IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

BLUETOOTH-ENABLED VOICE RECOGNITION FOR DC MOTOR SPEED CONTROL

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ABSTRACT

Technology is a never-ending process, and these technologies are essential to increase the quality of any product. The Android platform is the most popular mobile platform, and it is highly effective in generating many real-time applications that are important in our daily lives. Several industries, including paper mills, rolling mills, printing machines, machine tools, excavators, and cranes, employ dc motors to move a product from one location to another via a conveyor belt. As a result, controlling the speed and direction of the dc motor is critical. Purpose. The motor speed controller is responsible for taking a signal expressing the needed speed and driving a motor at that speed. To satisfy requirements for improved performance and durability, electric drive systems are increasingly used in mechanical applications. Due to its simplicity of controllability, the DC motor is a desirable piece of equipment in many contemporary applications needing changing speed and load characteristics.

This paper presents a system for speed control of a DC motor using voice recognition and a Bluetooth module. The proposed system enables users to control the speed of a DC motor using voice commands sent via Bluetooth from a mobile device. The system is designed to recognize specific voice commands and convert them into corresponding motor speed signals. The voice recognition module is based on the Google Assistant API and is implemented using an Android app. The Bluetooth module is used to establish a wireless connection between the mobile device and the motor control circuit. The motor speed is controlled using a pulse width modulation (PWM) technique, which varies the duty cycle of the applied voltage to the motor. Experimental results demonstrate the effectiveness of the proposed system in controlling the speed

of a DC motor by voice commands. The system provides a simple and convenient method for controlling the motor speed and can be used in various applications such as robotics, automation, and home appliances.

In this project DC motor speed regulation. We are regulating and monitoring the speed of a DC motor in this suggested system. This system is made up of a microcontroller, a DC motor, a potentiometer, a temperature sensor, an LCD display, and a Bluetooth module. We have control here. DC motors were the first type of motor that saw widespread usage in industrial applications. Tiny direct current motors are also found in tools, toys, and appliances. This motor belongs to the category of rotating electrical devices, which transform electrical energy into mechanical energy. Most electronic gadgets on the market today require automation for usage in daily life. Certain machines require manual regulation of motor speed based on the requirements.

Keywords—ARDUINOUNO, BLUETOOTHMODULE, DC MOTOR, LCD.

1. INTRODUCTION

Automation is the most widely utilized approach today, from industrial to consumer applications. The fast rise of industry and technological innovation has resulted in a reduction in human efforts, with machines being the primary reason for this. Machines are becoming increasingly crucial in our lives. DC motors are employed in numerous applications such as cooling fans, air conditioners, and AC equipment.

Most industries now employ direct current (DC) motors. As a result, regulating the speed of DC motors is critical. As a result, our study focuses on monitoring and regulating the speed of a DC motor utilizing an Android mobile application and Bluetooth technology. Because smart phones include Bluetooth technology, an external Bluetooth module is used to communicate with the micro controller unit (ARDUINO). The Bluetooth module gets commands from the Android application on the mobile phone.

The one of the implementation of a low-cost, robust, resilient, and secure Bluetooth-based DC motor speed and direction control have been provided in this paper. Bluetooth technology was used to offer communication access from a smart phone for the speed control. On the other side, we have the ATMEGA328P platform, which allows us to rapidly prototype electrical devices.

Android is the most popular and adaptable platform, which is extremely useful in developing a wide range of real-time apps that are useful in our daily lives. Bluetooth innovation is frequently utilized in wireless communications. The method of controlling a direct current motor utilizing Bluetooth technology is discussed in this work. The signal is sent from the smart phone, which is linked to the Arduino Uno board through Bluetooth module HC05. PWM techniques are commonly used to regulate the speed of a direct current motor.

