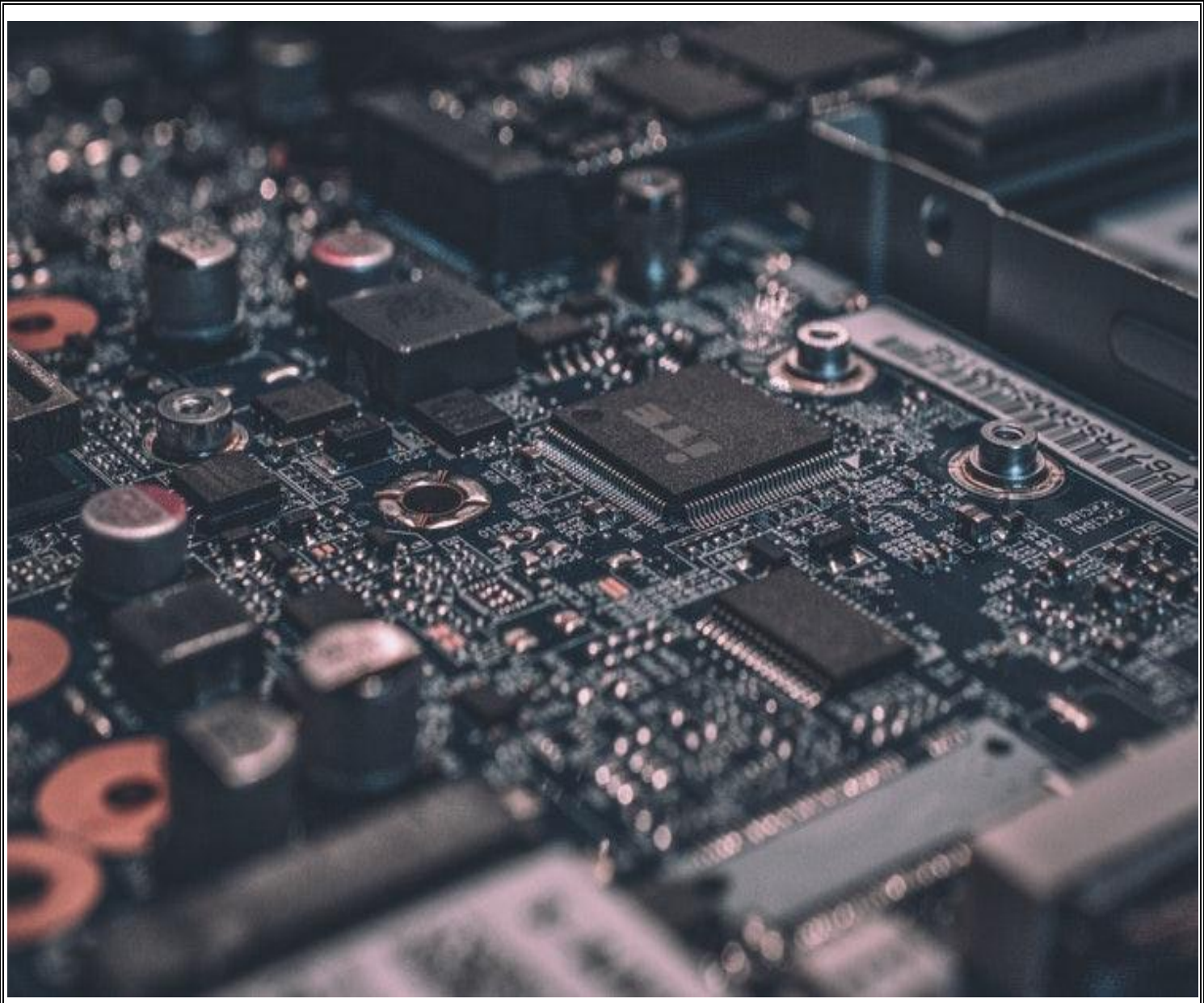

MULTI-PURPOSE AUTOMATION

MAJOR PROJECT REPORT

UBAID, NAUSHAD, RITIK,CHIRAG,SARIM

SESSION(2018-19)

BLE-692

ALIGARH MUSLIM UNIVERSITY

PROJECT REPORT

SESSION (2018-19)

PROJECT REPORT

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Certificate

This is to certify that the work embodied in the project report entitled "Multi-Purpose Automation" which is being submitted by UBAID UR REHMAN, NAUSHAD ALAM, RITIK SHARMA, CHIRAG AGARWAL AND MOHD SARIM as a major project work in "DIPLOMA IN ELECTRONICS ENGINEERING" of UNIVERSITY POLYTECHNIC (BOYS), ALIGARH MUSLIM UNIVERSITY, ALIGARH. This is a record of their cumulative effort carried out under my supervision and guidance. They completed this work with unflagging zeal, interest and enthusiasm.

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ACKNOWLEDGEMENT

With immense pleasure and great sense of satisfaction we acknowledge those without whom, the completion of this project couldn't have been achieved. It is with great privilege that I take this opportunity to express my heartfelt regard and gratitude to my teacher "Ms. Sarah Anjum", University Polytechnic (BOYS), Aligarh Muslim University, Aligarh for his inspiring guidance, constant encouragement and assistance which was always forthcoming.

This affectionate attitude and constructive criticism made this work easy and interesting.

ABSTRACT

In The Project "Multi-Purpose Automation" controls a car with the help of commands given through a remote . When the command is given through a encoder IC it is processed by the ASK RF T\R MODULE ,which perform digital modulation on the applied input, and it radiates signal which is received by RF receiver and the digital signals are then applied to the L298N module which controls the motion of the motors and the according to the command given by the user car moves accordingly. When the car moves left the motor on the right side moves in the clock-wise direction and the car turns left. Similarly when the car moves right the motor on the left side moves in clockwise direction and the motor turns right.

