A MINI PROJECT REPORT
ON

MOTOR DRIVER

SUBMITTED BY
1)Prasad Jadhav (71841678D)
2)Abhijeet Gite (71841649L)

THIRD YEAR INSTRUMENTATION & CONTROL ENGINEERING

GUIDED BY
Prof. A. V. Kulkarni
Assist. Professor

April 2020
(Month & Year of Submission)

GOVERNMENT COLLEGE OF ENGINEERING AND RESEARCH AWASARI (KHURD)

ACKNOWLEDGEMENT

I would like to place on record my deep sense of gratitude to Prof. N.S. Nehe, HOD-Dept. of Instrumentation & Control Engineering, GCOEAR, Awasari (Khurd), for his generous guidance, help and useful suggestions.

I express my sincere gratitude to Prof. A. V. Kulkarni, Dept. of Instrumentation & Control Engineering, GCOEAR, Awasari (Khurd), for his stimulating guidance, continuous encouragement and supervision throughout the course of present work.

I also wish to extend my thanks to all faculty members and other colleagues for attending my presentation and for their insightful comments and constructive suggestions to improve the quality of this mini project work.

Signature of Student

1. Abhijeet Gite (17161003) 2. Prasad Jadhav (17161002)

CERTIFICATE

I hereby certify that the work which is being presented in the T.E. Mini project Report entitled **"Motor Driver",** in partial fulfillment of the requirements for the completion of the **Third Year in Instrumentation & Control Engineering** and submitted to the Department of **Instrumentation & Control Engineering** of Government College of Engineering & Research, Awasari (Khurd) is an authentic record of my own work carried out during a period from **December 2019 to April 2020** under the supervision of **Prof**. **A.V. Kulkarni (Assist. Professor), Instrumentation & Control Department**.

This is to certify that the above statement made by the student(s) is correct to the best of my knowledge.

Prof. A. V. Kulkarni	**Dr. N. S. Nehe**
Assist. Professor	Head of Dept.
Dept. of Instrumentation and Control	Dept. of Instrumentation and Control

Date: 13/06/2020

Abstract:

Today DC motors are used commonly at lots of electrical application. DC drive systems are often used in many industrial applications such as robotics, actuation and manipulators. These motors are easy to drive, fully controllable and readily available in all sizes and configurations. When examined these applications dc motors are needed to be operated on variable or constant speed with forward or reverse operation. There are many control techniques to obtain control of different speeds. For this controlling process the electric drive systems are used frequently. Industrial applications are increasingly required to meet higher performance and reliability requirements. The DC motor is an attractive piece of equipment in many industrial applications requiring variable speed and load characteristics due to its ease of controllability. Controllers provide a suitable means of meeting these needs.

In these project, H bridge DC motor driver is designed and implemented. H bridge circuit is used for controlling DC motor speed and rotating side. The H bridge driver MOSFETs are driven by a high frequency PWM signal. Controlling the PWM duty cycle is equivalent to controlling the motor terminal voltage, which in turn adjust directly the motor speed. DC motor driver is controlled with using the PLC controller. PWM signals are generated at PLC and applied to DC motor driver circuit. Controllers has been investigated for different speed control of DC motor.

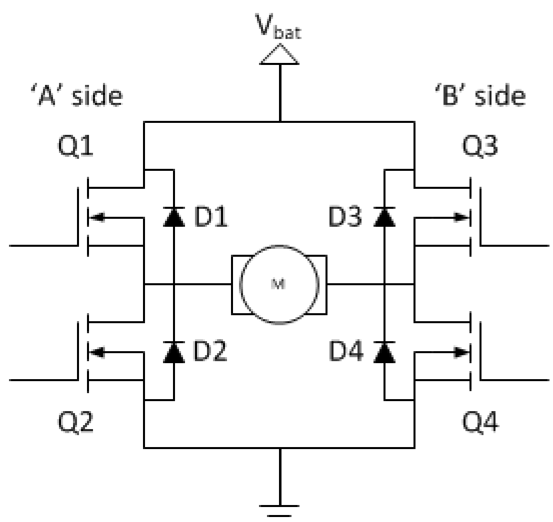
TABLE OF CONTENTS

Introduction

An H-Bridge is an electronic power circuit that allows motor speed and direction to be controlled. Often motors are controlled from some kind of "brain" or controller (PLC) to accomplish a mechanical goal. The controller provides the instructions to the motors, but it cannot provide the power required to drive the motors. An H-bridge circuit inputs the controller instructions and amplifies them to drive a mechanical motor. This process is similar to how the human body generates mechanical movement; the brain can provide electrical impulses that are instructions, but it requires the muscles to perform mechanical force. The muscle represents both the H-bridge and the motor combined. The H-bridge takes in the small electrical signal (PWM) and translates it into high power output for the mechanical motor.

