

Speed And Direction Control of Dc Moter With The Help of Arduino

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Abstract- The system consists of Arduino board, L293D Moter driver, HC-06 Bluetooth module, LCD, Moter, Potentiometer, etc. This system used to change the speed and direction of Dc Moter. The direction control of Dc Moter is done by H-bridge arrangement and the speed is controlled by giving pulse width modulation signal.

Keywords- Direction control, Speed control, H- bridge, Arduino, HC-06, PWM

I. INTRODUCTION

The DC motor works by using a direct current, it converts electrical energy into mechanical energy. But one might ask why it is important to study about speed control DC motor. Speed control in the machine shows an impact on the speed of rotation of the motor where this direct influence the machine functionality and is so important for the performance and outcome of the performance.

The system consists of Arduino board, L293D Motor driver, HC-06 Bluetooth module LCD, Motor, Potentiometer, etc. We have connected Dc Motor to L293D Motor driver and Arduino.

In this project, we will be able to show you ways to realize Speed and Direction Control of DC Motor using Arduino UNO. It is an easy project using Arduino UNO and a couple of easily available components to regulate the speed of rotation of a DC Motor and also its direction of rotation.

Speed and Direction Control of DC Motor using Arduino.

DC Motors are found everywhere: electronics, toys, fans, tools, discs, pumps etc. DC Motor is an actuator that converts the DC supply to rotation or movement.

There are differing kinds of DC motors: Brushed DC motor, Brushless DC motor, Geared DC motor, Servo motor, Stepper motor and DC Linear Actuator.

Different types of motors are utilized in different applications like Robotics, precision positioning, industrial automation etc.

Generally, when a DC motor is claimed to any microcontroller-based system, it's often connected employing a Motor Driver IC. A Motor Driver IC provides the required current for the motor to run. It can also control the direction of the rotation.

In this project, an Arduino based speed and direction control of DC motor without using Motor Driver IC is meant. A DC Motor can't be connected to a Microcontroller because the output current of the Microcontroller is extremely small and it cannot drive the motor.

Hence, we use transistors to make an H-bridge to drive the motor. The circuit diagram, description and its working are mentioned below.

II. HARDWARE COMPONENT

About Arduino:

Arduino is an electronic platform supported easy-to-use hardware and code. Arduino boards can read inputs - light on a sensor, to a finger on a button, or a Twitter message - and switch it into an output -turning on light-emitting diode (LED). You are able to tell your board what you want by giving a group of instructions to the microcontroller on the board. We can do this by using Arduino software.

Over the years Arduino has been the brain of thousands of activities and projects, from everyday objects to advanced scientific instruments. A community of manufacturers - students, hobbyists, artists, programmers and professionals have started to use this easy platform.

Arduino was discovered at the Ivrea Interaction Design Institute for fast prototyping and for the students who has not familiar with electronics and programming. When it reached a wider community, the Arduino board started to

adapt to new desires and challenges, differentiating its offers starting from 8-bit boards to product for IoT applications, wearable, 3D printing and embedded environments. All Arduino boards are open- source.



Why Arduino?

Arduino has easy and accessible user experience, Arduino has been utilized in thousands of activities, projects and applications. The Arduino programming is easy-to-use for beginners and flexible for expert users. It is possible to operate Arduino on mac, Windows and Linux. Academics and students use it to make low price scientific instruments, to prove chemistry and physics principles or for starting Robotics and programming. Arduino has become a key tool to find out new things. There are different alternative microcontrollers and microcontroller platforms can be used for physical computing. The messy details are taken by all of those tools from microcontroller programming then wrap it up in an easy-to-use package. Arduino conjointly simplifies the method of operating with microcontrollers, however it offers some advantage for academics, students, and interested amateurs over alternative systems.

DC MOTER



Both the DC machines i.e., DC generator and DC motor have identical construction. Therefore, either machine may be used as a motor or a generator, so that the following discussion regarding the development of DC motor is equally valid for the development of the DC generator. Also, we will entitle it as the construction of DC machine.

A DC motor or machine consists of 2 windings (field and armature). The field winding is stationary and the armature winding may be rotate.

A magnetic flux is produced By field winding between and armature

The main components utilized in the construction of DC motor are the yoke, poles, field winding, commutator, carbon brushes bearings, etc.

HC-06 Bluetooth module

The purpose of making HC-06 to establish short range wireless electronic communication between 2 microcontrollers or systems. The module works on Bluetooth 2.0 communication protocol and it will solely act as a slave device. It is an easy and least expensive technique for wireless data transmission and a versatile compared to different ways and it even can transmit files at speed of 2.1Mb/s.

