A

Project Report

On

"IOT BASED CONTROL OF DC MOTOR"

Submitted in partial fulfilment of the requirements

Of the degree of

Bachelor of Engineering in Electrical Engineering

Submitted by

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It gives me immense pleasure to present this project on "IOT BASED CONTROL OF DC MOTOR" carried out at AIKTC, New Panvel in accordance with prescribed syllabus of University of Mumbai for Electrical Engineering. I express my heartfelt gratitude to those who directly and indirectly contributed towards the completion of this project. I would like to thanks Mr.AbdulRazzak Principal, ACEM for allowing me to undertake this guide Prof. ShraddhaHule for continuous support. I would like to thanks all the faculty members, non-teaching staffs of Electrical Engineering of our College for their direct and indirect support and suggestion for performing the project.

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ABSTRACT

The rapid growth of industry and advancement of technology has resulted in reduction of human efforts, the main reason for which being machines. Machines are playing an important role in our life. In this project, we use internet to establish communication between the user and Monitoring unit. In this proposed system, we are monitoring and controlling the speed of DC motor as well as direction of the motor. This system consists of microcontroller, DC motor and WI-FI module Arduino.

Here we are controlling the speed of the motor using webpage through WI-FI. Simultaneously, we can also control the direction of the motor whether to be rotated in clockwise or anticlockwise direction.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

DC motors were the first form of motor widely used for industrial application. Small DC motors are also used in tools, toys and appliances. This motor is a class of rotary electrical machines that converts electrical energy into mechanical energy. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic to change the direction of current flow.

DC motors are classified on the basis of their excitation configuration as follows. 1) Separately Excited DC motor 2) Self Excited DC motor a) Series DC motor b) Shunt wound DC motor c) Compound wound DC motor the basic working principle of DC motor is "Whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The direction of this force is given by Fleming Left Hand Rule. The overall system based on IOT which is interrelated computing devices and ability to transfer data over a network without requiring human to human or human to computer interaction.

Internet was used in the earlier times only for basic communication and information sharing. However, the evolution of internet has brought about a boom in the world by the concept of Internet of Things [1]. Today the power of internet is applied for doing many tasks like controlling a remotely placed server machine from anywhere in the globe. Supported by the internet, came the concept of smartphones which have aided the same by a great extent. Application specific android applications have been developed which perform tasks and minimize the human effort by a great extent. Many low cost and flexible monitoring systems have been developed using the concept of IOT collaborated with wireless modes of communication. IOT is defined as an environment in which objects (devices) are given unique identifiers and the ability to transfer data over a network without having human to-human or human-to-computer interaction [2]. Many more ideas have been researched and developed. The Internet of Things is expected to play a key role in a range of domains, from factory automation to health-care [3]. However, a major limitation of these ideas is the fact that their reach is limited. The applications can only be controlled within a given environment and hence, the physical presence of the person concerned is required to some extent [4]. Android smartphones however have overcome this limitation because of its handy nature and excellent connectivity. Android is an open source framework and hence is widely popular amongst the users and smartphone manufacturers [5]. The proposed system allows the control person to control the system just by a click on his smart-phone. Alternatively, personal computers can also be used for the same. The system consists of very simple and easy to use equipment's which can handle tasks as big as controlling the traction of any machinery using the concept of Internet of Things (IOT).

1.2 NECCESITY

The system will improve the efficiency of industries to a great extent. Also, it will reduce the man power used substantially resulting in a great save in the company's revenue as human resource is very precious. By using this technology, ease of doing business can be achieved. For example, in nuclear reactors, after the chain reaction starts, one cannot go inside system. Continuous checking of the system is very necessary since even a small fault or some kind of leakage can affect people and can cover large area. So to keep an eye on everything happening inside a nuclear reactor, required electronic devices can be installed initially and later they can be monitored using IOT. These devices can be linked to many computers making a whole control room and even to smart phones so that emergency cases can also be handled.

For traffic management system, a small electronic device is installed in the vehicles including speed sensors. When a vehicle crosses the speed limit, the vehicle data is automatically sent to the police control room and a challan is generated automatically which they have to pay or their license will be cancelled. In order to protect any vehicle, small electronic lock is fixed inside the engine. If a person finds that his/her vehicle has been stolen, they themselves can lock the engine with the help of their smart phones and the thief is no longer able to control the vehicle since the lock is inserted inside the engine and is very difficult to open it in such situations.

1.3 OBJECTIVES

In IOT each device or devices constituting a system will be able to communicate with the other devices or system in the same premises over a common platform. Hence this leads to exchange of relevant data, statistics, logs and various other parameters information among various devices to improve their performance, which will help industries to have better productivity, management and increased throughput. This brings on a new terminology of “Smart Industries” in this new era of Monitoring as well as controlling of various Industrial applications.

