IJMRT: Volume (7), Issue 3, 2025
International Journal of Multidisciplinary Research Transactions
(A Peer Reviewed Journal)
www.ijmrt.in
ISSN (Print):2663-2381
ISSN (Online):2663-4007

Control of DC Motor using LabVIEW

Dr. Shanmugavalli M[1]*, Mathangini M[2], Praveena M[3], Kaavya N R[4]

[1]*Professor, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.*
[2]*Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.*
[3]*Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.*
[4]*Student, Department of Instrumentation and Control Engineering, Saranathan College of Engineering, India.*

*Corresponding Author
DoI: https://doi.org/10.5281/zenodo.15046941

Abstract

This paper presents an in-depth study of servo motor using the NI myRIO platform and LabVIEW software, Servo motors are widely used in automation, robotics, and control systems, requiring precise position control. The NI myRIO, a reconfigurable embedded devise, facilities real-time control applications through LabVIEW's graphical programming interface. The project demonstrates the implementation of a Pulse Width Modulation (PWM) signal to drive a (NAME) servo motor. The methodology includes setting up NI myRIO designing the LabVIEW virtual instrument, and analysing the system's response. The LabVIEW block diagram allow users to generate PWM signals, while the front panel provides an intuitive user interface for controlling servo motor position. Key challenges such as latency, PWM signal noise, and torque limitations are discussed, along with future enhancements, including multiple servo integration and wireless control. This study highlights the effectiveness of LabVIEW in servo motor applications, making it a valuable tool for embedded systems education and industrial automation. The practical implementation outlined in this paper serves as a foundational guide for engineers and students working with motion control systems.

Keywords: NI myRIO, Servo Motor, LabVIEW, Embedded Systems, Motion Control, Pulse Width Modulation (PWM), Real-Time Control, Motor Positioning, Block Diagram, Front Panel, Field Programmable Gate Array (FPGA).

1. Introduction

DC servo motors are essential components in modern control and automation systems, providing precise movement and position control. These motors consist of a DC motor, a control circuit, and a position sensing devise. Servo motors receive control signals in the form of Pulse Width Modulation (PWM), which determines the rotation angle and speed of the motor shaft. The built-in feedback mechanism ensures that the motor maintains its desired position by constantly adjusting its movement based on real-time data. This feature makes servo motors highly suitable for applications in robotics, CNC machines, aerospace systems, and industrial automation.

A crucial aspect of servo motor operation is the PWM signal, where the duty cycle of the signal dictates the angle of rotation. By varying pulse duration, users can precisely control the position of the motor shaft. The ability to provide accurate position control makes servo motors superior to traditional DC motors in applications where precision is critical. Their implementation in mechatronics and automation fields continue to grow due to their efficiency and reliability.LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is an industry-leading graphical programming environment developed by National Instruments. It is widely used for developing test, measurement, and control applications. Unlike traditional text-based programming languages, LabVIEW allows users to build programs using a virtual interface, making it highly accessible for engineers and researchers. Its intuitive design enables seamless integration with hardware devices such as NI myRIO, microcontrollers, and data acquisition systems.

NI myRIO is a compact and powerful embedded control device designed for academic and industrial applications. It features an onboard Field Programmable Gate Array (FPGA) and a real-time processor, making it an excellent platform for implementing motion control applications. NI myRIO provides multiple input/output channels, including digital, analog, and PWM, which are essential for interfacing with sensors and actuators. By using NI myRIO in conjunction with LabVIEW, users can efficiently design, simulate, and deploy real-time control systems.

In this paper, we explore the process of implementing servo motor control using NI myRIO and LabVIEW. The methodology involves hardware setup, PWM signal generation, and real-time motor control. The LabVIEW block diagram and front panel play a crucial role in designing and monitoring the system, providing a user-friendly for controlling motor movement. Additionally, we address common challenges in servo motor control, such as signal noise, response time, and system accuracy. By understanding these factors, engineers and students can develop more efficient motion control systems.