The electric drive systems must to have some standard characteristics, such as linear control, dependability, and stable operation. DC-driven devices benefit in several of these ways. The effectiveness of the drive is significantly influenced by the DC motor's speed control techniques. The major goal of a dc drive is to maintain a system with a stable speed regardless of load state, whereas the main goal of a speed

controller is to concentrate on how we may utilize a Bluetooth-based device to regulate speed and direction of a DC motor at a desired speed. In this work, we outline a recently created "Revving Up Efficiency: Voice-Controlled Bluetooth DC Motor Speed Control"a Bluetooth-enabled smart phone control experimental setup.

Revving Up Efficiency: Voice-Controlled Bluetooth DC Motor Speed Control is a project that aims to enhance the efficiency and user-friendliness of DC motors. This project involves the integration of Bluetooth and voice control technologies to control the speed of a DC motor wirelessly. The proposed system will enable users to control the speed of a DC motor using voice commands, eliminating the need for manual intervention. The system will also provide real-time feedback on the speed of the motor, enabling users to monitor and adjust the speed as required. This project will contribute to the automation of various industries, reducing labor costs and improving efficiency.

This study discusses DC motor speed regulation. We are regulating and monitoring the speed of a DC motor in this suggested system. This system is made up of a micro controller, a DC motor, a potentiometer, a temperature sensor, an LCD display, and a Bluetooth module. We're using a potentiometer to regulate the speed of the motor here. Simultaneously, we may use a temperature sensor to detect the temperature of the DC motor. This prevents overheating of the DC motor.

2. LITERATURE SURVEY

[1] This research then proposed an integral state feedback design for tracking control in DC motor, with Simulink Matlab simulation and the Arduino hardware implementation. The results will be compared with the implementation of the PID controller.

[2] An electronics technique is called Pulse Width Modulation (PWM) is used to achieve speed control, and this technique generates high and low pulses, then these pulses vary the speed in the motor. In order to control this PWM pulse, variable resistors are used and depend on it the speed of the DC motor will increase or decrease.

[3] Illustrates a solution to protect the motor from overheating. There are many explanations for motor failure and one of them is overheating. Motor overheating causes mechanical damage and reduces lifespan. A real-time monitoring and data logging system have developed to reduce the percentage of damage and the rate of

motor failure, improving the reliability of motor operation. The system has been developed using Arduino UNO and Lab VIEW software.

[4] Servomotors are special direct current or alternating current electric machines which have an adjustable rotational speed in a wide range, in both directions and which aim at moving a mechanical system along a trajectory in a prescribed time.

[5] The research proposes hardware design and implementation of controlling the angular speed of the DC motor in Arduino Uno as its embedded processor system, using a PID Controller. Some examinations

and analysis are done in the research, such as open- loop test, step-response, and the effect of PID parameters and sample time to the system performance.

[6] This work PID real time controller has been realized in MATLAB/SIMULINK environment and implemented practically to the control speed dc motor using Data Acquirement card, and monitored of the control system done by using LABVIEW.

[7] The research proposes controlling DC motor angular speed using the Proportional Integral Derivative (PID) controller and hardware implementation using a microcontroller. The microcontroller device is Arduino Uno as data processing, the encoder sensor is to calculate the angular speed, and the motor driver is L298.

[8] This paper experiences the speed control of a direct current servomotor, type SM-S2309S, with the help of the Arduino UNO platform, which is the simplest solution for the development of electronic applications. The study experiences also speed and step control of a stepper motor, type 28BYJ-48, with the Arduino UNO platform.

[9] The display includes a screen showing the commands and responses against each other. The motor can be rotated 0-360 degrees and can even change its direction from left to right until stopped. Thus, this proposed control methodology is applied to control speed and direction of DC motor wirelessly.

[10] These days many management theories are developed significantly; we have a tendency to do see the wide fashionable use of proportional-integral (PI) and proportional integral- derivative (PID) controller in speed and torque control, motor drives, control, and instrumentation.