CONTENTS

1. INTRODUCTION

This Work is based on RF communication, motor driver and encoder and decoder ICs. RF module is based on an IC in which the input signal is modulated by using Amplitude Shift Keying. The ASK transmitter module employs a crystal stabilized oscillator, ensuring accurate frequency control for best range performance.In an ASK system, the binary for a bit duration of t sec. If the signal value is 1 then the carrier signal will be transmitted otherwise, a signal value of 0 will be transmitted. Since robotics has become a major part in our daily life and also in the engineering field and it plays a vital role in the development of new technology.

This is a very simple and easy type form of remote control car, where the ordinary micro-controller has been replaced by RF module and IR sensors has been replaced by a Encoder and Decoder IC. The remote is based on RF transmitter module. This project can be made in a bigger scale for real time vehicles.

As can be seen by taking a look at the introduction, the main hardware requirement of the project is ASK rf transceiver module and L298N motor driver module.The project is based on transmitting digital signal and apply the recovered signal at the receiver to the motor driver inputs IN1, IN2, IN3 and IN4.

The hardware requirement of the project is –

1. ASK RF transmitter and receiver module
2. L298N Motor driver module
3. HT12E AND HT12D encoder & decoder ICs
4. DC motors (12V, 100rpm)
5. A wooden board
6. Some jumper wires.

1.1. RF MODULE

An **RF module** (radio frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio frequency (RF) communication. For many applications the medium of choice is RF since it does not require line of sight. RF communications incorporate a transmitter and a receiver. They are of various types and ranges. Some can transmit up to 500 feet. RF modules are widely used in electronic design owing to the difficulty of designing radio circuitry.

RF modules are most often used in medium and low volume products for consumer applications such as garage door openers, wireless alarm or monitoring systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are sometimes used to replace older infra red communication designs as they have the advantage of not requiring line-of-sight operation.

Several carrier frequencies are commonly used in commercially available RF modules, including those in the industrial, scientific and medical (ISM) radio bands such as 433.92 MHz, 915 MHz, and 2400 MHz. These frequencies are used because of national and international regulations governing the used of radio for communication. Short Range Devices may also use frequencies available for unlicensed such as 315 MHz and 868 MHz.

RF modules may comply with a defined protocol for RF communications such as Zigbee, Bluetooth low energy, or Wi-Fi, or they may implement a proprietary protocol.

1.1.1. TYPES OF RF MODULES

The term RF module can be applied to many different types, shapes and sizes of small electronic sub assembly circuit board. It can also be applied to modules across a huge variation of functionality and capability. RF modules typically incorporate a printed circuit board, transmit or receive circuit, antenna, and serial interface for communication to the host processor.

Most standard, well known types are covered here:

- Transmitter module
- Receiver module
- Transceiver module
- System on a chip module

1.1.2. TRANSMITTER MODULES

An RF transmitter module is a small PCB sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro controller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics, and band edge requirements.

1.1.3.RECEIVER MODULES

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: superheterodyne receivers and super-regenerative receivers. Super-regenerative modules are usually low cost and low power designs using a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage Superheterodyne receivers have a performance advantage over

super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range. This stability comes from a fixed crystal design which in the past tended to mean a comparatively more expensive product. However, advances in receiver chip design now mean that currently there is little price difference between superheterodyne and super-regenerative receiver modules.

1.1.4. RF SIGNAL MODULATION

There are three types of signal modulation methods commonly used in RF transmitter and receiver modules:

- ASK
- OOK
- FSK
- Direct-sequence spread spectrum
- Frequency-hopping spread spectrum

1.1.5.MAIN FACTORS AFFECTING RF MODULE PERFOMANCE

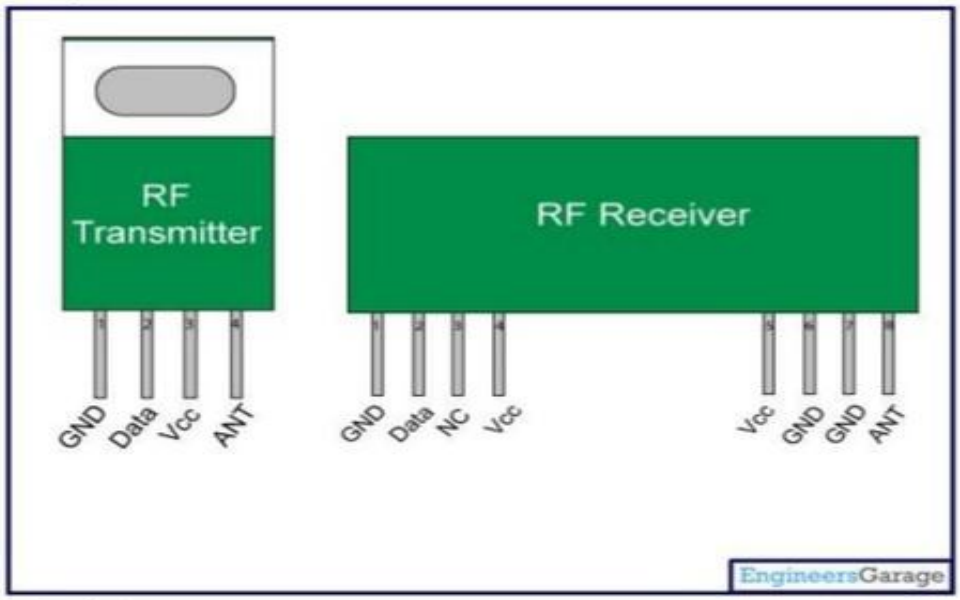
As with any other RF device, the performance of an RF module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. However, this will also result in a higher electrical power drain on the transmitter device, which will cause shorter operating life for battery powered devices. Also, using a higher transmit power will make the system more prone to interference with other RF devices, and may in fact possibly cause the device to become illegal depending on the jurisdiction. Correspondingly, increasing the receiver sensitivity will also increase the effective communication range, but will also potentially cause malfunction due to interference from other RF devices.