2. Control of Motor

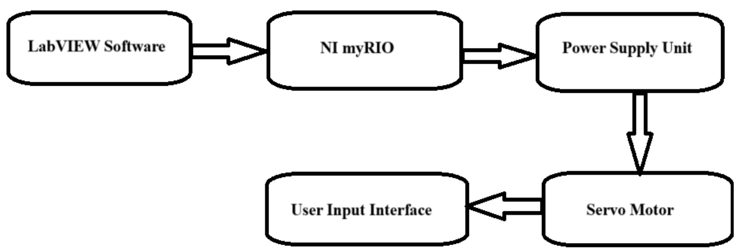

Figure.1. Block Diagram

The block diagram represents the process of controlling a servo motor using NI myRIO and LabVIEW software. The system is designed to achieve precise position control through a series of interconnected components. Each block in the diagram represents a critical component involved in the servo motor control process. The first block in the diagram is LabVIEW

Software, which serves as the primary control interface. LabVIEW is a graphical programming environment that allows users to create programs using block diagrams. It is used to design the control logic, generate Pulse Width Modulation (PWM) signals, and provide a user-friendly interface for motor control. The next component is NI myRIO, an embedded hardware device used to process commands from LabVIEW. NI myRIO contains a Field-Programmable Gate Array (FPGA) and a real-time processor, allowing it to execute control algorithms efficiently.

It acts as a bridge between the software and the hardware components. The Power Supply Unit is responsible for supplying the necessary voltage and current to the servo motor. Servo motors require a stable power source to function correctly, and the power supply ensures that the motor receives adequate energy for smooth operation. The Servo Motor is the actuator responsible for performing mechanical movements based on the control signals received from NI myRIO.

The motor rotates to a specific angle as dictated by the Pulse Width Modulation (PWM) signal generated in LabVIEW. The User Input Interface represents the method by which users interact with the system. Through the LabVIEW front panel, users can specify the desired position of the servo motor. This input is processed by NI myRIO, which adjusts the PWM signal accordingly. The diagram also illustrates the interconnections between these components, showing the data flow and power connections. The arrows indicate the sequence in which control signals and power are transmitted throughout the system.This block diagram effectively demonstrates how NI myRIO and LabVIEW work together to control a servo motor in an automated system.

3. Control using LabVIEW

3.1. Front Panel

The provided LabVIEW front panel appears to be designed for controlling and monitoring a system, possibly related to motor control or signal generation. The "Channel Name" field