Working

In general an H-bridge is a rather simple circuit, containing four switching element, with the load at the center, in an H-like configuration:

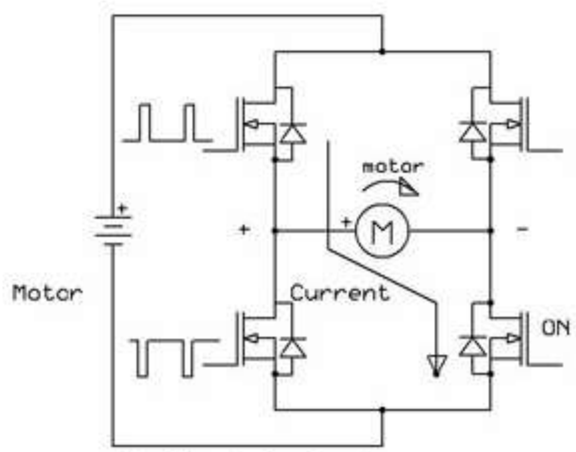


The switching elements (Q1..Q4) are usually bi-polar or FET, (MOSFET) transistors, in some high-voltage applications IGBTs. The diodes (D1,D4) are called catch diodes and are usually of a Schottky type. The top-end of the bridge is connected to a power supply (battery for example) and the bottom-end is grounded. In general all four switching elements can be turned on and off independently, though there are some obvious restrictions. H-bridges is with a brushed DC load.

Operation

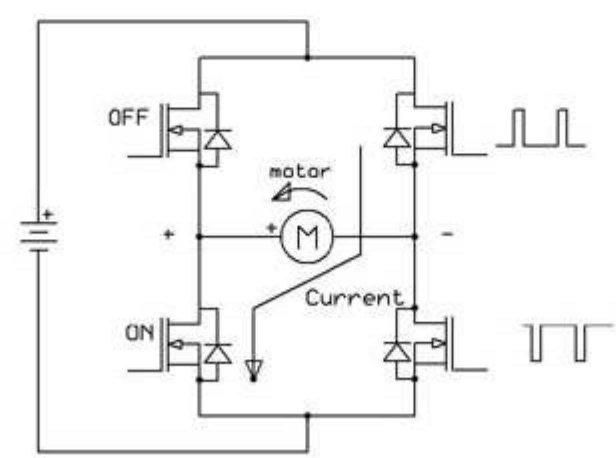
1. Motoring

The basic operating mode of an H-bridge is fairly simple: if Q1 and Q4 are turned on, the left lead of the motor will be connected to the power supply, while the right lead is connected to ground. Current starts flowing through the motor which energizes the motor in (let's say) the forward direction and the motor shaft starts spinning.



(A) First Quadrant

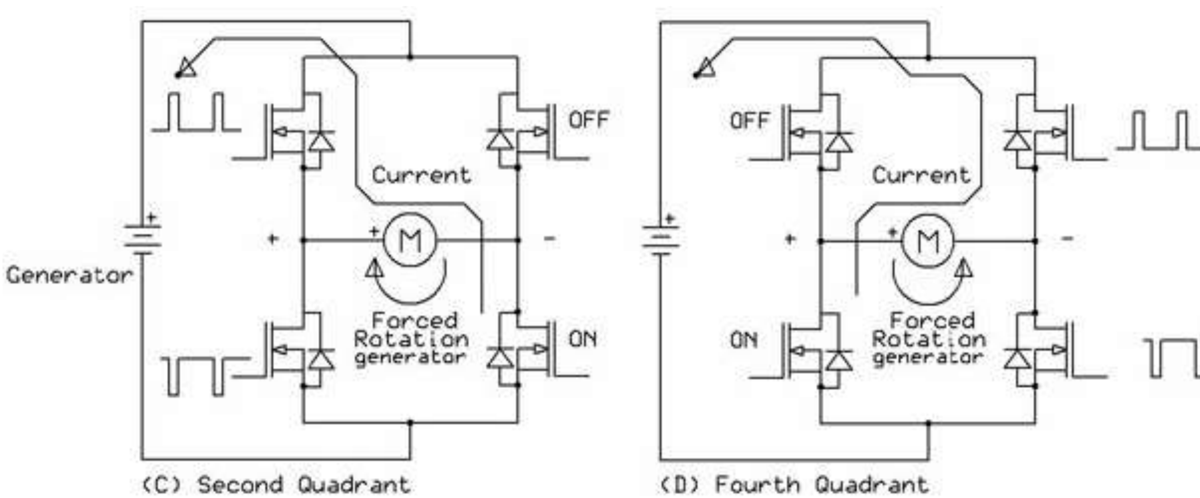
If Q2 and Q3 are turned on, the reverse will happen, the motor gets energized in the reverse direction, and the shaft will start spinning backwards.