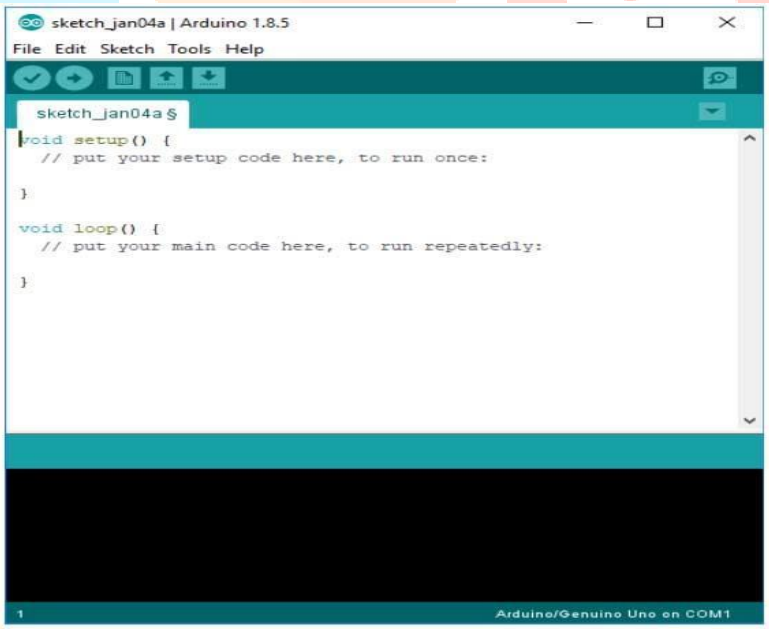
3. PROPOSED METHOD

DC motors play a vital part in a variety of industrial applications. This work developed a system that can remotely guard, regulate, and monitor the speed of a DC motor using a Bluetooth module. The system employs an ATMEGA328P microprocessor that is linked to a potentiometer and a temperature sensor. The potentiometer controls the speed of the DC motor, which may be set to high, medium, or low. The temperature sensor protects against thermal overloading. The temperature sensor detects heat generated in the motor. The entire project's technique is built on a Bluetooth module-based embedded system. For remote monitoring of the DC motor, the Bluetooth module is updated with the system's observed parameters and data. Also, an LCD monitor shows it. The ATMEGA328P micro controller is then loaded with the complete programming, which was completed in the Arduino IDE. The outcomes will shield the motor from the aberrant or problematic circumstances. This method of speed control and overheat prevention has an excellent functioning capacity to guard against damage and overheating issues with the motor. The user can use this gadget more effectively because to its low power consumption.

4. SOFTWARE DESCRIPTION

4.1. ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross- platform (Windows, mac OS, and Linux) application built in the Java programming language. It is used to program and upload Arduino boards. The IDE 's source code is available under the GNU General Public License, version. The Arduino IDE supports the programming languages C and C++ by employing unique code organization conventions. The Wiring project's software library, which supports many common input and output operations, is included with the Arduino IDE. User-written code only requires two basic functions, which are built and linked with a program stub main () into an executable cyclic executive program with the GNU tool chain, which is also included with the IDE release. The argued program is used by the Arduino IDE to convert executable code into a text file in hexadecimal format, which is then loaded into the Arduino board by a loader software in the board's firmware. Arduino is a free and open-source electronics platform with simple hardware and software. Arduino boards can read inputs such as a light on a sensor, a finger on a button, or a Twitter tweet and convert them into outputs such as operating a motor, turning on an LED, or posting anything online. You may direct your board by delivering a series of instructions to the board's microcontroller.



4.2. PROTEUS

The Proteus Design Suite is a closed-source software tool set primarily used for electrical design automation. Electronic design experts and technicians mostly utilize the program to develop schematics and electronic prints for the fabrication of printed circuit boards. Proteus is electronic circuit modeling, schematic capture, and PCB design software developed by Lab center Electronics. Its ease of use and simplicity made it popular among electronics amateurs. Proteus is frequently used to simulate digital devices such as micro controllers and microprocessors. It is capable of simulating LED, LDR, and USB communication. Proteus is a simulation and design software tool for electrical and electronic circuit design

created by Lab Center Electronics. It also has a 2D CAD drawing capability. The tagline "From concept to completion" is appropriate.