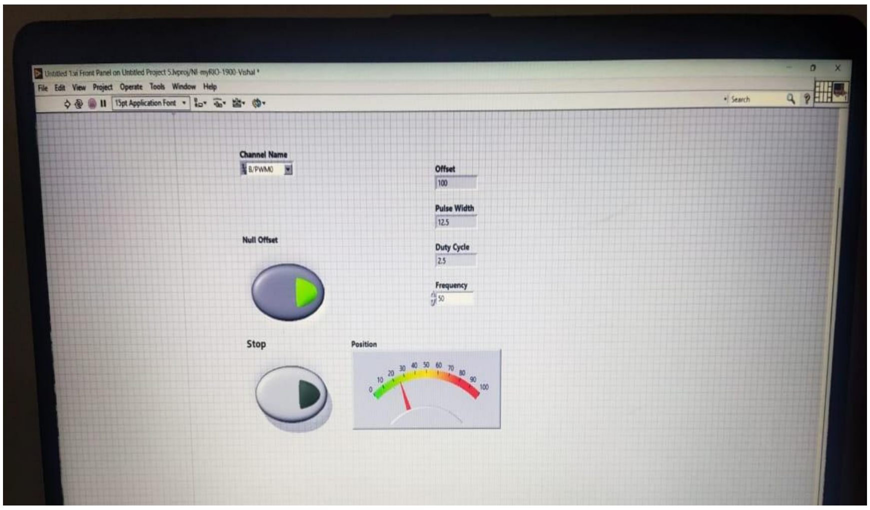

Figure.2. Front Panel

allows the user to input or select a channel, and the "Offset," "Pulse Width," "Duty Cycle," and "Frequency" fields enable the adjustment of signal parameters. The "Null Offset" button likely resets any applied offset, while the "Stop" button halts the operation. The "Position" indicator visually displays a value, potentially representing the position of a motor or the level of a signal. In operation, the user would first input the desired channel name and set the parameters for offset, pulse width, duty cycle, and frequency. Activating the "Null Offset" button, if needed, would reset the offset. Pressing the "play" button would start the system, and the "Position" indicator would display the current value. The "Stop" button would halt the process. The specific functionality would depend on the underlying LabVIEW block diagram and the connected hardware.

3.2. Block Diagram

The LabVIEW block diagram in this project represents the implementation of servo motor control using NI myRIO. The block diagram consists of multiple functional elements that work together to generate a Pulse Width Modulation (PWM) signal for controlling the servo motor. A channel name block is used to define the input source from the NI myRIO hardware. The offset control is implemented to adjust the base position of the servo motor. The duty cycle

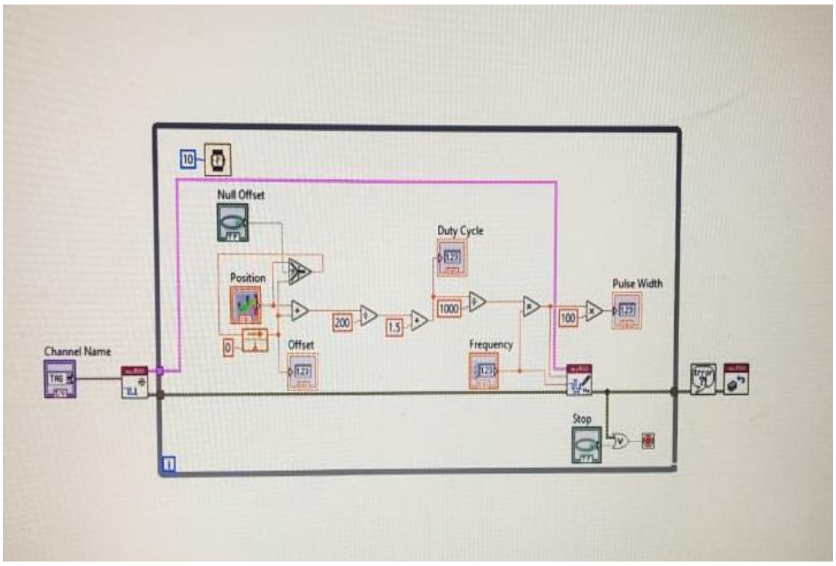

Figure.3. Block Diagram

control is included, determining the percentage of the PWM signal that remains high, affecting the servo position. The frequency control block is used to set the oscillation frequency of the PWM signal. Mathematical functions such as addition and multiplication are used for signal processing and scaling. The position feedback loop ensures real-time monitoring and adjustment of the servo position. A stop control is implemented to halt the motor operation when required. Logical comparison blocks are used to process signals and implement error correction. The LabVIEW while loop ensures continuous execution of the program, providing real-time control. The generated PWM signal is sent to the servo motor driver through the NI myRIO output channel. The block diagram visually represents the working of the control algorithm, making it easier to modify and analyse performance parameters. Each component in the block diagram plays a critical role in ensuring precise and stable servo motor control.

