

Four Quadrant DC Motor Speed Control by Using Arduino

G. Tejaswi¹, SK. Baji², D. Suresh Kumar², K. Lenin², M. Santhosh kumar², M. Kalyani²

¹Associate Professor Department of EEE, Sree Vahini Institute of Science & Technology, Tiruvuru, A.P

^{2,3,4,5}UG Student, Department of EEE, SVIST, Tiruvuru, A.P

ABSTRACT

The goal of this project is to build a four-quadrant DC motor speed control system. The motor has four quadrants of operation: clockwise, counter clockwise, forward brake, and reverse brake. It also features a speed control function. The DC motor's four-quadrant operation is best suited for industries where motors are used based on needs. They can rotate in both clockwise and counter clockwise directions, and brakes can be applied simultaneously in both directions. When performing a certain activity in an industrial plant, the motor must be stopped instantly. In this situation, the proposed system is ideal because it includes both forward and reverse brakes. Instantaneous braking in both directions is performed by briefly applying a reverse voltage across the running motor, and the motor's speed may be controlled using PWM pulses provided by the Arduino Board. This operation is performed using an Arduino Microcontroller Board. The motor is controlled by push buttons that are connected to the Arduino, which receives an input signal and regulates the speed of the motor with a motor driver IC. This project also has a speed control option with a push-button operation.

Keywords: DC motor, Arduino, L293D Motor driver IC, Speed control, PWM

I. INTRODUCTION

DC machines are extremely important in both industry and everyday life. DC machines have the distinct advantage of having easily adjustable properties. The goal of this study is to use Arduino to create a four-quadrant speed control system for a DC motor. The notion of four quadrant speed control of a dc motor, i.e., clockwise motion, anticlockwise motion, instantaneous forward braking, and immediate reverse braking, has been introduced in this work using Arduino and a motor driver (L293D). The same application is used to control the rudder of an aeroplane, an electric bicycle, or an electric car, among other things. A stationary magnet and revolving coils make up the motor. The brushes provide power to the coil located near the motor magnet pole pieces. The rotor rotates, and the polarity of each coil is reversed, and the motor rotates continuously. The rotational direction. Brush polarity affects the outcome. The torque applied to the rotor is determined by the current going through it through the tangles. The constant speed is determined by the current flowing through the coils as well as the load. The motor is driving the vehicle.

II. BLOCK DIAGRAM AND CIRCUIT DIAGRAM DESCRIPTION

The block diagram of the proposed circuit as shown in Fig. 1.



Fig. 1. Block Diagram of Four Quadrant DC Motor Speed Control by Using Arduino

Four Quadrant Dc Motor Speed Control Using Arduino 1

Dawina Ibrahim



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DC Motor Control - A case study MOHAMMED ASLAM HUSAIN, 2018-11-20 In this book the four quadrant speed control system for DC motor has been studied and constructed To achieve speed control an electronic technique called pulse width modulation is used which generates high and low pulses These pulses vary in the speed of the engine For the generation of these pulses a microcontroller is used It is a periodic change in the program Different speed grades and the direction are depended on different buttons The experiment has proved that this system is higher performance Speed control of a machine is the most vital and important part of any industrial organization This paper is designed to develop a four quad speed control system for a DC motor using microcontroller The engine is operated in four quadrants ie clockwise counterclockwise forward brake and reverse brake It also has a feature of speed control The four quadrant operation of the dc engine is best suited for industries where engines are used and as a requirement they can rotate in clockwise counter clockwise and thus apply brakes immediately in both the directions In the case of a specific operation in an industrial environment the engine needs to be stopped immediately In this scenario this system is very integral The PWM pulses generated by the microcontroller are instantaneous in both directions and as a result of applying the PWM pulses The microcontroller used in this project is from 8051 family Push buttons are provided for the operation of the motor which are interfaced to the microcontroller that provides an input signal to it and controls the speed of the engine through a motor driver IC The speed and direction of DC motor has been observed on digital CRO