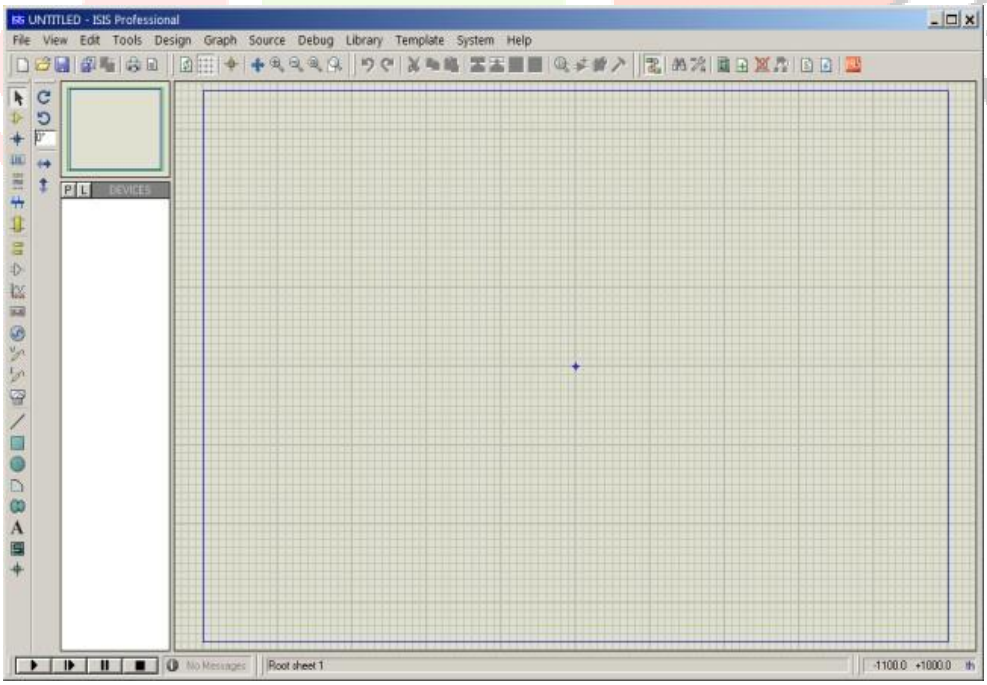
It is a software package that includes schematic, simulation, and PCB design. ISIS is a piece of software that is used to create schematics and simulate circuits in real time. The simulation allows for human interaction during runtime, resulting in real-time simulation. ARES is a PCB design software. It provides the capability of seeing output in 3D perspective of the created PCB as well as components. The product's designer can also create 2D drawings. Features ISIS 's library has a diverse set of components. It includes sources, signal generators, measurement and analysis instruments such as oscilloscopes, voltmeters, ammeters, and so on, probes for real-time monitoring of circuit characteristics, switches, displays, loads such as motors and lamps, and so on.