Frequency hopping spread spectrum technique (FHSS)used by HC-06 to avoid interference with different devices and to possess full duplex transmission. The device works on the frequency varying from a 2.402 GHz to a pair of.480GHz.

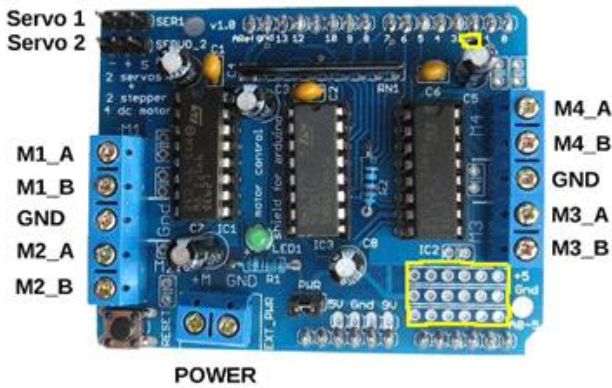


L293D IC

L293D IC has a typical Motor Driver IC that permits the DC motor to drive on any direction. This IC consists of 16-pins that are used for management a group of 2 DC motors in any direction. It means, by employing a L293D IC we will be able to control 2 DC motors. As well, this IC is able to drive little and quiet large motors.

This L293D IC works on the principle of H-bridge, this motor control circuit permits the voltage to be flowing in any direction. As we all know that the voltage should be change the direction of having the ability to rotate the DC motor in each the directions. Hence, H-bridge circuit by using the L293D ICs are best for driving a motor. Single L293D IC consists of 2 H-bridge circuits within which we may rotate 2

DC motors individually. Generally, these circuits are generally used in robotics because of its small size for controlling DC motors.



LCDs

16x2 and 20x2 displays are the LCDs which are most commonly connected with microcontroller. This implies sixteen characters per line by two lines and twenty characters per line by two lines, respectively. It refers to the controller chip which receives information from different external sources and communicates directly with the LCD.

In this project we've used the 16x2 liquid crystal display. it's the characteristics that fulfils our requirements of the project. it's simple and effective to use in our project.



Specifications of 16x2 LCD

The specifications of this LCD mainly include:

- The operative voltage of this LCD is nearly 4.7V-5.3V.
- It includes 2 rows wherever every row will turn out 16-characters.
- With no backlight it utilizes 1mA of current.
- Every character is made with a 5x8-pixel box.
- The alphanumeric LCDs contain alphabets & numbers.
- Its display may work on 2 different modes like 4-bit & 8-bit.
- These are available in Green & Blue Backlight.
- It displays some custom generated characters

Working:

H-bridge:

An H-bridge has an easy circuit that enables you to manage a DC motor to travel backward or forward.

You ordinarily use it with a microcontroller, like Arduino, to regulate motors.

When you'll be able to manage 2 motors to travel either forward or backward – you can build yourself a robot!

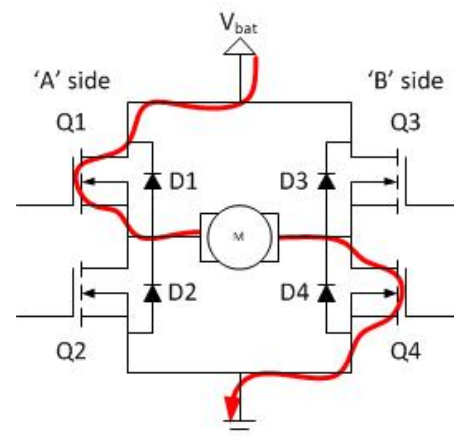
H-Bridge working principal:

Here's the idea of the H-bridge: A DC motor spins either backward or forward, depending on the polarity of connection. If you close switch 1 and 4, you will get plus connection to the left side of the motor and minus to the opposite side and hence the motor can begin spinning in one direction. If you close switch 2 and 3, you will get plus connection on right side and minus to the left side and hence the motor spins in different direction. You can build H-bridge with four transistors. If you're not able to understand how the transistors works, I like to recommend you browse the article 'How Transistors Work' first. From there you'll learn that the transistor will work as a switch that you simply will open and close with the voltage on the bottom.