The performance of the overall system may be improved by using matched antennas at each end of the communication link, such as those described earlier.

Finally, the labeled remote distance of any particular system is normally measured in an open-air line of sight configuration without any interference, but often there will be obstacles such as walls, floors, or dense construction to absorb the radio wave signals, so the effective operational distance will in most practical instances be less than specified.

1.1.5. PIN CONFIGURATION

Pin Diagram:



Pin Description:

RF Transmitter

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage; 5V	Vcc
4	Antenna output pin	ANT

RF Receiver

Pin No	Function	Name
1	Ground (0V)	Ground
2	Serial data output pin	Data
3	Linear output pin; not connected	NC
4	Supply voltage; 5V	Vcc

Fig 1.1

1.2. HT12E (ENCODER IC)

HT12E is an **encoder integrated circuit** of 2^{12} series of encoders. They are paired with 2^{12} series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format.

Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits.

HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

1.2.1. PIN CONFIGURATION

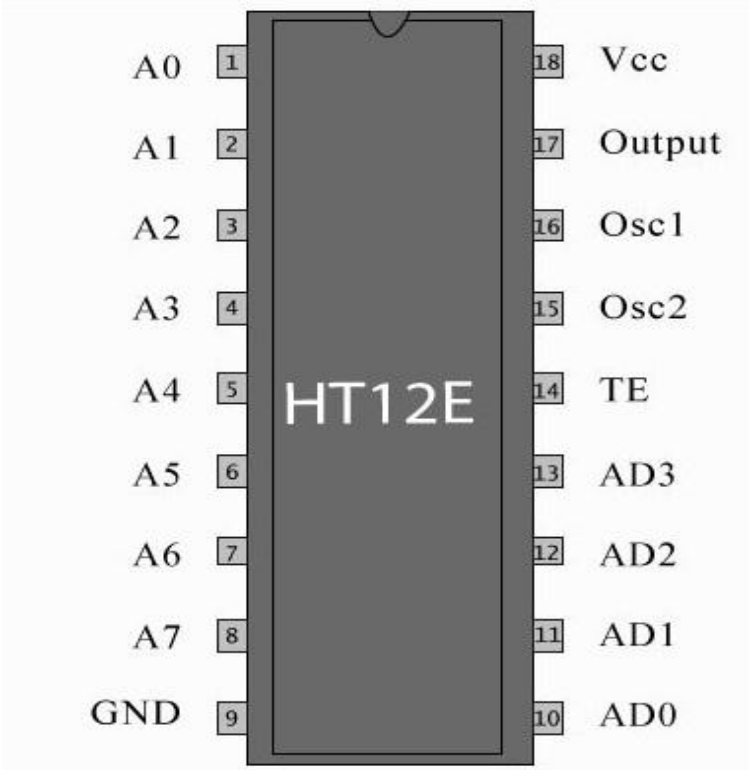


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Fig 1.2

1.2.2. PIN DESCRIPTION:

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground
10	4 bit Data/Address pins for input	AD0

11		AD1
12		AD2
13		AD3
14	Transmission enable; active low	TE
15	Oscillator input	Osc2
16	Oscillator output	Osc1
17	Serial data output	Output
18	Supply voltage; 5V (2.4V-12V)	Vcc

1.2. HT12D(DECODER IC)

HT12D is a **decoder integrated circuit** that belongs to 2^{12} series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 2^{12} series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format.

In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin.

HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new is received.

1.2.3. PIN CONFIGURATION

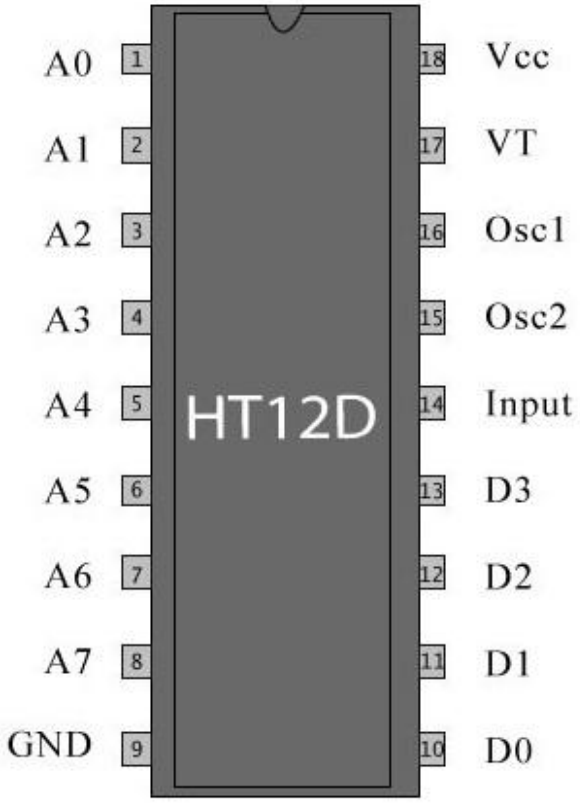


Fig 1.3

1.2.4. PIN DESCRIPTION:

Pin No	Function	Name
1	8 bit Address pins for input	A0
2		A1
3		A2
4		A3
5		A4
6		A5
7		A6
8		A7
9	Ground (0V)	Ground

10	4 bit Data/Address pins for output	D0
11		D1
12		D2
13		D3
14	Serial data input	Input
15	Oscillator output	Osc2
16	Oscillator input	Osc1
17	Valid transmission; active high	VT
18	Supply voltage; 5V (2.4V-12V)	Vcc

1.3. RF COMMUNICATION

RF communication works by creating electromagnetic waves at a source and being able to pick up those electromagnetic waves at a particular destination. These electromagnetic waves travel through the air at near the speed of light. The wavelength of an electromagnetic signal is inversely proportional to the frequency; the higher the frequency, the shorter the wavelength.