4.3. ADVANTAGES OF PROTEUS ISIS PROFESSIONAL

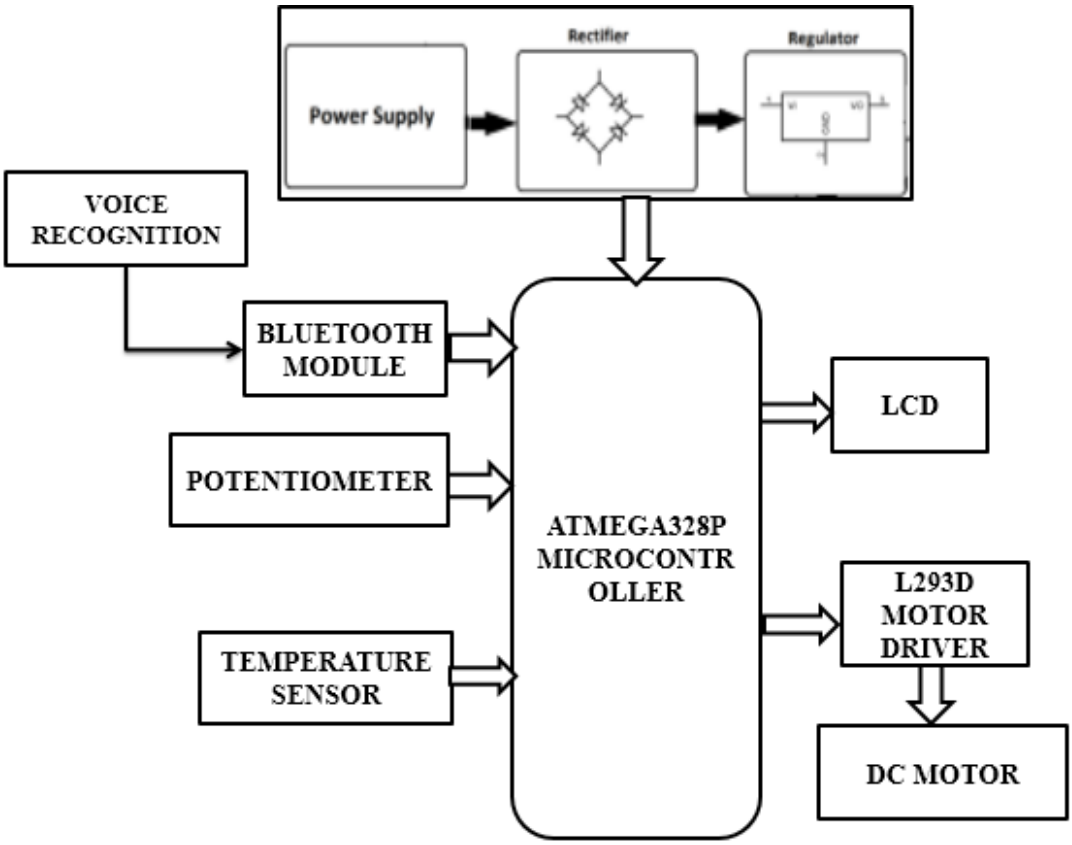
1. It gives the proper idea and implementation of your code and circuit before implementing on hardware.

2. It reduces the time on creating hardware and testing your errors directly on hardware. You can analysis your circuit and code both on Proteus and find the errors encountering before implementing on hardware.

3. Reduces project cost and software dependency.



4.4. HARDWARE BLOCK DIAGRAM



Hardware Block Diagram

4.5. HARDWARE EXPLANATION

In my project, I use Bluetooth Module to regulate dc speed by speech recognition. If the voice recommends, the speed control ATMEGA328P micro controller to dc motor through L293D driver. And the temperature level of the DC motor is sensed by the temperature sensor, and the values are presented on the LCD. Via the dc motor running voltage, the potentiometer was compared to the maximum speed of the dc motor. The LCD indicates whether the dc motor speed exceeds the maximum voltage. Otherwise, we have control over the speed of speech recognition everywhere.

5. METHODS

5.1. MODULE LIST

- Power Supply
- Atmega328p Micro controller
- Potentiometer
- Temperature Sensor
- Node mcu
- Lcd
- L293d Motor Driver

- Dc Motor

5.2. MODULE DESCRIPTION

POWER SUPPLY

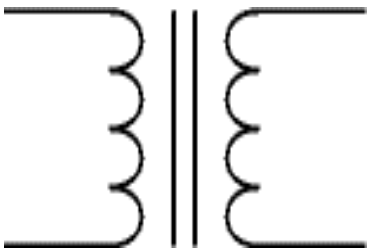
The term "power supply" refers to a source of electrical power. A power supply unit, or PSU, is a device or system that distributes electrical or other forms of energy to an output load or set of loads. The word is most typically applied to electrical energy suppliers, less frequently to mechanical energy providers, and rarely to others. Electronic device power supplies are generically classified as linear or switching power supply. For high current devices, the linear supply is a relatively simple design that becomes progressively bulky and heavy; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply with the same rating as a linear supply is smaller, more efficient, and more sophisticated.