CHAPTER 2

LITERATURE REVIEW

IOT based control of DC traction motor Akanksha1, Shubham Kathuria2 1,2 School of Electrical Engineering, VIT University, Chennai Tamilnadu 600127, India

We have gone through this paper and got so many useful information regarding our project. In this paper, the IOT based control of DC traction motor has been reported. Internet is the most widely used, high speed and easily accessible communication medium in the modern-day world. The proposed system allows any person from any corner of the world to control heavy industrial machines. The proposed system is simple and highly effective in terms of cost and efficiency. In this system, the switching and the speed of the DC motor can be controlled by using a self-developed android application. The PROTEUS simulation confirmed the theoretical estimates of the performance of the proposed system.

The theme of this paper is almost same as our project like controlling the dc motor with the help of internet, by using esp. 8266 WIFI module. Also, they have used the driver for motor control which is not modern and effective (L293D). therefore, to compensate that we decided to use the new motor driver which (L298N). To control the dc motor, they have opted mobile phone (android smartphone) as a tool to do that they had to build the app using android studio which is quite a complicated task, to make it simpler we have used the inbuilt serial monitor to control the Moorthy have used the microcontroller uno which is a very cost-effective alternative for microcontroller also it offers lots of feature like inbuilt pwm(pulse width modulation) pins which helps to increase or decrease the motor speed or control the speed of motor by changing the width of the supply pulse.

Speed Control of DC Motor by using IoTPratima A. Uparwat1, Lalit S. Khiradkar2, Arati S. Sindhimeshram3, Chaitrali P. Dhenge4, Kunal K. Kamble5, Pratiksha Panchabhai6 1,2,3,4,5UG Students, Dept. of Electrical Engineering, JDCOEM, Maharashtra, India 6 Professor Dept. of Electrical Engineering, JDCOEM, Maharashtra, India.

We gone through this paper and the theme of the paper to be as follows,

DC motor plays very important role in different industry application. This paper deals with a system which provides protection to the DC motor as well as helps in controlling and monitoring a various parameter. This project makes used of Atmega328, 8266 Wi-Fi modules and DC motor. The main zest of this paper is to controlled the speed of DC motor using IOT (Internet of Things).

This paper has mentioned various types of dc motor based on their excitation as follows,

1. **Separately excited dc motor**
2. **Self-excited dc motor**
3. **Shunt wound dc motor**
4. **Compound wound dc motor**

The main methodology of this entire project depends on IoT based embedded system so interfacing of hardware's with wi-fi and internet is very important part in its functioning. The whole programming is done in Arduino IDE and then load in the ATMEGA 328 microcontroller and with the help of wi-fi and various sensors. The required results will be done like providing protection to motor from the abnormal or faulty conditions. Observation of various parameters of motor like temperature, current and voltage will be achieved and also controlled direction of motion of motor with the help of relay and heat developed in motor which is sense by temperature sensor.

This paper, introduced a system that can protect, control and monitor the speed of DC motor remotely with the help of Wifi modules and IOT based system. Protection against the over current and thermal overloading is done by current and temperature sensor.

SPEED MONITORING AND CONTROLLING OF MOTOR USING INTERNET OF THINGS (IOT) ENHANCED WITH WI-FI 1Mr.P.Balaji, Ganadipathy Tulis's Jain Engineering College, Vellore, India.

The rapid growth of industry and advancement of technology has resulted in reduction of human efforts, the main reason for which being machines. Machines are playing an important role in our life. In this project, we use internet to establish communication between the user and Monitoring unit. In this proposed system, we are monitoring and controlling the speed of DC motor as well as direction of the motor. This system consists of microcontroller, Temperature sensor, DC motor and WI-FI module. Here we are controlling the speed of the motor using webpage through WI-FI. Simultaneously, we can also control the direction of the motor whether to be rotated in clockwise or anticlockwise direction. We can measure the temperature of the DC motor using temperature sensor. Keywords: WIFI, Anti Clockwise, Sensor.

This paper has presented the design and implementation of Internet of things for monitoring and controlling of various application and parameters in industries using wireless communication technique. The key idea of the proposed work is to provide flexible and long-distance connectivity between industrial environment and user. The advantages of the developed system are to have a continuous monitoring over industrial applications and also control them if going beyond their threshold conditions. Future work will focus on improvement of above proposed work and adding features to make a reliable smart Industrial monitoring and controlling system

We have gone through this paper available on the website given above. The most of the dc motor and motor driver L298N and connection of L298N and motor with the Arduino is fully explained in the pdf or website.

Also how direction of dc motor can be changed is also given in this paper.but the only missing part which was not there was the connection of esp. WIFI module with Arduino.

CHAPTER 3

SYSTEM DESIGN

3.1 DC MOTOR

The first practical DC (Direct Current) motor was invented by the British scientist William Sturgeon in 1832. Since then DC motors have been part of countless pieces of equipment and machinery.