Frequency is measured in Hertz (cycles per second) and radio frequencies are measured in kilohertz (KHz or thousands of cycles per second), megahertz (MHz or millions of cycles per second) and gigahertz (GHz or billions of cycles per second). Higher frequencies result in shorter wavelengths. The wavelength for a 900 MHz device is longer than that of a 2.4 GHz device.

In general, signals with longer wavelengths travel a greater distance and penetrate through, and around objects better than signals with shorter wavelengths.

1.3.1. ADVANTAGES

- The first advantage of RF over IR is in the improved user experience and much better range.
- RF does not require the typical IR point-and-shoot action anymore. You can walk anywhere in the house and use the remote.
- The rf remote control can transmits its signal through walls,doors and furnitures, which makes it possible to install the set top box in a closed cabinet or closet.
- Another benefit of RF over IR is that RF allows two-way communication and enables a status display on the remote.
- The direct interaction with the end-user will allow the service provider to send messages to the remote control display.
- The combination of no line of sight operation and bi-directional communications also enables one of the most nerve soothing features of RF remote controls- a simple yet efficient “find-me-function”.

1.3.2. DISADVANTAGES

The main disadvantages of radio communication or radio waves is that it is harmful to skin as well as health,

- Large doses of radio waves are believed to cause cancer,leukemia and other disorders.
- Exposure to RFs have been unofficially linked to sleep disorders, headaches and other neurological problems.

1.4. L298N MODULE

The L298N is a dual H-Bridge motor driver[see Fig.(2.1)] which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

✓ The module has two screw terminal blocks for the motor A and B, and another screw terminal block for the Ground pin, the VCC for motor and a 5V pin which can either be an input or output.

✓ This depends on the voltage used at the motors VCC. The module have an onboard 5V regulator which is either enabled or disabled using a jumper. If the motor supply voltage is up to 12V we can enable the 5V regulator and the 5V pin can be used as output, for example for powering our Arduino board [see fig.(2.2)].

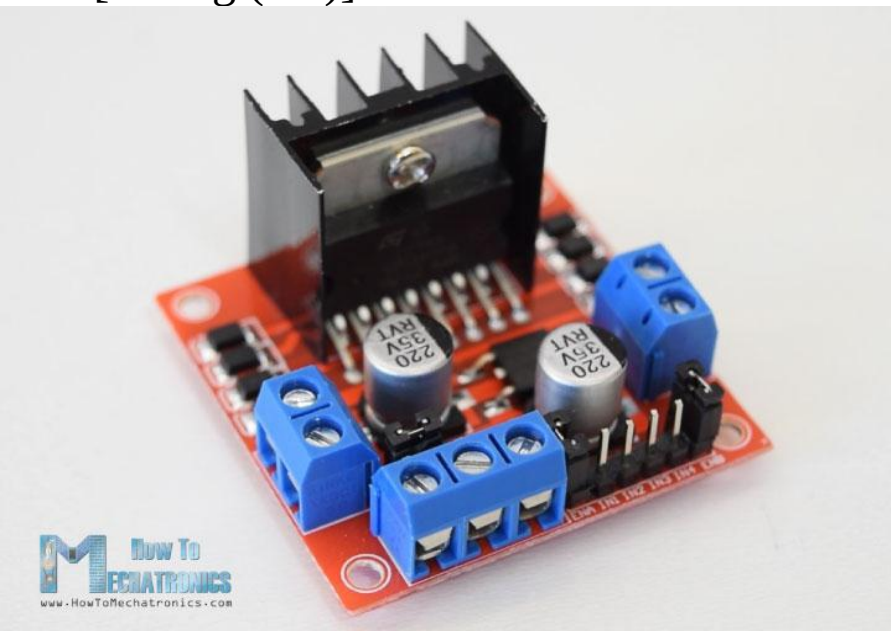


Fig 2.1

✓ But if the motor voltage is greater than 12V we must disconnect the jumper because those voltages will cause damage to the onboard 5V

regulator. In this case the 5V pin will be used as input as we need connect it to a 5V power supply in order the IC to work properly.