LINEAR POWER SUPPLY

An AC driven linear power supply often employs a transformer to convert the voltage from the mains to a different, usually lower voltage. A rectifier is employed if it is used to generate DC. A capacitor is used to calm the rectifier's pulsing current. Ripple occurs when little periodic variations from smooth direct current remain. These pulsations occur at a frequency linked to the frequency of alternating current power (for example, a multiple of 50 or 60 Hz).

TRANSFORMER

Transformers transfer alternating current (AC) electricity from one voltage to another with little power loss. Transformers only function with alternating current (AC), which is one of the reasons why mains power is alternating current. Step-up transformers raise voltage, whereas step-down transformers lower voltage. A step- down transformer is used in most power supply to decrease the dangerously high mains voltage (230V in the UK) to a safer low voltage. The primary coil is the input coil, while the secondary coil is the output coil. The two coils are not electrically connected; instead, they are linked by an alternating magnetic field formed in the transformer's soft-iron core. The core is represented by the two lines in the centre of the circuit symbol.



Transformer

5.3. ARDUINO UNO

The Arduino UNO is an open-source micro controller board designed by Arduino.cc that is based on the Microchip ATmega328P microprocessor. The board has a number of digital and analogue input/output (I/O) pins that may be used to connect to various expansion boards (shields) and other circuits. The board features 14 digital pins, 6 analogue pins, and is programmable through a type B USB connector using the Arduino IDE (Integrated Development Environment). It may be powered by a USB connection or an external 9 volts battery, and it supports voltages ranging from 7 to 20 volts.

It also resembles the Arduino Mini and Leonardo. The hardware reference design is available on the Arduino website under a Creative Commons Attribution Share-Alike 2.5 license. Konzept and production files for various hardware variants are also available. The name "Uno" means "one" in Italian and was selected to commemorate the launching of the Arduino Software (IDE) 1.0. The Uno board and Arduino Software (IDE) version 1.0 were the reference versions of Arduino, which have since progressed to later releases. The Uno board is the first of a series of USB Arduino boards and serves as the platform's standard model.

PINS General Pin functions

- **LED:** There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- **VIN:** The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V:** This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- **3V3:** A 3.3 volts supply generated by the on-board regulator. Maximum current draw is 50 mA.
- **GND:** Ground pins.
- **IOREF:** This pin on the Arduino / Genuino board provides the voltage reference with which the micro controller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
- **Reset:** Typically used to add a reset button to shields which block the one on the board.

5.4. POTENTIO METER

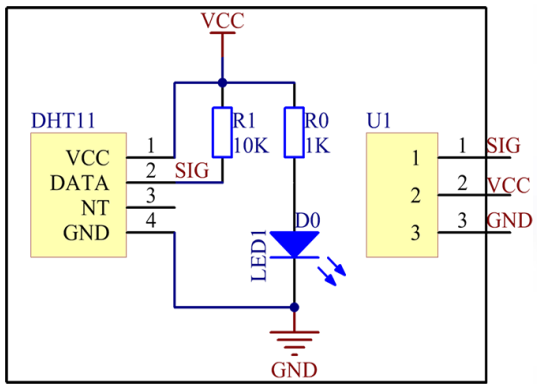
A potentiometer, sometimes known colloquially as a pot, is a three-terminal resistor with a sliding or revolving contact that serves as an adjustable voltage divider. It functions as a variable resistor or rheostat when just two terminals are employed, one end and the wiper. A potentiometer is a measuring tool that is basically a voltage divider used to measure electric potential (voltage); the component is an embodiment of the same idea, thus its name. Potentiometer are often used to regulate electrical devices such as audio volume controls. Potentiometer with a mechanism can be used as position transducers, such as in a joystick. Potentiometer are rarely used to regulate considerable power directly (more than a watt).

5.5. FEATURES

DC Output Proportional to Potentiometer Position Input Potentiometer values ranging from 1 to 50 kilograms Enclosure with Low-Drift Chopper-Stabilized Input 50 mm X 50 mm.