Today DC motors range from huge models used in industrial equipment to tiny devices that can fit in the palm of your hand. They are inexpensive and are ideal for use in your Robotics, Quadcopter, and Internet of Things projects.

Unlike LED's you can't just connect a DC motor to one of the output pins of your Arduino or Raspberry Pi and expect it to work. DC motors have current and voltage requirements that are beyond the capabilities of your microcontroller or microcomputer. It is necessary to use some external electronics to drive and control the motor, and you'll probably need a separate power supply as well.

There are a number of ways to drive a DC motor from the output of your computing device. A single transistor can be used to drive a DC motor, this works well providing you do not need to change the direction that the motor is spinning.

A more versatile way of controlling a DC motor is to use a circuit called an "H-Bridge". An "H-Bridge" is an arrangement of transistors that allow you to control both the direction and speed of the motor. Today we'll examine a very common H-Bridge module based around the L298N integrated circuit.

3.1.1 HOW DC MOTOR WORK

In a simple DC motor, there are two main components, the "stator" and the "armature". The stator is a permanent magnet and provides a constant magnetic field. The armature, which is the rotating part, is a simple coil.

The armature is connected to a DC power source using a 2-piece ring installed around the motor shaft, these ring sections are called "commutator rings". The two pieces of the commutator rings are connected to each end of the armature coil. Direct Current of a suitable voltage is applied to the commutator rings via two “brushes” that rub against the rings.

When DC is applied to the commutator rings it flows through the armature coil, producing a magnetic field. This field is attracted to the stator magnet (remember, opposite magnetic polarities attract, similar ones repel) and the motor shaft begins to spin.

The motor shaft rotates until it arrives at the junction between the two halves of the commutator. At that point the brushes come into contact with the other half of the commutator rings, reversing the polarity of the armature coil (or coils, most modern DC motors have several). This is great because at this point the motor shaft has rotated 180 degrees and the magnetic field polarities need to be reversed for the motor to continue rotating. This process repeats itself indefinitely until the current is removed from the armature coils.

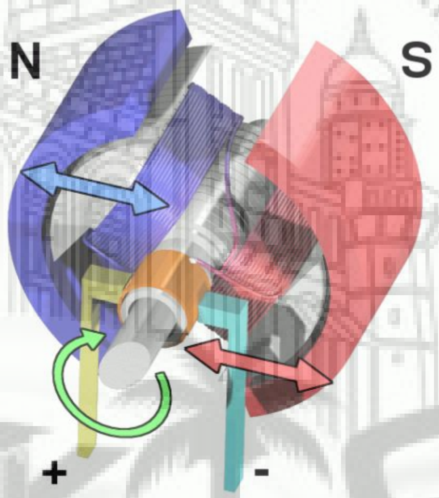

FIG 3.1 DC MOTOR WORKING

The motor I have just described is referred to as a brushed DC motor because (obviously) it has brushes. Brushes, however, create many problems – they can start to wear over time, they rub against the motor shaft and they can even cause sparking as the motor gets older.

Better quality DC motors are the brushless variety. Brushless motors use a more complex arrangement of coils and do not require a commutator. The moving part of the motor is connected to the permanent magnet. Because they do not contain brushes these brushless motors will last longer and are also much quieter than brushed DC motors. Most quadcopter Motors are brushless motors.

DC motors are specified by the voltage level at which they operate. Common hobbyist motors run at 6 Volts or 12 volts DC.

To reverse the direction in which the DC motor rotates you simply reverse the polarity of the DC current that you apply to it. Changing the speed however, is a different story.

One method of changing the speed of a DC motor is to simply reduce its supply voltage. While this will work to some degree it is actually not a very good method of controlling motor speed as lowering the voltage will also lower the torque that the motor is capable of producing. Also, once the voltage drops below a certain point the motor will not rotate at all.

3.1.2 PULSE WIDTH MODULATION (PWM)

A far better method of controlling DC motors is to use pulse width modulation or PWM. If you've read up on controlling LEDs with your microcontroller you probably have already run into PWM as it's also a good method of controlling the brightness of an LED.

With PWM the motor is sent a series of pulses. Each pulse is of the full voltage that the motor can handle so a 6-volt motor will be sent 6-volt pulses while a 12-volt motor will be sent 12-volt pulses. The width of the pulses is varied to control the motor speed, pulses with a narrow width will cause the motor to spin quite slowly. Increasing the pulse width will increase the speed of the motor, as illustrated below.