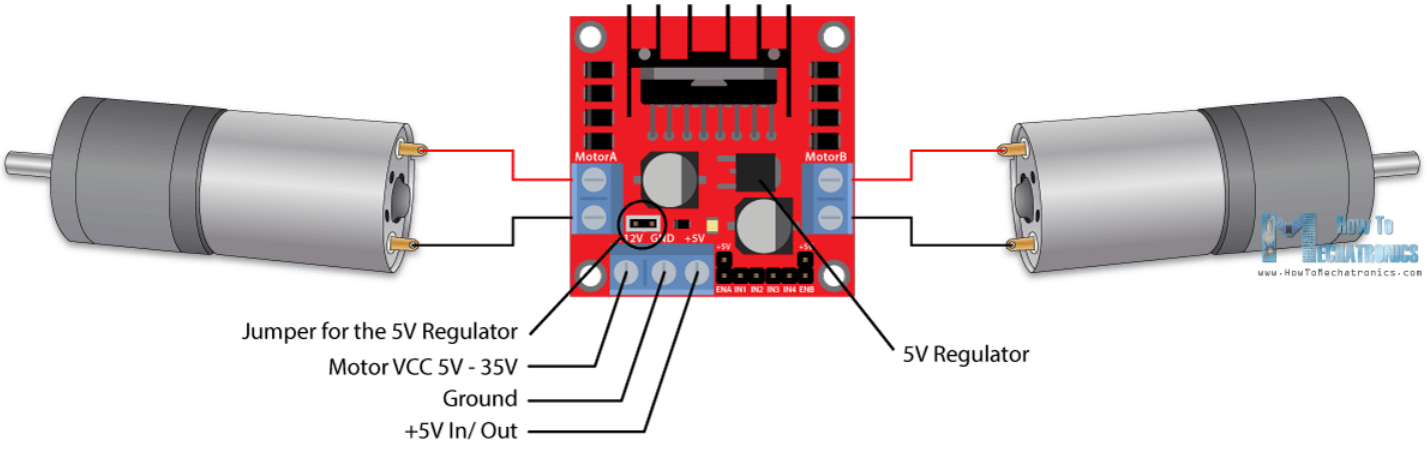
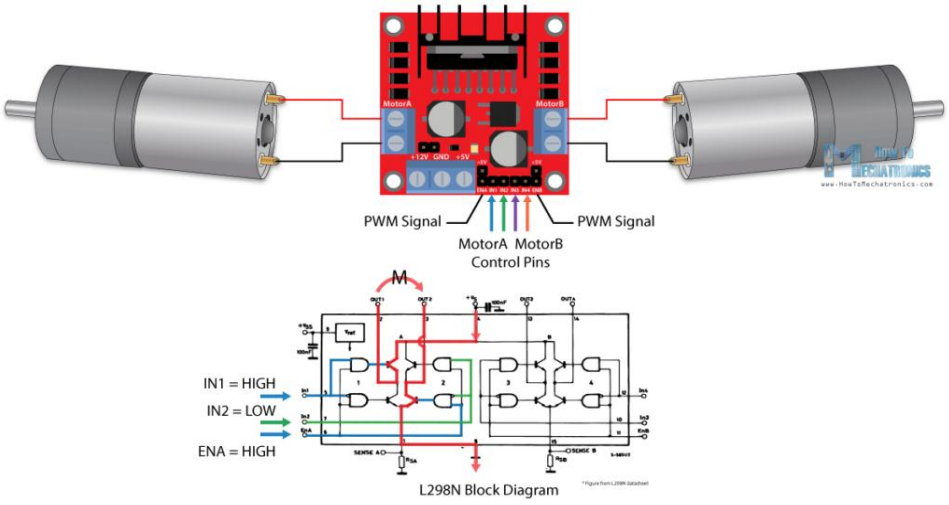


Fig.2.2.

We can note here that this IC makes a voltage drop of about 2V. So for example, if we use a 12V power supply, the voltage at motors terminals will be about 10V, which means that we won't be able to get the maximum speed out of our 12V DC motor.

Next are the logic control inputs. The Enable A and Enable B pins are used for enabling and controlling the speed of the motor. If a jumper is present on this pin, the motor will be enabled and work at maximum speed, and if we remove the jumper we can connect a PWM input to this pin and in that way control the speed of the motor. If we connect this pin to a Ground the motor will be disabled.[see fig.(4.3)]



1.5. JUMPER WIRE

A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPontwire, or DuPont cable – named for one manufacturer of them) is an electrical wire or group of them in a cable with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.
Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

1.5.1. TYPES

Jumper wires with crocodile clips

Jump wires at the end of a multi-colored ribbon cable are used to connect the pin header at the left side of a blue USB2Serial board to a white

breadboard below. Another jumper cable ending in a USB micro male connector mates it**.**

2. OUR WORK

The car which has been designed in the project consisting of two modules namely: transmitter and the receiver send the signals from one end to another and due to this the motor on getting the signals, the motor drives either in forward or reverse direction.

- If both the motors i.e. left and right moves in the forward direction then the direction of the car is in the forward direction.
- When the left motor moves in the forward direction and the right motor in the reverse direction then the resultant direction of the car will be in the right direction.
- The left motor moving in the reverse direction and the right motor moving in the forward direction then the final movement of the car is in lest direction.
- And finally If both the motors i.e. left and right moves in the reverse direction then the direction of the car is in the backward direction.

From the project made it is understood that the use of radio frequency can be used in driving a simple robot car with the use of transmitter and receiver. The driver IC which is being connected to the decoder is also a great help to th project which can get programmed and can give out the called instruction for various occasion signaled byt the transmitter with the help of the antenna and the encoder.

The voltage regulator on getting a power supply gives out a stable DC voltage of 5 volt. This prevent the other components especially the decoder and the receiver module from getting damaged.

The led n the receiver circuit gives an ease in understanding the received signal. This led when goes off then it indicates that the signal is transmitted.