(B) Third Quadrant

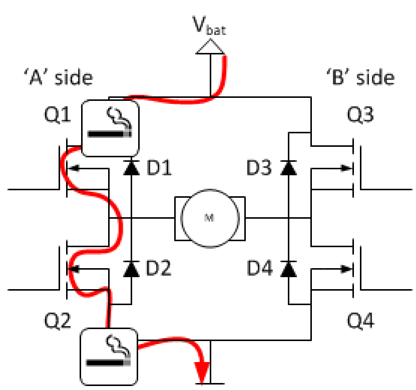
2. Regenerative Braking

When the back emf **(Vback>>Vs)** of the motor is greater than the input voltage the current starts flowing from the motor towards the battery. This happens when we apply the brake, the motor starts regenerating due to PWM signal and the current flows via diode towards the battery. The below circuit shows the operation.



3. Fault

In a bridge, If Q1 and Q2 (or Q3 and Q4) are closed at the same time. It creates really low-resistance path between power and GND, effectively short-circuiting bridge power supply. This condition is called 'shoot-through' and is an almost guaranteed way to quickly destroy your bridge, or something else in your circuit.



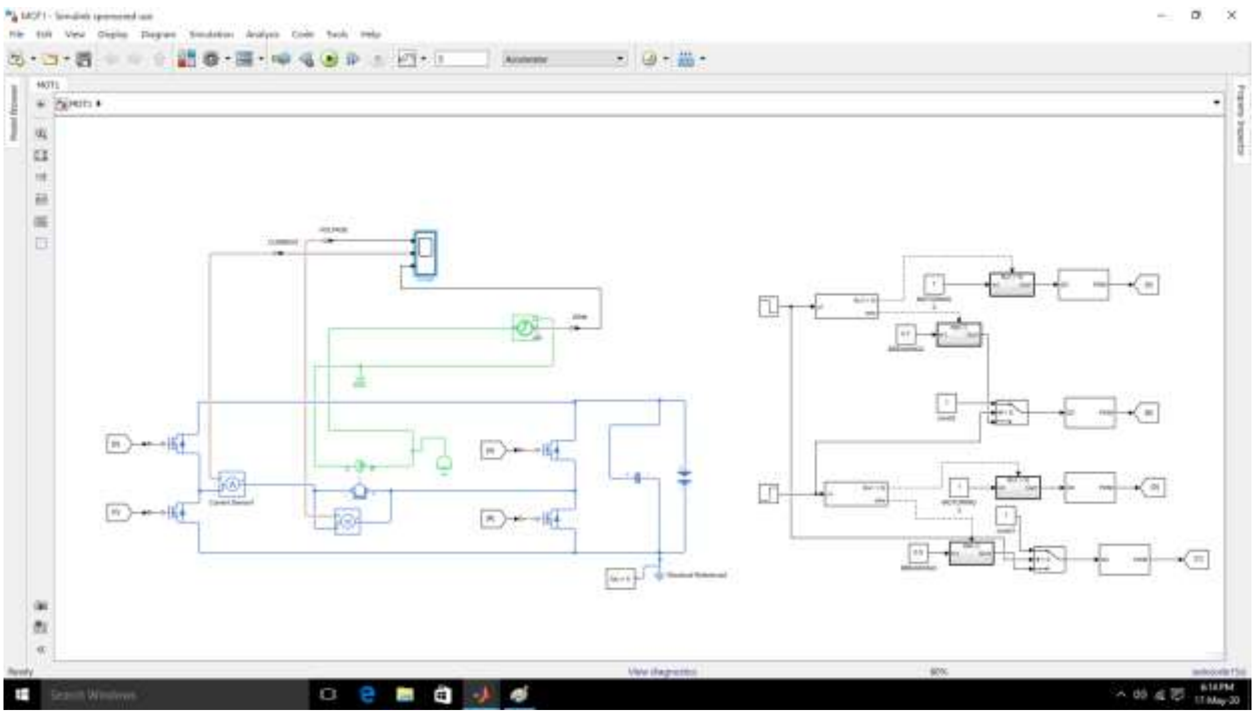
9 different states for the full bridge

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**

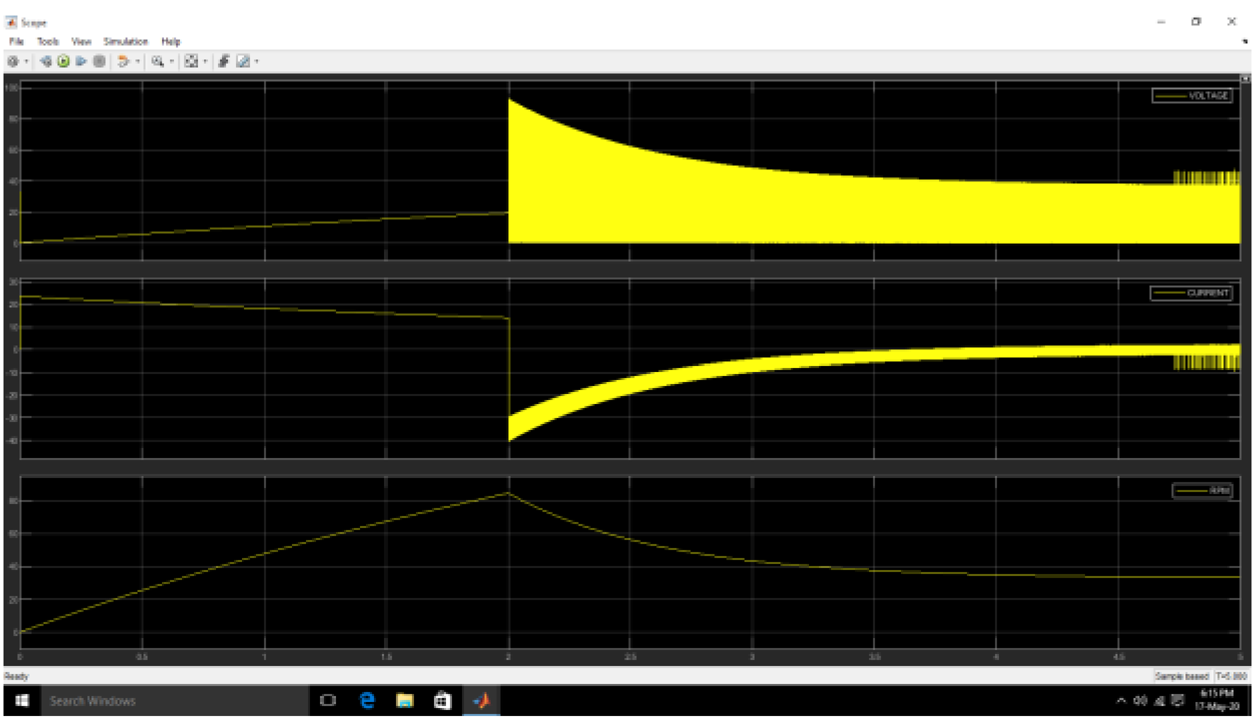
Specifications:

1. DC Motor - 12 Volt
2. PLC Controller - Allen Bradley 1400
3. N -channel MOSFETs – IRF840
4. Battery – Orange 1000Mah 12Volt