5.6. TEMPERATURE SENSOR (DH11)

The DHT11 digital temperature and humidity sensor is a composite sensor with a calibrated digital temperature and humidity signal output. The technology of a dedicated digital module collection, as well as temperature and humidity sensors, are used to assure the product's high dependability and long-term stability. The sensor consists of a resistive wet component and an NTC temperature measuring device, and it is linked to a high-performance 8-bit microprocessor. The following is a schematic representation of the Humiture Sensor Module:



Temperature Sensor

5.7. LIQUID CRYSTAL DISPLAY (LCD)

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that makes advantage of liquid crystals' light modulating characteristics. Liquid crystals do not directly emit light. LCDs can display random graphics (as in a general-purpose computer display) or fixed images that can be displayed or concealed, such as present text, numerals, and 7- segment displays like those seen in digital clocks. They both employ the same fundamental technology, with the exception that arbitrary pictures are composed of a vast number of little pixels, whilst other displays contain bigger parts. An LCD display is a compact, low-cost display. Because of the inbuilt controller, it is simple to communicate with a micro controller (the black blob on the back of the board). While this controller is common on many displays (HD 44780), several micro controllers (like the Arduino) have libraries that allow displaying messages as simple as a single line of code.

LCD Display Unit

5.8. NODEMCU

NodeMCU is an open source Lua - based firmware for Espressif's ESP8266 Wi-Fi SOC that employs an on-module flash-based SPIFFS file system. NodeMCU is written in C and is built on the Espressif NON-OS SDK. The firmware was originally created as a companion project to the popular ESP8266-based NodeMCU development modules, but it is now community-supported and may be run on any ESP module.

Features:

Interactive Programmable Open Source

- Minimal cost
- Easy
- Smart
- WI-FI enabled.

The ESP8266 Development Kit integrates GPIO, PWM, IIC, 1- Wire, and ADC on a single board. Accelerate your development by combining it with NodeMCU

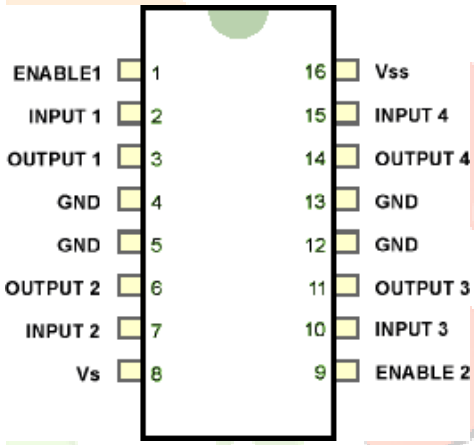
Firmware

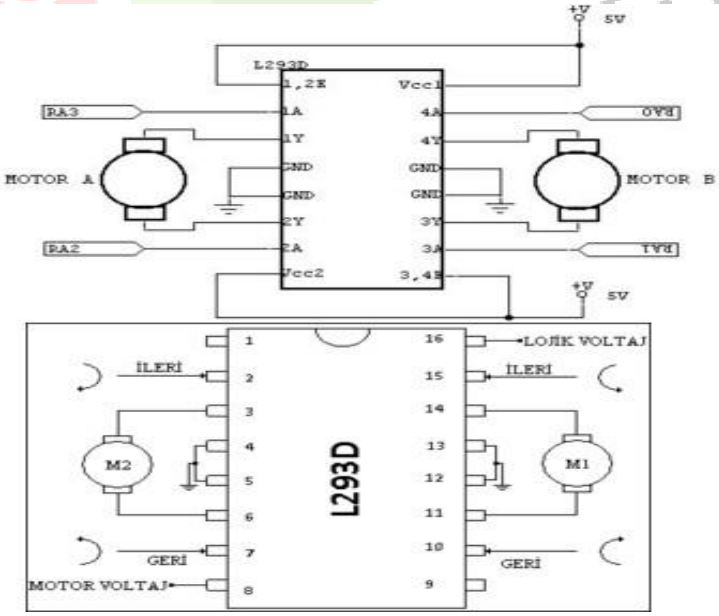
- USB-TTL, plug&play
- 10 GPIO, each GPIO may be PWM, I2C, or 1-wire: FCC WI-FI CERTIFIED MODULE (COMING SOON)