2.1. BLOCK DIAGRAM SHOWING THE BASIC WORKING

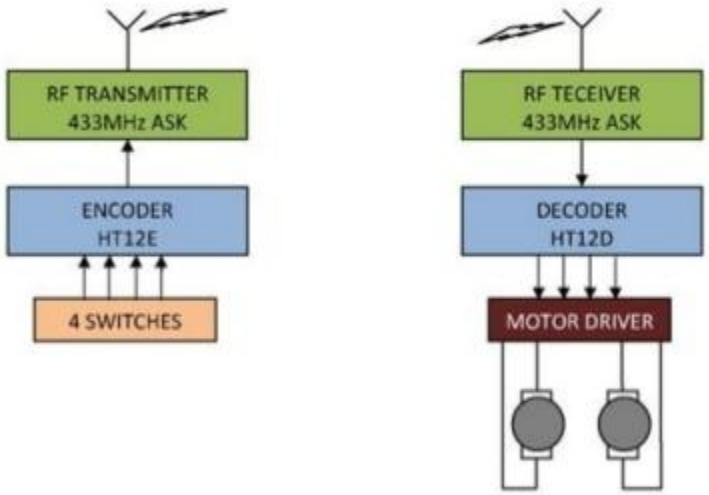


Fig3.1 Block diagram of RF controlled car

Fig 3.1

The above shown figure in the block diagram of the entire radio frequency controlled car. Here we are using an ASK transmitter receiver module. Remote which is having a transmitter is used to transmit the signal from one point to another. There are controlling switches used which are used pinpoint which way the car should move or turn. The supply when applied to the switches it gives to the encoder which encodes the signal. This encoded signal is then send to the RF-tx which is used to perform the task of transmitting the signal from one end to the receiver.

The antenna is attached on both the modules which acts as a source to catch and transmit the signals. The signal which is transmitted by the transmitter is caught by the receiver in the receiving section with the help

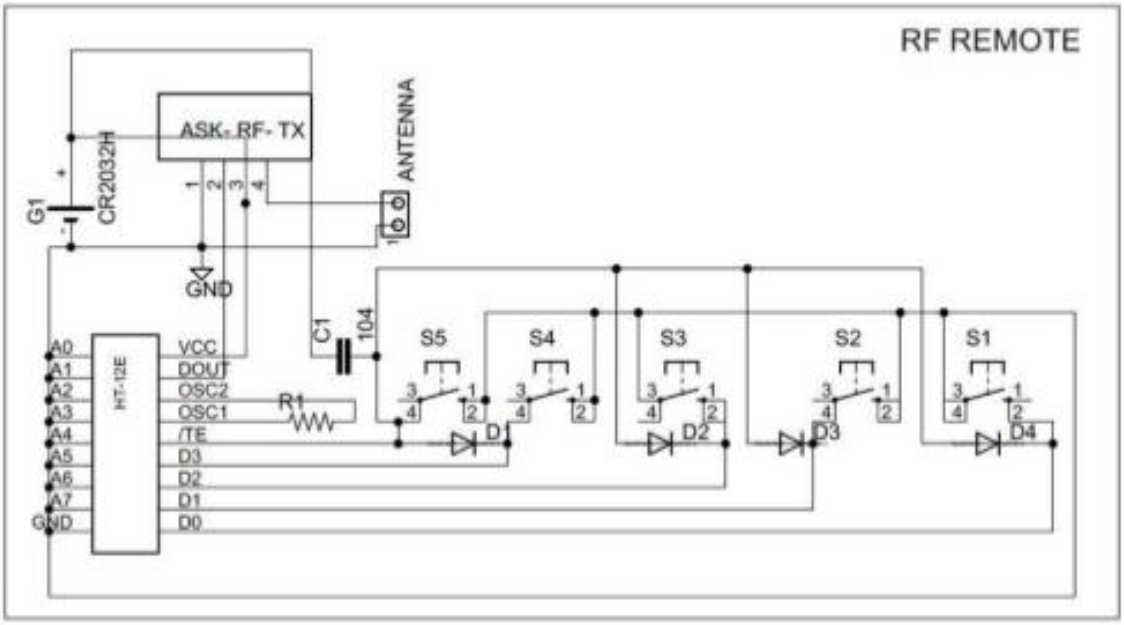
of the antenna. This signal is then send to the decoder IC. The decoder sends the signal to the motor driver which then ultimately drives the motor connected to it.

CIRCUIT DIAGRAM

The circuit of the car is divided in two parts (i) Transmitter & (ii) Receiver.The first circuit diagram is the transmitter and followed by the receiver. The receiver has been supplied with a regulator IC 7805 which will give a 5 volt DC supply to the circuit from 12 Volt DC main supply.

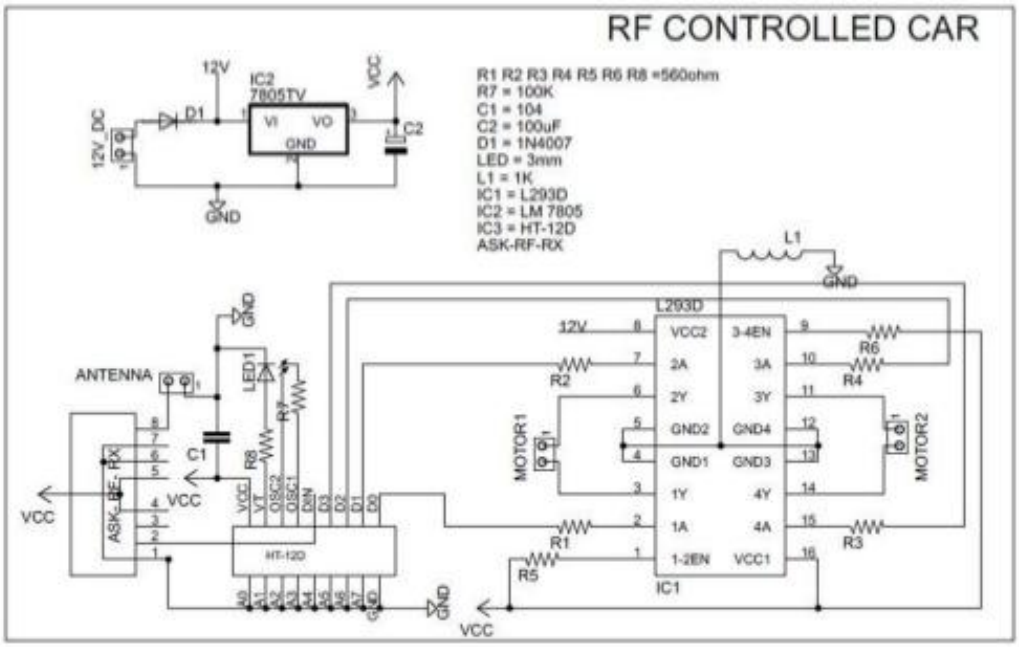
In the transmitter section circuit has there are 5 switches used in the circuit for controlling the direction of the car. Four of them are used to give the direction instruction to the receiver and the fifth switch is used to switch on or off the switching control. It acts as the main switch for the transmitter section. The diode in the circuit with the help of the logic gates using binary language instruct the receiver for performing the tasks.