Advanced Power Electronics Converters for Future Renewable Energy Systems Neeraj Priyadarshi, P. Sanjeevikumar, Farooque Azam, C. Bharatiraja, Rajesh Singh, 2023-03-31 This book narrates an assessment of numerous advanced power converters employed on primitive phase to enhance the efficiency of power translation pertaining to renewable energy systems It presents the mathematical modelling analysis and control of recent power converters topologies namely AC DC DC DC and DC AC converters Numerous advanced DC DC Converters namely multi input DC DC Converter Cuk SEPIC Zeta and so forth have been assessed mathematically using state space analysis applied with an aim to enhance power efficiency of renewable energy systems The book Explains various power electronics converters for different types of renewable energy sources Provides a review of the major power conversion topologies in one book Focuses on experimental analysis rather than simulation work Recommends usage of MATLAB PSCAD and PSIM simulation software for detailed analysis Includes DC DC converters with reasonable peculiar power rating This book is aimed at researchers graduate students in electric power engineering power and industrial electronics and renewable energy

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To Motor Control Using Arduino Mila Cavicchi,2021-03-20 Arduino in the US and recently Genuino outside the US a development platform that is easy to use inexpensive and has a large and active community This guide will show you just how easy it is to control motors with Arduino This book is about controlling motors using Arduinos called Genuinos outside the United States The author starts with simple direct current DC motors covering turning them on and off controlling their speed and reversing direction He then gets into more complicated motors and discusses two types of stepper motors a type of precision motor that can be used for detailed control of devices like 3D printers CNC routers robot arms etc He also discusses servo motors which are useful for setting positions and brushless motors which are good for high speeds like you might need for drone or model plane propellers fans model boat propellers high speed model cars and any other application that requires high speeds **Development of P-resonant Voltage Control for DC Motor Using Arduino** ,2014 DC

Motor Speed Control Using a Phase-locked Loop Erik Nelson,1975 **Design of DC Motor Speed Controller Using Microcontroller** ,2011 **Background, Proceedings and Repercussions of the July PSUC Trials in Barcelona** ,1952

Design of a Three Phase Four Quadrant Variable Speed Drive for Permanent Magnet Brushless DC Motors Jonas-Yelee Dakora,2016 *DC Motor Speed Control with PWM* ,2015 Speed Control of DC Motor Using PI Controller Mohd Azri Abd Mutalib,2008 The development of technologies affects the demands of industries at the present time Thus automatic control has played a vital role in the advance of engineering and science In today s industries control of DC motors is a common practice Therefore implementation of DC motor controller is required There are many types of controller that can be

used to implement the elegant and effective output One of them is by using a PI controller PI stands for Proportional and Integral Controllers which are designed to eliminate the need for continuous operator attention thus provide automatic control to the system Cruise control in a car and a house thermostat are common examples of how controllers are used to automatically adjust some variable to hold the measurement or process variable at the set point This project is focusing on implementing PI controller to control speed of a dc motor The overall project is divided into two parts The first part is concern on the simulation using MATLAB simulink where the dc motor is modeled and PI controller is tuned using Ziegler Nichols rules and software tuning The second part is implementing the simulation This part is divided into another two parts Graphical User Interface GUI development and hardware interfacing GUI is built using National Instrument LabVIEW software with implementation of PI controller An oscilloscope also had been build there Hardware interfacing part is built with Mitsumi dc mini motors M31E 1 Series speed sensor and analog to digital converter DAC8032 As the result PI controller is capable to control the speed of dc motor followed the result from simulation

DC Motor Speed Control Using Logic Controller ,2014 A D.C. Motor Speed Controller Using a Single Chip Micro John A. Murtagh,1981 DC Motor Speed Control Using SCR Chopper John Y. H. Chen,1977 **Simulation of Dc Motor Speed Control Using Matlab/simulink** ,2008

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