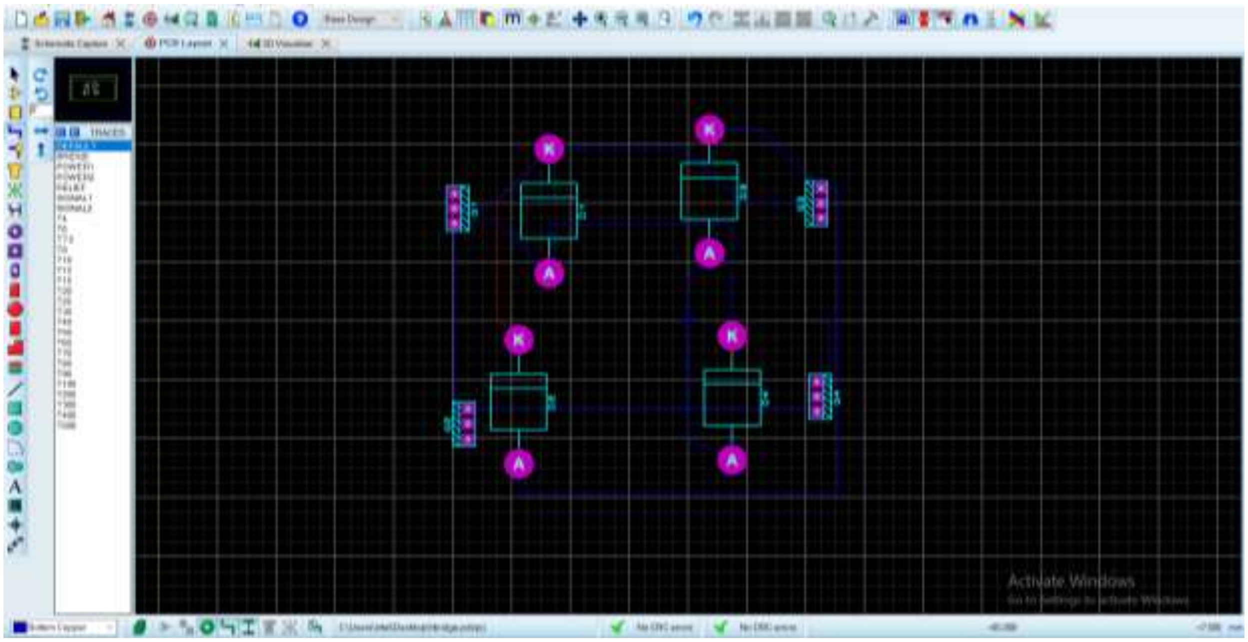
Circuit Diagram

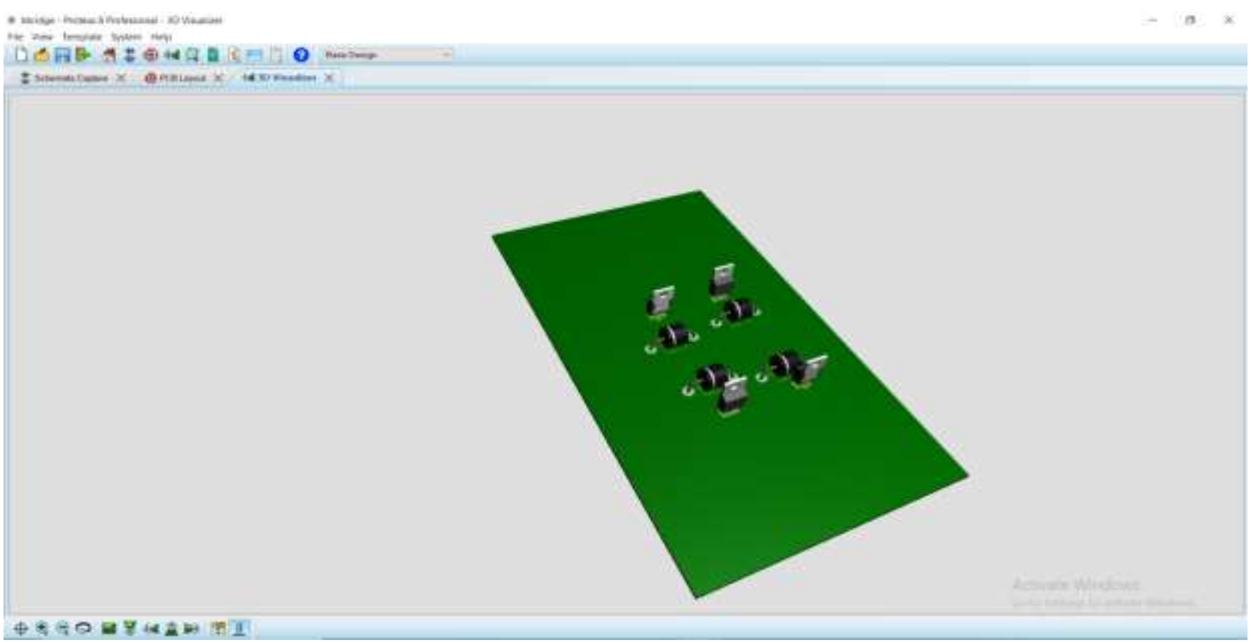


Simulation



PCB





Results & Conclusion

Circuit model simulated in MatLab and the desired results are achieved.