3.3. Hardware Setup

This setup involves an NI myRIO connected to a servo motor for control. The NI myRIO, a real-time embedded hardware device, is linked to a laptop via USB for programming and monitoring. A servo motor, which requires a PWM signal for position control, is wired toA servo motor, which requires a PWM signal for position control, is wired to the myRIO

Figure.4. Hardware Setup

using three connections: power, ground, and signal. The servo motor typically has three wires: the power wire (usually red) is connected to the 5V output of the myRIO, the ground wire (black or brown) is connected to the GND pin of the myRIO, and the signal wire (yellow or white) is connected to a PWM-capable digital output pin on the myRIO. The myRIO provides PWM outputs through its MXP connectors, with pins such as C0 to C3 on either MXP A or MXP B being suitable choices. To control the servo, a PWM signal with a frequency of 50Hz is generated using LabVIEW and the NI myRIO Toolkit. The pulse width of this signal, typically ranging from 1ms to 2ms, determines the position of the servo. By adjusting this pulse width programmatically, the servo can be rotated to different angles as required.

4. Results

The results of the NI myRIO-based servo motor control system demonstrate precise position control using LabVIEW. The PWM signals generated through LabVIEW effectively drive the servo motor to the desired position. Real-time feedback from position sensors allows accurate monitoring and correction of motor movement. The system ensures smooth operation with minimal latency and noise interference. The LabVIEW front panel provides an intuitive interface for adjusting motor parameters and monitoring real-time performance. The duty cycle and frequency adjustments impact the servo response, ensuring accurate control. The error correction algorithm successfully minimizes the deviation between the desired and actual motor position. The experimental setup confirms the reliability of NI myRIO for embedded motion control applications. The system's performance suggests its applicability in automation, robotics, and industrial control. Future improvements may include integrating multiple servos and enhancing wireless communication for remote control.