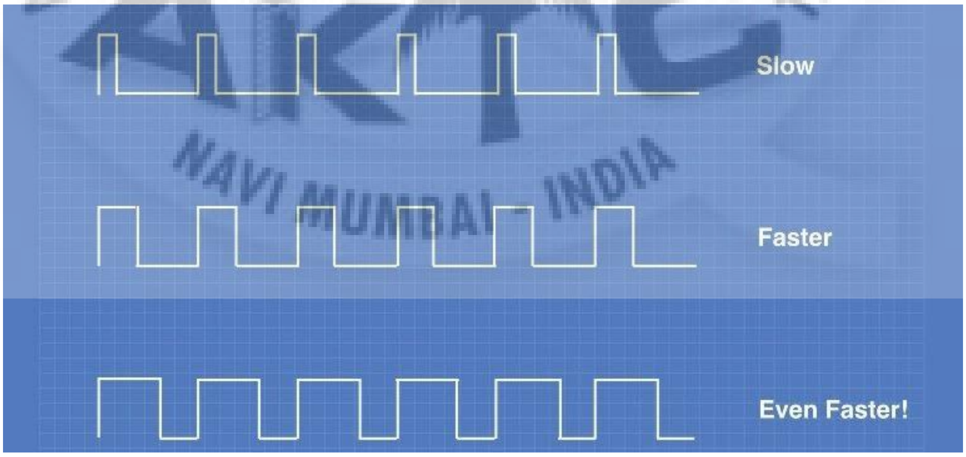

FIG 3.2 PWM

In order to stop the motor completely you just stop pulsing it, essentially sending it zero volts. To run it at full speed you send it the full voltage, again without pulsing it.

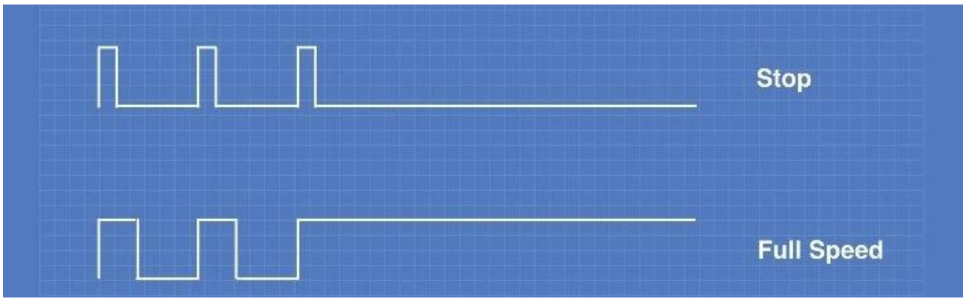

FIG 3.3 PWM

You can build a simple PWM generator using a 555 timer and discrete components but it's a lot easier to use an Arduino. The Arduino has a function called "analog Write" which is used to drive any of its PWM-capable outputs (the Arduino Uno has 6 digital outputs that are also capable of PWM)

3.1.3 H-BRIDGE

Now that you know how DC motors work, how you can reverse their direction by changing polarity and how you can change their speed using pulse width modulation, let's examine an easy way to do this using a very common circuit configuration called an "H-Bridge".

An "H-Bridge" is simply an arrangement of switching the polarity of the voltage applied to a DC motor, thus controlling its direction of rotation. To visualize how this all works I'll use some switches, although in real life an H-Bridge is usually built using transistors. Using transistors also allows you to control the motor, speed with PWM, as described above.

In the first diagram we can see four switches which are all in the open or "off" position. In the center of the circuit is a DC motor. If you look at the circuit as it is drawn here you can distinctly see a letter "H", with the motor attached in the center or "bridge" section – thus the term "H-Bridge".

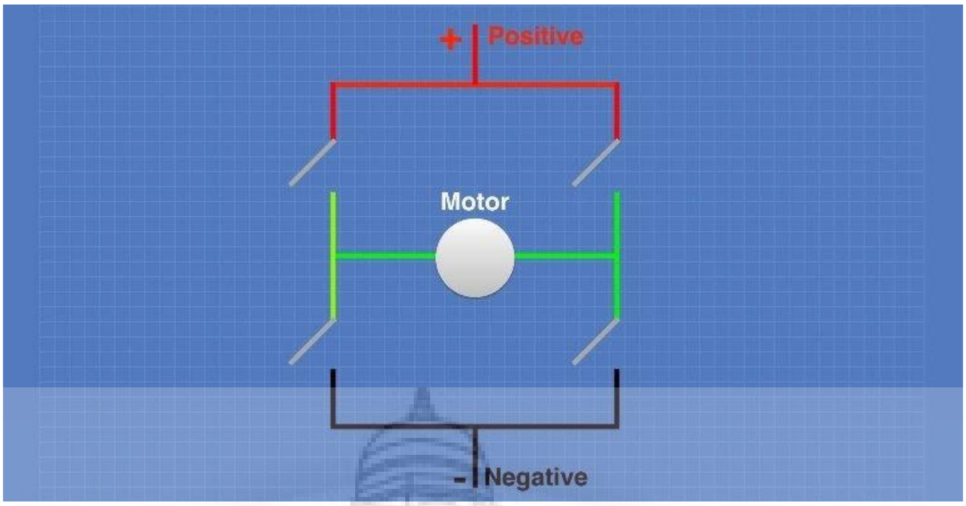

FIG 3.4 H-BRIDGE

If we close (i.e. turn on) two of the switches you can see how the voltage is applied to the motor, causing it to turn clockwise.