Transmitter uses an encoder which IC i.e. HT- 12E which encodes the voltage signal in the binary language which is the connected to the switches.There is transmitter ASK-RF-TX used which is capable of sending data to the other end.



Circuit diagram of RF transmitter section circuit

Fig 4.1



Circuit diagram of RF receiver section circuit

Fig 4.2

The receiver section has three ICs and one receiver module. It consist of a decoder HT- 12D, driver IC L293D, voltage regulator IC 7805 and the receiver module ASK-RF-Rx. The working of the car starts with the 7805 IC voltage regulator where in the input voltage given to it is 12 volt DC and it converts that 12 volt to 5 volt DC.There are two 16 pins ICs as encoder and the decoder which are connected to the switches and transmitter and to the driver IC along with the voltage regulator respectively.

Each of the IC has its own basic properties and functions which have been discussed in detail in the below section. Wireless transmission can be done by using 433 MHz or 315MHz ASK RF

Transmitter and Receiver modules. In these modules digital data is represented by different amplitudes of the carrier wave, hence this modulation is known as Amplitude Shift Keying (ASK). Radio Frequency (RF) transmission is stronger and more reliable than Infrared (IR) transmission due to following reasons:

Radio Frequency signals can travel longer distances than Infrared.

Only line of sight communication is possible through Infrared while radio frequency signals can be transmitted even when there is an obstacle.

Infrared signals will get interfered by other IR sources but signals on one frequency band in RF will not interfered by other frequency RF signals.

PWM DC MOTOR CONTROL

We can control the speed of the DC motor by simply controlling the input voltage to the motor and the most common method of doing that is by using PWM signal.

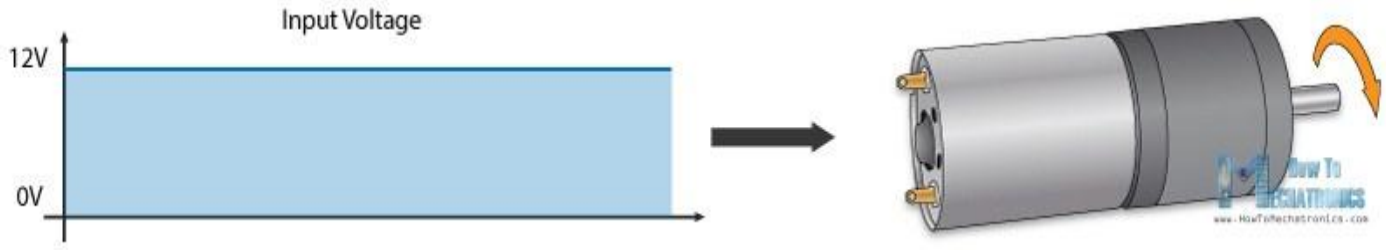


Fig 5.1

PWM, or pulse width modulation is a technique which allows us to adjust the average value of the voltage that's going to the electronic device by turning on and off the power at a fast rate. The average voltage depends on the duty cycle, or the amount of time the signal is ON versus the amount of time the signal is OFF in a single period of time.

