Design of a Speed Controller for a DC Motor in an Electric Car

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***Abstract*—This undergraduate thesis designs a speed controller for a DC motor in an electric car. The prototype combines an Arduino Nano, a quadrature encoder, a speed-setting potentiometer, and PID control. The report explains the control circuit, component integration, and tests of motor-speed regulation. The author describes the prototype as relatively stable and estimates that it met approximately 85% of the project's requirements. This percentage is a project assessment rather than a separately documented accuracy measurement. The thesis recommends further work on circuit layout, accuracy, and larger-scale application.**

***Index Terms*—PID control, Arduino Nano, quadrature encoder, electric motor, speed control, electric car**

I. Introduction

The thesis provides an overview of electric cars and single-phase electric motors, explaining their components and functions. The author discusses the challenges faced during the design and construction of the system, including component selection and design direction. The project aimed to design a speed control system for a DC motor on an electric car, using an Arduino Nano board, a quadrature encoder, and a PID controller. The author faced several challenges, such as selecting the appropriate components and integrating them into a functional system. Despite these difficulties, the project was completed on time and showed relatively stable operation [1]. Related earlier ICTU undergraduate theses provide context for this English summary [7], [8], [9]. Published articles on the methods and subject of this project provide context for this English summary [10].

II. Methods

The design was implemented using an Arduino Nano board, an LCD display, a quadrature encoder, a MOSFET, a diode, and a motor. The PID control algorithm was used to regulate the motor speed. The system was tested using a potentiometer to set the speed target and a quadrature encoder to measure the motor position. The author implemented a PID controller with specific parameters (kp = 0.5, ki = 0.05, kd = 0.01) to achieve the desired speed control. The system was tested using a potentiometer to set the speed target and a quadrature encoder to measure the motor position. The author also used a LiquidCrystal library to display the speed and RPM on an LCD screen [1].

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III. Results

the author estimated that the model met about 85% of the project requirements, but still had some limitations, particularly in its ability to handle larger scales. The author noted that the product still had many shortcomings and needed further refinement. The system was tested using a potentiometer to set the speed target and a quadrature encoder to measure the motor position. The author reported that the system was able to regulate the motor speed effectively, but it did not meet all the required specifications. The author suggested that future work should focus on optimizing the circuit details to achieve better space utilization and ensure the highest possible accuracy in controlling the electric motor speed. The source documents the DC-motor control circuit and PID-based speed regulation; the stated percentage is the author's project self-assessment [1].

IV. Discussion

The author's conclusion estimates that the prototype met about 85% of its intended requirements. This is a broad self-assessment of project completion, not a separately documented speed-control accuracy measurement. The report identifies limitations in scaling the prototype and in the arrangement of the control circuit. It therefore proposes refinements to the electronic design and control accuracy. The work also documents the integration challenges involved in combining the Arduino board, encoder feedback, and PID regulation [1].

V. Conclusion

The project successfully designed a speed control system for a DC motor on an electric car, but still requires further optimization and improvement. The author learned new knowledge and reinforced existing knowledge through this project. The author highlighted the challenges faced during the project, such as selecting the appropriate components and integrating them into a functional system. The author suggested that future work should focus on optimizing the circuit details to achieve better space utilization and ensure the highest possible accuracy in controlling the electric motor speed [1].

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