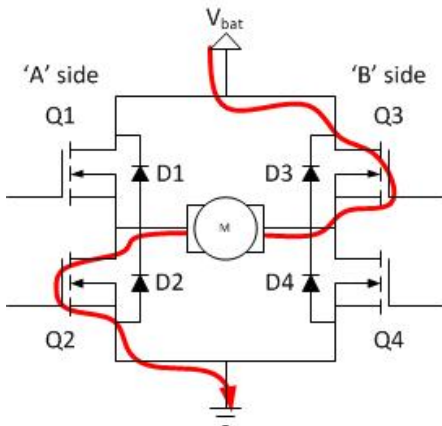
Since the transistor work as a switch, you'll be able to create the motor spin in either direction by turning on and off the four transistors. Usually, you can manage the transistors from a microcontroller, such as Arduino.

The basic operating mode of an H-bridge:

When Q1 and Q4 are turned on, the left lead of the motor is going to be connected to power supply, while the right-side lead is connected to ground. Since, the circuit is completed current flows and the motor starts to spin.

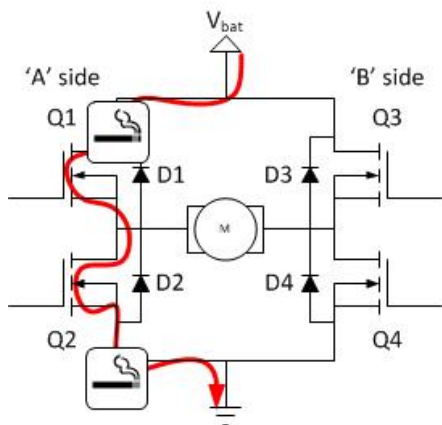


When Q2 and Q3 are turned on, the reverse will happen, the motor will start spinning backwards.



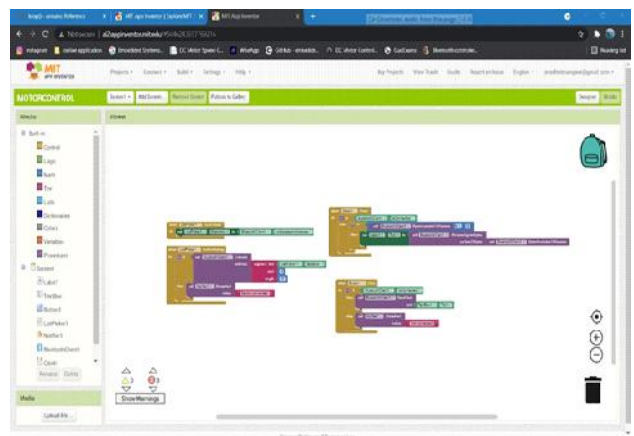
Q1	Q2	Q3	Q4
close	open	open	open
close	open	open	close
close	open	close	open
open	close	open	open
open	close	open	close
open	close	close	open
open	open	open	open
open	open	open	close
open	open	close	open

In a bridge you ought to never ever close both Q1 and Q2 (or Q3 and Q4) at a same time. If you probably did that, you just have created a very low-resistance path between power and GND, effectively short-circuiting your power supply. This condition is known as ‘shoot-through’.



III. DESCRIPTION OF APP

Blocks for app



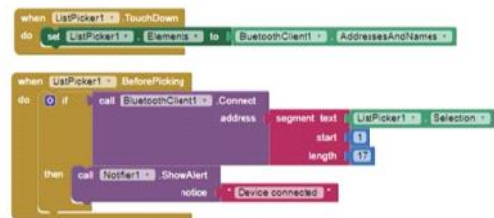
An android app was made for our project on MIT APP inventor called “MOTOR CONTROL”. This is an open-source web site so anybody can use it for developing app. The app content control of two motor individually. We decided to give the terminal mode to the printer control app from the terminal we can send any information to the Bluetooth module.

There are 3 different ways to control the flow of current, as mentioned below:

Q1	Q2
open	open
close	open
open	close

Similarly for side-B:

Q3	Q4
open	open
close	open
open	close

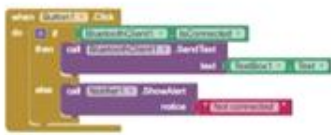


The first block in the app developed is for the overall screen information. In this block we can select different types of Bluetooth module through app the name of the Bluetooth module it's soon in the app we can send 1 to 17 length of text from the app

There are 9 different states are possible for the full bridge to be in:

