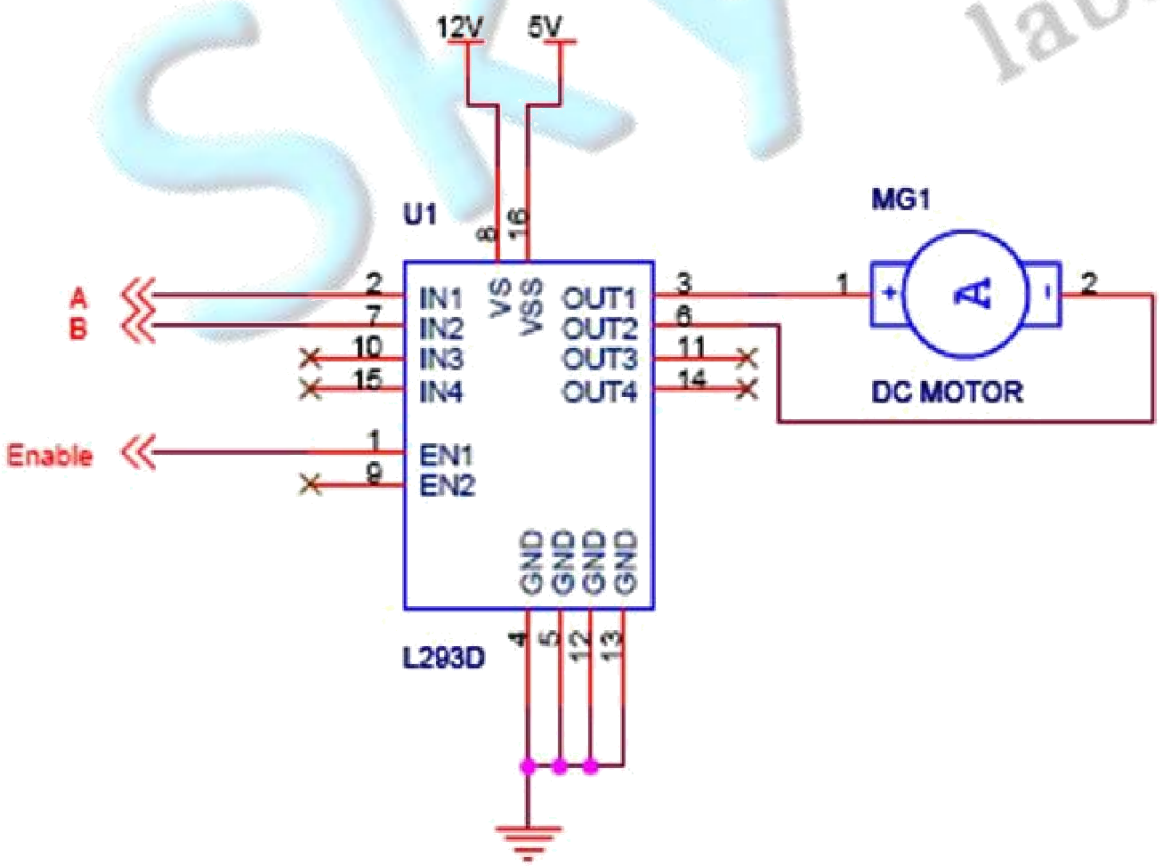


MOTOR DRIVER:

- The L293 and L293D are quadruple high-current half-H drivers.
- The L293 is designed to provide bidirectional drive currents of up to 1A at voltages from 4.5V to 3.6V



OPERATION OF MOTOR DRIVER (L293D):



TRUTH TABLE:

A	B	DESCRIPTION
0	**0**	Motor stops or Breaks
0	**1**	Motor Runs Anti-Clockwise
1	**0**	Motor runs Clockwise
1	**1**	Motor stops or breaks

For the above table, the Enable has to be set 1. Motor power is mentioned as 12V, but the power supply can be connected according to the rating of the motors used.

NOTE:

- The above operation of a Motor Driver demonstrates its working with only one DC motor connected to it. Note that in our robot the PCB is used to drive two motors and the settings need to be done accordingly.

DC MOTORS:

DC Motors convert electrical energy (voltage) to mechanical energy (produce rotational motion). The Dc motor works on the principle of Lorentz force which states that when a wire

carrying current is placed in a region having magnetic field, than the wire experiences a force. This Lorentz force provides a torque to the coil to rotate..