4.1. Photograph

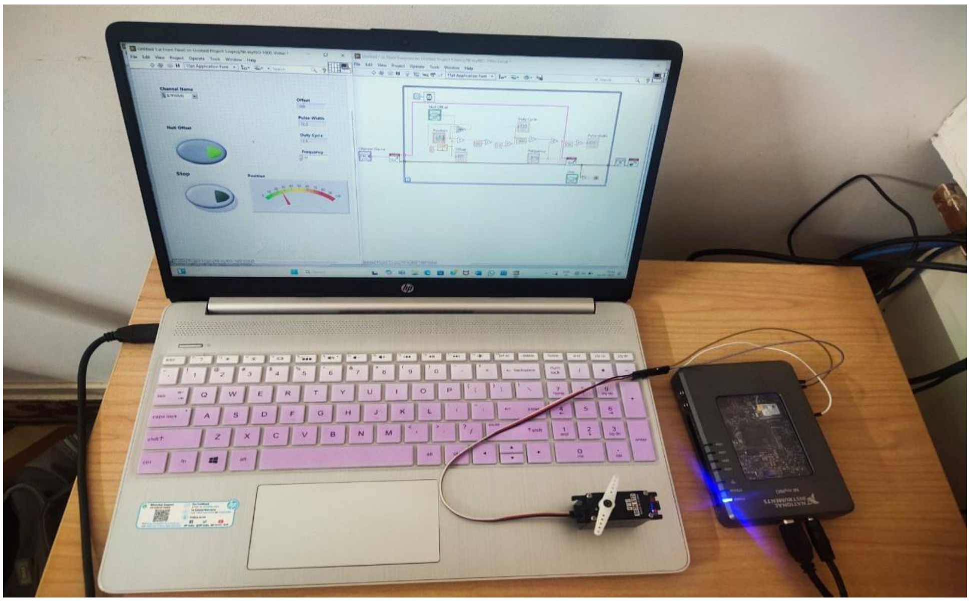

Figure.5. NI myRIO and LabVIEW Interface for Servo Motor Control

Table.1. Summary Table

Authors	Title	Year	Summary
[1] Bacac N., Slukic V., Puškaric M., Stih B., Kamenar E., Zelenika S.	Comparison of different DC motor positioning control algorithms	2014	This paper presents a comparative analysis of various DC motor positioning control algorithms. It evaluates different control strategies, including PID, state-space, and advanced model-based techniques, in terms of accuracy, response time, and robustness.
[2] N. Kumar and P. Krishna	Low-cost data acquisition and control using Arduino prototyping platform and LabVIEW	2013	This paper discusses the implementation of a low-cost data acquisition and control system using the Arduino prototyping platform integrated with LabVIEW.
[3] A. S. Bazanella, L. F. A. Pereira, and A. Parraga	A New Method for PID Tuning Including Plants Without Ultimate Frequency	2017	This paper presents a novel method for PID controller tuning that is applicable to plants without an ultimate frequency, addressing limitations of traditional tuning techniques such as Ziegler-Nichols.
[4] N. H. Binti Yaziz	Digital Speed and Position Control System Incorporating an Incremental Encoder	2014	This M.Sc. project presents a digital control system for speed and position regulation using an incremental encoder.
[5] J.-H. Yang and H.-K. Xu	Robust Controller Design for Non-Minimum Phase UAV System and System Analysis	2018	This paper presents a robust controller design for UAVs with non-minimum phase characteristics. It analyzes system stability and control performance under uncertain conditions, proposing an advanced control strategy to improve flight stability and maneuverability.
[6] J. Wang, Z. Luo, Y. Wang, B. Yang, and F. Assadian	Coordination Control of Differential Drive Assist Steering and Vehicle Stability Control for Four-Wheel-Independent-Drive	2018	This study proposes a coordinated control strategy for electric vehicles with four-wheel-independent drive, integrating differential drive assist steering and vehicle stability control to enhance handling performance and stability. Simulation results validate the

	EV		effectiveness of the method.
[7] T. Mohammad Ridha et al.	Model-Free iPID Control for Glycemia Regulation of Type-1 Diabetes	2018	This research introduces an intelligent proportional-integral-derivative (iPID) control approach for blood glucose regulation in Type-1 diabetes patients.
[8] W. M. A. Rosado, L. G. V. Valdes, A. B. Ortega, J. R. Ascencio, and C. D. G. Beltran	Passive Rehabilitation Exercises with an Ankle Rehabilitation Prototype Based in a Robot Parallel Structure	2017	This study presents a robotic ankle rehabilitation prototype based on a parallel structure for passive exercises. The system aids in rehabilitation therapy by providing controlled ankle movements, enhancing motor recovery in patients with lower limb impairments.
[9] Khichada Bhavin A, Kalpesh Chudasama, Vyas Darsan, Shiyal Jignesh	3-Phase Induction Motor Parameter Monitoring and Analysis Using LabVIEW	2021	This paper discusses the implementation of a LabVIEW-based system for real-time monitoring and analysis of 3-phase induction motor parameters. The system enhances fault detection and performance analysis, enabling efficient industrial motor management.
[10] V.Gholamrezaie, M. G. Dozein, H. Monsef, and B. Wu	An Optimal Frequency Control Method Through a Dynamic Load Frequency Control (LFC) Model Incorporating Wind farm	2018	This paper proposes an optimal frequency control strategy for power systems integrating wind farms. The dynamic LFC model improves system frequency stability by adjusting power output based on real-time grid conditions, ensuring a reliable and efficient energy supply.