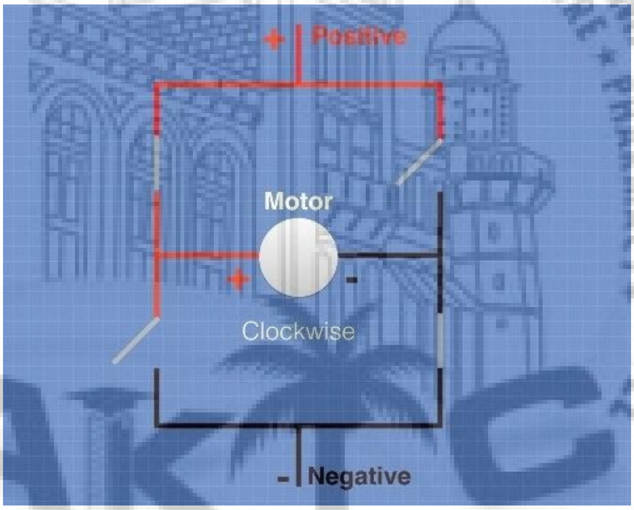

FIG 3.5 CLOCKWISE ROTATION

Now we'll open those switches and close the other two. As you can see this causes the polarity of the voltage applied to the motor to be

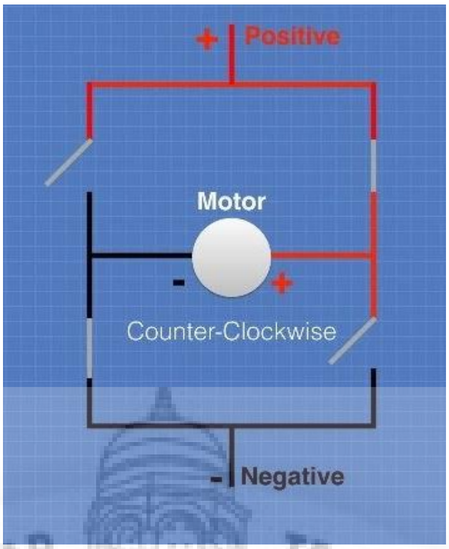

FIG 3.6 COUNTERCLOCKWISE ROTATION

This is pretty simple but effective. In fact, if all you need to do is design a circuit to drive the motor full-speed in either direction you could actually build this as shown here, using a 4PDT (4 Pole Double-Throw) center-off switch. But of course, we want to control the motor using an Arduino, so an electronic circuit where the switches are replaced by transistors is what we need.

3.2 THE L298N BRIDGE

While you can use discrete transistors to build an H-Bridge there are a number of advantages in using an integrated circuit. A number of H-Bridge motor driver IC's are available and all of them work in pretty much the same fashion. One of the most popular is the L298N.

The L298N is a member of a family of IC's that all have the designation "L298". The difference between the family members is in the amount of current they can handle. The L298N can handle up to 3 amperes at 35 Volts DC, which is suitable for most hobby motors.

The L298N actually contains two complete H-Bridge circuits, so it is capable of driving a pair of DC motors. This makes it ideal for robotic projects, as most robots have either two or four powered wheels. The L298N can also be used to drive a single stepper motor, however we won't cover that configuration in this article.

Here is a diagram of the pinouts of an L298N integrated circuit: Although you can certainly purchase an L298N integrated circuit and wire it up yourself it is far easier to just buy a complete L298N circuit board, which is wired up and complete with connectors for motors, power supplies and input logic. These boards also have a 5-volt voltage regulator which can be used to supply the logic circuits. L298N driver boards are available from a number of sources like eBay or your local electronics shop at very reasonable prices.

3.2.1 L298N MODULE PINOUTS

You'll find a few different styles of L298N boards but they all operate in the same fashion. The board contains an L298N mounted on a heatsink, a 5-volt voltage regulator to "optionally) provide power for logic circuits, supporting diodes and capacitors and connectors as follows:

- Logic inputs for each H-Bridge circuit
- Power supply inputs for the motor power supply
- An optional 5 Volt power input for the logic circuits.
- Outputs for each DC motor

A typical L298N Board is shown here.