NODEMCU

5.9. L293D MOTOR DRIVER

The L293D is a well-known motor driving integrated circuit. It is a 16-pin integrated circuit. The integrated circuit includes 8 pins on both sides. It features two enable pins, one VSS pin, one VS pin, four ground pins, four input pins, and four output pins. Though not essential, if you want to understand how to interface the L293D with a micro controller.





Motor Driver Module

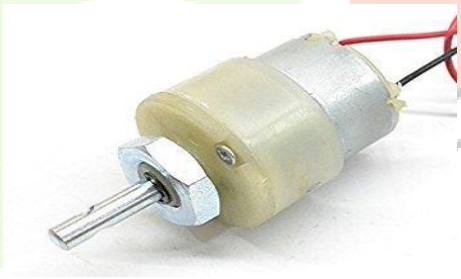
FEATURES

- Wide Supply-Voltage Range: **4.5 V to 36 V**.
- Separate Input-Logic Supply.
- Internal ESD Protection.
- Thermal Shutdown.
- High-Noise-Immunity Inputs.
- Output Current 1 A Per Channel (**600 mA for L293D**).
- Peak Output Current 2 A Per Channel (**1.2 A forL293D**).
- Output Clamp Diodes for Inductive Transient Suppression (L293D).

5.10. DC MOTOR

Continuous actuators that transform electrical energy into mechanical energy are known as direct current motors. The DC motor does this by providing a constant angular rotation, which may be used to rotate pumps, fans, compressors, wheels, and other similar devices. In addition to traditional rotary DC motors, linear motors capable of providing continuous liner movement are provided.

A direct current motor is made up of two parts: a "Stator," which is stationary, and a "Rotor," which rotates. As a result, there are three primary types of DC motors available. Motor with a brushed finish the brushless motor Servo motor Gear motor.



Dc motor

6. CONCLUSION

It has features that integrate all of the hardware components employed. Every module's presence has been carefully thought out and arranged, adding to the unit's optimal performance. Second, the project was effectively executed employing very advanced ICs and expanding technologies. As a result, the paper's concept has been effectively created and tested. The article "Wireless DC Motor Speed and Direction Control Using Bluetooth" was created to operate a DC motor using PWM and control through Bluetooth module, with the system capable of monitoring motor speed on an LCD display. The RPM of a DC motor is measured using an infrared sensor. We can control the DC motor with a PWM signal. The suggested project approach would create a hardware model using the IOT Technology to operate a dc motor. As a result, the speed and temperature of a dc motor may be controlled and monitored via IOT. This paper discusses the real-time monitoring and control of a system designed to protect a dc motor. For real- time monitoring, the system is coupled with IOT. The suggested solution provides precision, reliability, and

lowers the motor's failure rate. In this case, we utilized a microcontroller (ATMEGA328P) as a data gathering system. A potentiometer may be used to control the speed. The technology described in this work may be employed in a variety of industrial applications, and it is relatively inexpensive and contributes to the stability of the system.

7. ADVANTAGES

- Bluetooth consumes less energy than other gadgets.
- The Android application is simple to use; no technical expertise is required.
- Wireless communication has been enhanced.
- Programming has become simpler.

8. DISADVANTAGES

- The use of a Bluetooth module limits the use to a small range.
- The use of Android applications on smart phones depletes the battery.

9. APPLICATIONS

- Home automation.
- Several industrial applications necessitate variable speed drives and constant speed to improve product quality.
- The intensity of light may also be changed using an Android application.
- Future versions of this technology might potentially be used to control the direction and speed of single-phase and three-phase AC motors, in addition to DC motors.
- A WIFI module can be used for long-distance wireless communication. The use of touch screen technology is also possible.

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