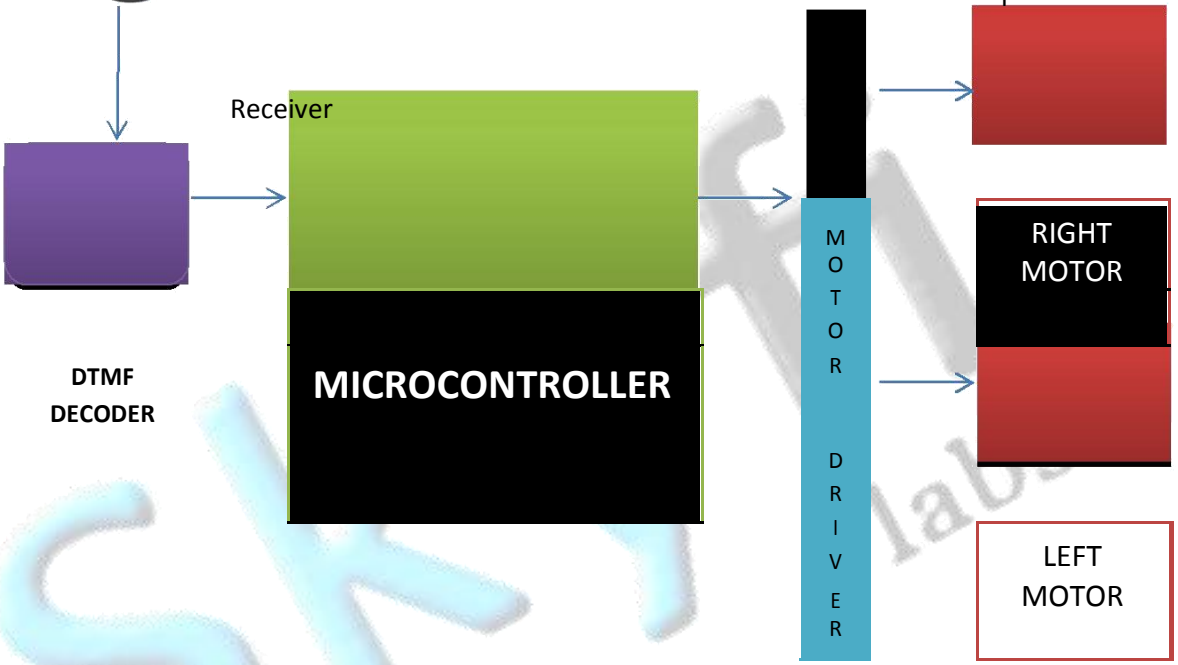
Figure of DC Motor

Speed of motor depends upon its RPM rating and we can vary the speed of motor by changing the voltage across the motor terminals. Gears are used to increase the torque of D.C Motor on the expense of its speed.

SPECIFICATIONS OF THE MOTORS USED IN WORKSHOP:

60 RPM-12V DC Geared Motor.

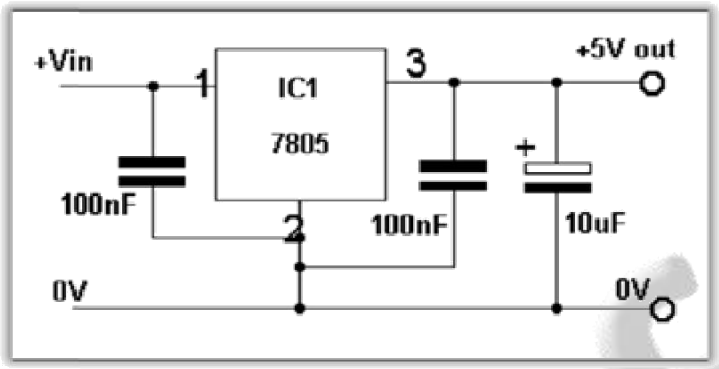
OVERVIEW:



VOLTAGE REGULATOR:

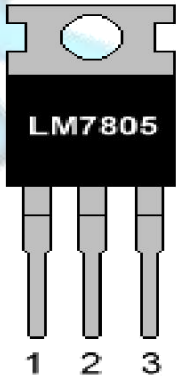
7805 is a **Voltage Regulator** Integrated Circuit. It is a member of 78xx series of fixed linear voltage regulator ICs.

BLOCK DIAGRAM:



The **voltage regulator IC** maintains the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage to which it is designed to provide. 7805 provides +5V regulated power supply.

PIN DIAGRAM OF 7805:



PIN CONFIGURATION OF 7805:

Pin No	NAME	FUNCTION
1	Input	Input Voltage; (5V-18V)
2	Ground	Ground (0V)
3	Output	Output Voltage; (4.8V-5.2V)