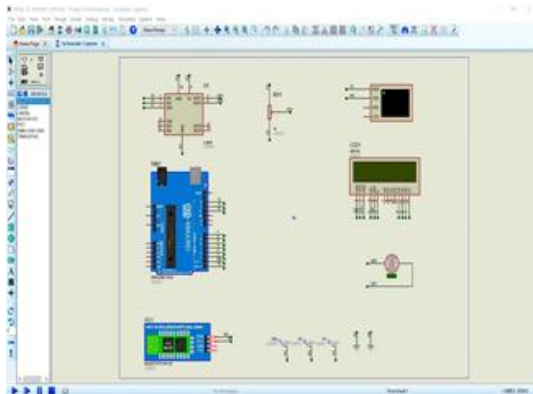


When the Bluetooth is connected the s block checks that the information is written or not if the bit is greater than zero then the APP send the information to the client when send button is pressed



3rd block contains the information to be sent and if the client is not available then they show notify alert “not connected

Operating:



The above diagram shows the how to control a speed and direction of rotation of DC Motor by using the L293D motor driver chip and Arduino UNO.

The L293D quadruple half-H drivers chip permits you to drive two motors in each direction, with 2 PWM outputs from the Arduino we will simply manage the speed additionally the direction of rotation of 1 DC motor by (PWM: Pulse Width Modulation).

For direction control of DC motor, we've need to pin high and low of motor. This work is done through the motor

driver l293d. When we send a message through app, the Bluetooth module receive the information and send to the Arduino. Arduino processes the given information and provides high or low pulse to the motor driver as written in code.

For speed management of motor reset 5 speed values with duty cycle, 100 percent duty cycle, 75 percent duty cycle, 75 percent duty cycle, 25 percent duty cycle and stop with duty cycle 0 percent. This speed control will be achieved in each direction clockwise and anticlockwise.

Instructions	Action
1	Full speed forward
2 and 7	duty cycle 75%
3 and 8	duty cycle 50%
4 and 9	duty cycle 25%
5	duty cycle 0%
6	Full speed reverse

Arduino DC control circuit:

Project circuit schematic diagram is that the one below. The speed of the DC motor (both directions) is controlled by the Arduino app through Bluetooth module that is connected to channel 0 and 1(RX, TX) and additionally the direction of rotation is controlled with the app. If the button is pressed the motor can modification its direction automatically.

The L298 driver has two VCCs: VCC1 is +5V and VCC2 is +12V (same as motor nominal voltage). Pins IN1 and IN2 are control pins where:

IN1	IN2	Function
L	H	Direction 1
H	L	Direction 2
L	L	Fast motor stop
H	H	Fast motor stop

In circuit we are going to use 10 pins of Arduino, number 2 to number 7 are connected to LCD digital display, number 12 and number 13 are connected to the motor driver, number 11 is connected to the motor driver. The Bluetooth module HC06 is connected to the Arduino pin 0 and 1 the TX pin of Arduino is connected to the RX pin of HC06 and RX pin of Arduino is connected to the TX pin of HC 06. The output pins are connected to the dc motor

Advantages of PWM Technique: -

- The main advantage Of PWM is that power loss within the switching devices is extremely low.

- When a switch is off there's no current, and once it's on then power is being transferred to the load, there's nearly no fall across the switch
- Power loss is close to zero.
- PWM works well with digital controls, that as a result of their on/off nature, which simply set the required duty cycle.
- Also, the temperature sensing element DHT22 has low error (0.5%) and its temperature range is high (- 40 to SOC) as compared to alternative temperature sensing element like LM35, DHTII etc.

IV. CONCLUSION

In this project, by using Arduino we controlled direction and speed of Dc Moter. A DC Motor can't be connected to a Microcontroller because the output current of the Microcontroller is incredibly little and it cannot drive the motor.

Hence, we have used H-Bridge circuit to drive the motor. we have demonstrated a system that consists of electrical, electronics, programming (encryption and coding). Arduino compiler is used to operate and manage the switching actions of dc motor and additionally stepper motor. The speed of dc motor and stepper motor varies from maximum to minimum and additionally the direction of dc motor is modified.

Applications:

- The circuit is used to drive DC motor without any Motor Driver IC.
- The circuit are often extended to 2 motors by implementing twin H-bridge connections.
- Can be employed in easy robotic applications to regulate direction and speed of single motor.

V. FUTURE SCOPE

This concept can be used as a proto type further development and growth in technology. This device is often integrated with robotic drones, cameras, house doors, lockers, good systems and buildings.

Output of an Arduino Microcontroller controls the speed of dc motor by using the pulse width modulation, that Simulates a treadmill machine

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