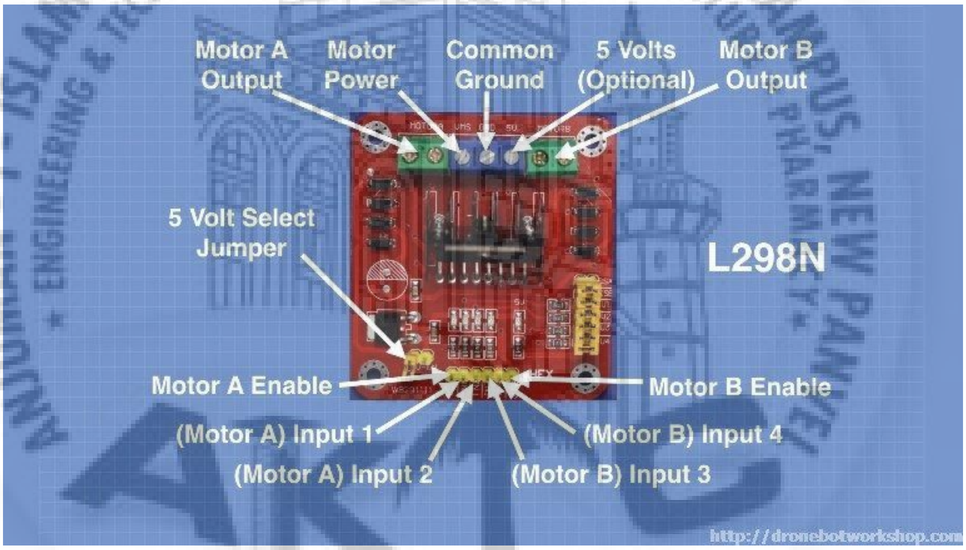

FIG 3.7 MOTOR DRIVER L298N

You'll notice that the board also has a number of jumpers. Most of the time you will leave them in place, with the exception of one. They are as follows:

- **CSA** – This is the "current sensing" function for Motor A. If the jumper is in this function is ignored. Most of the time you'll leave this jumper in place.
- **CSB** – The "current sensing" function for Motor B. Again, you'll usually just leave this in place to disable this function.
- **U1** – Input 1 pull-up resistor. You will usually leave this in place, which enables a 10k pull-up resistor for the input.

- **U2** – Input 2 pull-up resistor.
- **U3** – Input 3 pull-up resistor.
- **U4** – Input 4 pull-up resistor.
- **5v-EN** – This is the only jumper that you need to really pay attention to. When this jumper is in place it enables the boards internal 78M05 5 Volt regulators, supplying logic power from the motor power supply. When this jumper is enabled you will NOT supply 5 volts to the 5 Volt input terminal. When the jumper is removed you will need to supply 5 Volts to the 5 Volt input terminal.

If you do use the internal voltage regulator, you'll have to supply the motor power supply with at least 7.5 volts.

Speaking of the motor power supply it needs to be a bit higher voltage than the actual motor requirements. This is due to the internal voltage drop in the transistors that form the H-Bridge circuit. The combined voltage drop is 1.4 volts, so if you are using 6 Volt motors, you'll need to give the board 7.4 volts, if you have 12-volt motors then your motor supply voltage will need to be 13.4 volts.

The board has four input terminals plus two enable terminals. You will use these terminals to control both direction and speed or each motor. They are as follows:

- **IN1** – Input 1 for Motor A
- **IN2** – Input 2 for Motor A
- **IN3** – Input 3 for Motor B
- **IN4** – Input 4 for Motor B
- **EN1** – Enable line for Motor A
- **EN2** – Enable Line for Motor B

In order to simplify things a bit I'll just discuss the inputs and enable for Motor A, Motor B functions identically. The two Input lines control the direction that the motor rotates. I will call one direction "forward" and the other one "reverse", if it makes more sense to you just substitute "clockwise" and "counterclockwise". You control motor direction by applying either a Logic 1 (5 Volts) or Logic 0 (Ground) to the inputs. This chart illustrates how this is done.

TABLE NO 3.2.1

INPUT 1	**INPUT 2**	**DIRECTION**

GROUND (0)	GROUND (0)	MOTOR OFF
5 VOLTS (1)	5 VOLTS (1)	FORWARD
GROUND (0)	GROUND (0)	REVERSE
5 VOLTS (1)	5 VOLTS (1)	NOT USED

As you can see only two combinations are actually used to control the direction of the motor's rotation. The Enable line can be used to turn the motor on, to turn it off and to control its speed. When the Enable line is at 5 Volts (1) the motor will be on. Grounding the Enable line (0) will turn the motor off. To control the speed of the motor you apply a Pulse Width Modulation (PWM) signal to the Enable line. The shorter the pulse width, the slower the motor will spin.