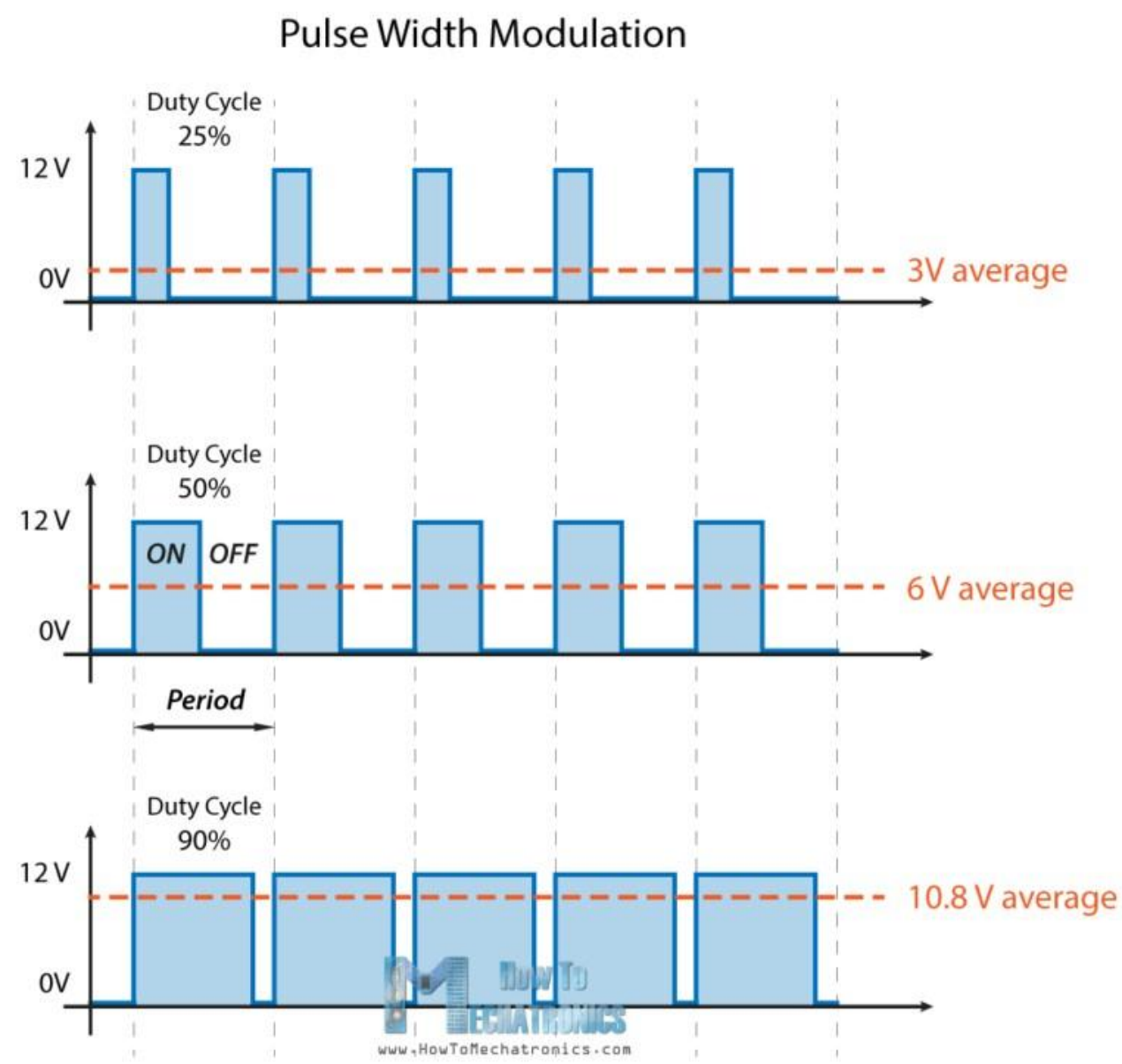


Fig 5.2

So depending on the size of the motor, we can simply connect an Arduino
PWM output to the base of transistor or the gate of a MOSFET and control the speed of the motor by controlling the PWM output. The low power Arduino PWM signal switches on and off the gate at the MOSFET through which the high power motor is driven.

H-BRIDGE DC MOTOR CONTROL

On the other hand, for controlling the rotation direction, we just need to inverse the direction of the current flow through the motor, and the most common method of doing that is by using an H-Bridge. An H-Bridge circuit contains four switching elements, transistors or MOSFETs, with the motor at the center forming an H-like configuration. By activating two particular switches at the same time we can change the direction of the current flow, thus change the rotation direction of the motor.

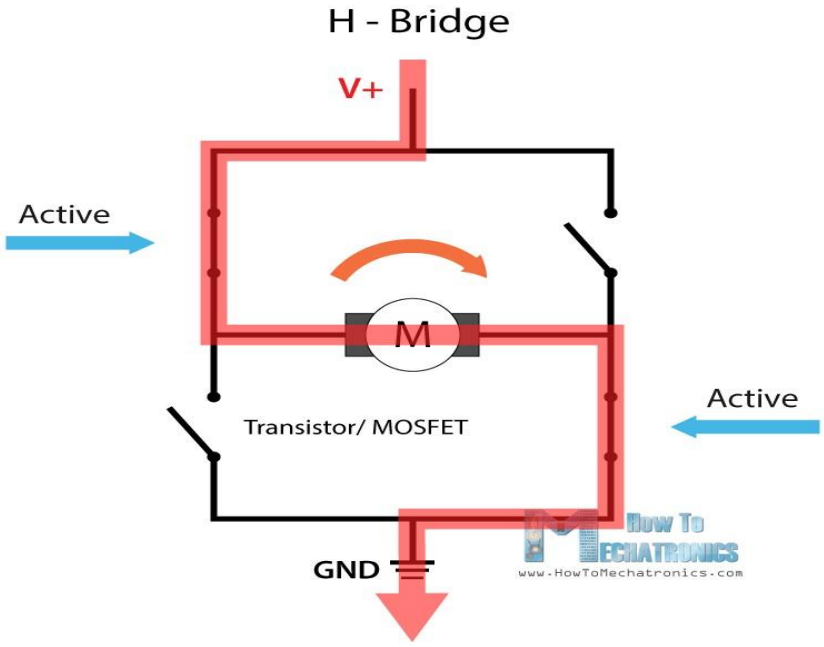


Fig 5.3

So if we combine these two methods, the PWM and the H-Bridge, we can have a complete control over the DC motor. There are many DC motor drivers that have these features and the L298N is one of them.

CONCLUSIONS & FUTURE SCOPES

Conclusion

A transmitter on the one side sends the signals to the receiver end. The antenna on both the side of the module are used as a help to catch the signals which are been transmitted through the transmitter. The receivers on receiving the signal with the help of the decoder decode the signal and are transmitted to the motor driver IC. The motors which are connected to the driver IC on getting the logic signals turns on and gives the direction to the car.

Future scopes

Radio frequency which helps in the communication of the information has increased its value for the use of the same in future. With the of advancement of technology in the radio frequency a gesture control robot is one of the finest projects which can be worked upon. Here in the gestures gives out by the person are sensed by the RF module which performs the task as shown by the gestures.