5. Conclusion

The implementation of a DC servo motor control system using LabVIEW and NI myRIO has demonstrated an efficient and interactive approach to motion control applications. The integration of myRIO, a powerful real-time embedded device, with LabVIEW's graphical programming environment allows for seamless data acquisition, signal processing, and control execution. Through this setup, precise position and speed control of the servo motor is achieved using Pulse Width Modulation (PWM) signals generated by myRIO. The hardware setup, including the connection of the servo motor to the myRIO PWM output pins, enables real-time operation with minimal latency. The LabVIEW interface provides an intuitive user experience, allowing for easy parameter tuning and system monitoring. The implementation of closed-loop control enhances the accuracy and stability of the motor movement, making it suitable for various automation and robotics applications. Furthermore, the use of LabVIEW's built-in control functions simplifies the process of designing and testing different control strategies. The system's ability to provide real-time feedback ensures precise motion execution, reducing errors and improving overall performance. The modularity and flexibility of the LabVIEW environment enable the integration of additional sensors or actuators, expanding the system's applicability in advanced control tasks. This study highlights the effectiveness of using NI myRIO for embedded control applications, bridging the gap between software-based simulation and real-world hardware implementation. The graphical nature of LabVIEW programming eliminates the complexity of traditional coding while maintaining high performance and reliability. The successful control of a DC servo motor in this project proves the potential of this platform in educational, industrial, and research-based automation systems. Future improvements could involve the implementation of advanced control algorithms such as PID tuning, adaptive control, or machine learning-based optimization to enhance motor response. Additionally, integrating wireless communication for remote operation and monitoring could expand the system’s usability in modern automation solutions. Overall, the combination of LabVIEW and myRIO provides a robust and user-friendly framework for developing intelligent motor control systems.

REFERENCES

[1]. Bacac N., Slukic V., Puškarić M., Stih B., Kamenar E., Zelenika S, “Comparison of different DC motor positioning control algorithms,” 37th International Convention on Information and Communication Technology, Electronics and Microelectronics, pp. 1654–1659, 2014.

[2]. N. Kumar and P. Krishna, “Low-cost data acquition and control using Arduino prototyping platform and LabVIEW,” IJSR, vol. 2, pp.366- 369, February 2013. give these in same format.
[3]. A. S. Bazanella, L. F. A. Pereira, and A. Parraga, “A New Method for PID Tuning Including Plants Without Ultimate Frequency,” IEEE Trans. Control Syst. Technol., vol. 25, no. 2, pp. 637–644, Mar. 2017.
[4]. N. H. Binti Yaziz, Digital speed and position control system incorporating an incremental encoder, M.Sc. project, UTHM, July 2014.
[5]. J.-H. Yang and H.-K. Xu, “Robust Controller Design for Nonminimum Phase UAV System and System Analysis,” IEEE Access, vol. 6, pp. 70734–70769, 2018.
[6]. J. Wang, Z. Luo, Y. Wang, B. Yang, and F. Assadian, “Coordination Control of Differential Drive Assist Steering and Vehicle Stability Control for Four-Wheel-Independent-Drive EV,” IEEE Trans. Veh. Technol., vol. 67, no. 12, pp. 11453–11467, Dec. 2018.
[7]. T. Mohammad Ridha et al., “Model Free iPID Control for Glycemia Regulation of Type-1 Diabetes,” IEEE Trans. Biomed. Eng., vol. 65, no. 1, pp. 199–206, Jan. 2018.
[8]. Khichada Bhavin A, Kalpesh Chudasama, Vyas Darsan, Shiyal Jignesh,” 3-phase induction motor parameter monitoring and analysis using LabVIEW”, International journal of Electrical Engineering and Technology, Vol.7, issue 6, Nov-Dec, 2016, pp. 81-91.
[9]. W. M. A. Rosado, L. G. V. Valdes, A. B. Ortega, J. R. Ascencio, and C. D. G. Beltran, “Passive Rehabilitation Exercises with an Ankle Rehabilitation Prototype Based in a Robot Parallel Structure,” IEEE Lat. Am. Trans., vol. 15, no. 1, pp. 48–56, Jan. 2017.
[10]. V. Gholamrezaie, M. G. Dozein, H. Monsef, and B. Wu, “An Optimal Frequency Control Method Through a Dynamic Load Frequency Control (LFC) Model Incorporating Wind Farm,” IEEE Syst. J., vol. 12, no. 1, pp. 392–401, Mar. 2018.