3.3 MICROCONTROLLER

The Arduino UNO microcontroller comes with the ATmega328P microcontroller embedded. ARDUINO UNO is designed to provide many facilities for communicating with the computers, another ARDUINO and other on-board controllers [8]. The standard operating voltage for the board is 5V. However, the recommended input voltage ranges from 7V to 12V. It contains 14 digital input/output pins, out of which 6 are pulse width modulation enabled pins. There are 6 analog input pins present on the board. It supports a flash memory of 32 KB of which 0.5 KB is used by the boot loader. The clock speed is 16MHz. The SRAM and EEPROM are 2 KB and 1 KB respectively. Also, the microcontroller has incredibly convenient sizing wherein its length and width are 68.6 mm and 53.4 mm respectively [9]. The Arduino microcontroller will be loaded with a program written on Arduino C. The program will be guiding the microcontroller to download the control data from the online cloud web server. The data will be fetched using the Wi-Fi module at regular intervals. This data will be in form of analog values 0-255. Accordingly, the microcontroller can be used to modulate the pins of the motor driver IC to make the motor operate in different modes like forward motoring, forward braking, reverse motoring, reverse braking. Also, the respective analog values received represent speeds where 0 represents 0 speed and 255 represents full speed. Fig.3 shows the Arduino UNO microcontroller.

FIG 3.8 ARDUINO UNO

3.4 ESP 8266 WIFI MODULE

There are a number of ways in which the Arduino microcontroller can be connected with the internet. One way is using the Arduino UNO Wi-Fi board [10]. It has been represented in Fig 5. It is a microcontroller board with Wi-Fi module embedded in it. Another way is to use a separate ESP8266 Wi-Fi module. It has integrated TCP/IP protocol stack. It comes pre-programmed with AT command set firmware. It has 1MB Flash memory. It is IEEE 802.11 b/g/n Wi-Fi. It has 16 GPOI pins. It supports SPI as well as I2C communication protocols [11]. Predefined library is also available for coding. The fig.4 shows a ESP8266 Wi-Fi module.

FIG 3.9 ESP 8266 WIFI MODULE

3.5 HARDWARE IMPLEMENTATION

Bringing an Arduino or similar microcontroller into the picture allows us to control both the direction and speed of each motor. I am going to show you how to do this using an Arduino Uno but you can also accomplish the same thing with a Mega, Nano or other Arduino compatible controller. The Arduino Uno has 14 digital Input/output (I/O) pins, six of which are capable of supplying a PWM signal. The following diagram shows how I have hooked up the Arduino Uno to the L298N board.

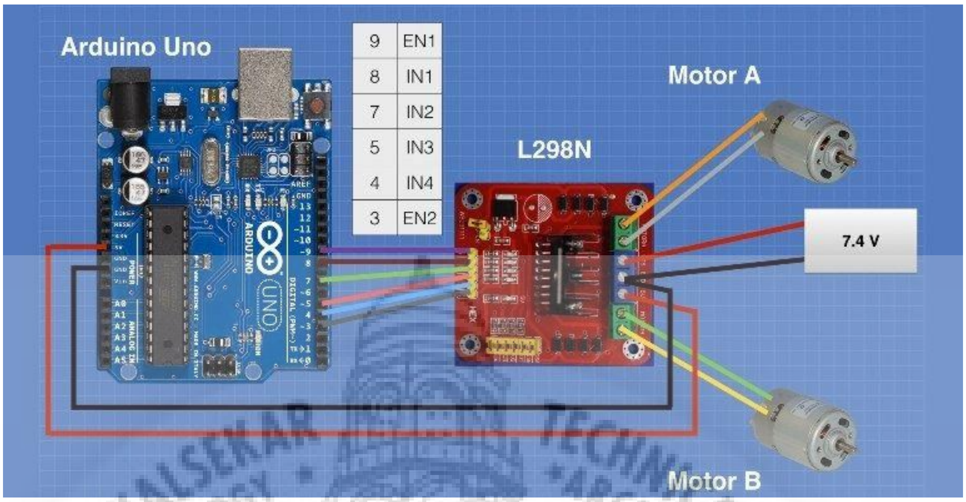

FIG 3.10 USING AN ARDUINO WITH L298N

Note that the 5 Volts for the L298N board is now being supplied from the Arduino 5 Volt output. The Arduino itself is being powered via its USB cable, which of course will also allow you to load the sketch to make everything work. After the sketch is loaded you could remove the USB cable and power the Arduino with an external power supply (or a USB supply).

The input and enable lines in the L298N are driven from six Arduino digital output pins, as follows:

TABLE NO 3.5.1

ARDUINO	L298N
9	EN1
8	IN1
7	IN2
5	IN3
4	IN4
3	EN2

This pinout as Arduino output pins 9 and 3 are both capable of Pulse Width Modulation, if you wish you can use alternate pins.

3.6 ESP 8266 CONNECTION WITH ARDUINO

The steps you need to take are simple. This is written for the ESP8266-01 but you can find the pinout for other models easily and use the same pins. First we will connect the Arduino UNO to a breadboard:

1. Connect the Arduino's **3v3** (3.3V) output to the red line on a breadboard. The ESP8266 works with 3.3V and not 5V, so this is necessary. If you want to connect other components that use 5V, you can connect the 5V output to the other red line of the breadboard, just make sure you don't connect the two.
2. Connect **GND** (ground) to the blue line.
3. Connect the **RES** or **RESET** pin to the blue line. When you ground the reset pin, the Arduino works as a dumb USB to serial connector, which is what we want to talk to the ESP8266.
4. Connect the **RXD** pin of the Arduino to the **RX** pin of the ESP8266 (yellow color in the picture).
5. Connect the **TXD** pin of the Arduino to the **TX** pin of the ESP (green color in the picture). Usually, when we want two things to talk to each other over serial, we connect the **TX** pin of one to the **RX** of the other (send goes to receive and the opposite). Here we do not have the Arduino talk to the ESP8266 though, our computer is talking to it *via* the Arduino.
6. Connect the **GND** pin of the ESP to the blue line and the **VCC** pin to the red line.
7. Finally, **CH_PD** goes to the red line, supposedly it will not work if you do not connect this. According to a discussion I found:

In the Arduino IDE, you don't need to choose a board, as we're not uploading anything to the ESP8266. Just choose the right port in the **Tools** menu and go to **Tools** → **Serial Monitor**. Then simply set your baud rate to **115200** (the default ESP8266 firmware uses it) and your line endings to **Both NL & CR**.

If you type AT in the message field and press enter, it should respond with OK.

And since we talked about the CH_PD pin, remember that if you want to flash the ESP8266 you should connect the GPIO0 pin to GND (blue line), which puts the ESP into flash mode.

CHAPTER 4

CONCLUSION

4.1. CONCLUSION

The proposed project technique will make hardware model where the IOT Technique is used for control dc motor. Therefore the speed and the direction of dc Motor can be controlled by use of phone using IOT.

4.2 FUTURE SCOPE

The intelligent control of DC series motor and DC separately excited motor with DC-DC converter has been taken up in this work. Further modifications in the fuzzy membership function can also be carried out in the work presented. The intelligent control can be extended for other special electrical motors. The stability analysis of nonlinear ANN controller can be one in future.

The controller implementation was done on a NXP 80C51 based microcontroller in the work. The designed control algorithm scan be implemented in other embedded system platforms such as DSP processor VLSI based chips.

4.3. APPLICATION

The motor with control through webpage can be used for varieties of applications. The application the motor can be controlled with ease and comfort with this technology, and reliable operation of motor is possible by using this technology. This technology can be very useful in the situation where physically going to control the motor is not possible. And others application of dc motor type applications are as follows.

1) DC SERIES MOTOR

The series DC motors are used where high starting torque is required and variations in speed are possible. For example – the series motors are used in the traction system, cranes, air compressors, Vacuum Cleaner, Sewing machine, etc.

2) DC SHUNT MOTOR

The shunt motors are used where constant speed is required and starting conditions are not severe. The various applications of DC shunt motor are in Lathe Machines, Centrifugal Pumps, Fans, Blowers, Conveyors, Lifts, Weaving Machine, Spinning machines, etc.

3) DC COMPOUND MOTOR

The compound motors are used where higher starting torque and fairly constant speed is required. The examples of usage of compound motors are in Presses, Shears, Conveyors.The small DC machines whose ratings are in fractional kilowatt are mainly used as control device such in techno generators for speed sensing and in servo motors for positioning and tracking.

Advantage:

Good speed control:

DC motors offer highly controllable speed. By changing the armature or field voltage it's possible to achieve wide speed variation and with this level of controllability, DC motors offer the precision required by a wide range of industry applications.

High torque:

A DC motor also offers a high starting torque, which makes it perfect for use in applications that are designed to move heavier loads, such as wiper systems and in industrial automation applications, such as conveyor systems or materials handling equipment. The consistent drive power that DC motors deliver means they're ideal for maintaining a constant torque whilst an application is in use, making them an excellent choice for a geared motor solution.

Seamless operation:

As DC motors operate with high levels of controllable power across a range of speeds, they offer the benefit of seamless operation. In some industries, it is vital that DC motors can start and stop efficiently to cope with the requirements of the application. If you are looking for a solution that offers rapid acceleration, an option to reverse direction and start/stop efficiency, a DC motor is a good choice.

Free from harmonics:

In any electric power system, a harmonic is a voltage or current at a multiple of the fundamental frequency of the system, typically produced by the action of non-linear loads such as rectifiers or saturated magnetic devices. Harmonic frequencies in the power grid can be the cause of power quality problems and harmonics in some AC motors can cause torque pulsations, resulting in a decrease in torque. DC motors are free from issues associated with harmonics.

4.4. LIMITATIONS

Operation and maintenance cost due to presence of commutator and brush gear cannot operate in explosive and hazard conditions due to sparking occur at brush (risk in commutation failure)

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