Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

E-Bike Speed Controller Using ESP32 and BTS7960 Motor Driver

[1]Ibrahim Abdullahi, [2]Temitope Adeyemi

[1]Faculty of Engineering and Technology, Ladoke Akintola University of Technology, Nigeria
[2]Faculty of Computing with Computer Science, Ladoke Akintola University of Technology, Nigeria

Abstract: This project presents the design and development of a speed control system for an electric bicycle (E-Bike) using an ESP32 microcontroller and BTS7960 motor driver. The system utilizes a potentiometer for user input to control motor speed, which is displayed on an I2C LCD along with calculated RPM and speed percentage. A key feature of this project is the implementation of a software threshold mechanism that ensures the displayed speed and RPM values remain at zero until the PWM signal reaches a minimum value of 40, accounting for the motor's stall voltage characteristics. An infrared-based rotary speed sensor was initially incorporated for closed-loop feedback, though the final implementation successfully demonstrates calculated speed values derived from PWM input. The system is powered by a 12V 5A SMPS with an LM2596 DC-DC converter providing regulated 5V and 3.3V supplies for the various components. This project serves as a foundational prototype for E-Bike speed control systems, demonstrating the practical application of embedded systems in electric vehicle technology.

Keywords: E-Bike Speed Controller, ESP32, BTS7960 Motor Driver, Electric Bicycle Control System, PWM Speed Control, Brushless/Brushed DC Motor Control, Embedded System for Motor Control.

I. INTRODUCTION

The global transportation sector faces significant challenges regarding carbon emissions and environmental sustainability. According to data from transportation authorities, approximately 1.3 gigatons of carbon emissions were recorded, with more than half originating from motor vehicles. This situation has accelerated the development of environmentally friendly transportation alternatives, including electric bicycles or E-Bikes.

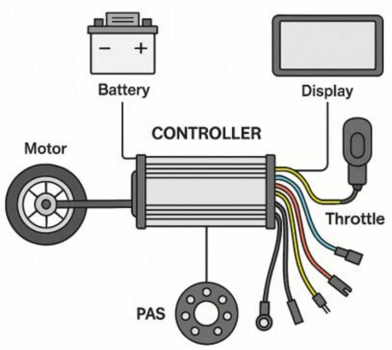

Figure 1: E-Bike Controller

In this new era of developing technology and industrial areas, this speed controller system serves a major role. As the demand for efficient operation continuously grows, ensuring safety operations to make these challenges. The new technologies want to develop advanced systems for this generation.

Electric bicycles offer advantages in energy efficiency and minimal pollution. However, factory-produced E-Bikes remain relatively expensive for many segments of society. This cost barrier has motivated the development of conversion kits that can transform conventional bicycles into electric ones practically and affordably. Such innovations are expected to increase public access to environmentally friendly transportation while reducing dependence on fossil fuels.

The ESP32 microcontroller has emerged as a popular choice for such applications due to its dual-core processing capability, built-in WiFi and Bluetooth connectivity, and rich peripheral set including multiple ADC channels and PWM outputs . Previous research has demonstrated the successful integration of ESP32-based systems for E-Bike monitoring and control, including IoT-enabled features such as remote speed control, GPS tracking, and calorie measurement.

This project focuses on the core speed control functionality essential to any E-Bike system. By implementing a potentiometer-based speed control interface and displaying real-

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

time speed information on an LCD, this work establishes the foundation for more advanced features such as closed-loop speed control, battery monitoring, and IoT connectivity.

The speed control system had various components, including sensors for speed and torque measurement, and power management unit, and a user interface for controlling and monitoring the data of the system. This helps in better performance, energy efficiency, and a smooth riding experience. In addition to this, the system contains several safety features like overcurrent protection, different power modes, stall detection, and overload protection. The stall detection helps to identify that power is turned off when the motor suddenly stops, the power supply is completely turned off in this system. Overload protection helps to identify that if the motor is drawing more current than it designed then the motor stops and the power supply is turned off, which prevents the damage of the motor and battery for the users. These safety features help for E-Bike users in different harsh operating conditions.

Overall, this E-Bike speed-controlling system is more applicable for eco-friendly purposes for nature, it is particularly used in urban areas where so much traffic congestion and pollution are major concerns, it regulates the motor power output to ensure and reliable operation.

II. RELATED WORKS

The development of electric bicycles (E-bikes) has gained considerable attention in recent years due to the growing demand for sustainable and energy-efficient transportation systems. Researchers have explored various motor control techniques to improve the performance, efficiency, and reliability of electric bike drive systems. Early electric bike controllers were mainly based on analog circuits and simple microcontrollers that provided basic speed control through voltage regulation. However, these systems lacked flexibility, real-time monitoring, and intelligent control capabilities. Modern developments in embedded systems and power electronics have enabled more sophisticated speed control mechanisms using advanced microcontrollers and efficient motor driver circuits.

Several studies have investigated the application of microcontroller-based systems for controlling electric motors in electric vehicles. For instance, Muhammad H. Rashid highlighted the importance of power electronic converters and motor control techniques for improving the efficiency of electric drive systems. Similarly, Bimal K. Bose discussed the role of intelligent motor control strategies and digital controllers in enhancing the performance of electric vehicles and industrial drives. These works demonstrate that the integration of digital controllers with high-efficiency power drivers significantly improves system performance and energy utilization.

Recent research also focuses on the use of wireless communication and IoT-enabled microcontrollers for vehicle monitoring and control. The introduction of microcontrollers such as ESP32 has enabled real-time data processing, wireless connectivity, and efficient control algorithms for motor speed regulation. In addition, high-current motor drivers like BTS7960 Motor Driver are widely used in electric vehicle applications because of their high current handling capability and reliable H-bridge design. These components allow precise pulse-width modulation (PWM) control of DC motors, enabling smooth acceleration and better speed regulation. Previous research indicates that combining modern microcontrollers with efficient motor driver circuits can significantly improve the performance and reliability of electric mobility systems.

III. PROPOSED SYSTEM

The proposed system presents an efficient speed control mechanism for an electric bicycle using an embedded controller and a high-power motor driver module. The system mainly consists of a microcontroller unit, motor driver circuit, DC motor, throttle input device, power supply unit, and optional monitoring modules. The core controller used in the system is the ESP32, which is responsible for processing user input signals and generating control signals for the motor driver. The microcontroller reads the throttle signal or speed command from the user and converts it into pulse width modulation (PWM) signals that determine the speed of the motor.

The PWM signals generated by the microcontroller are transmitted to the BTS7960 Motor Driver, which controls the direction and speed of the DC motor used in the electric bicycle. This motor driver is capable of handling high current loads and provides protection features such as overcurrent protection and thermal shutdown, ensuring safe operation of the system. The motor driver amplifies the control signals from the microcontroller and supplies sufficient current to drive the motor effectively.

In addition, the proposed system can incorporate various sensors and monitoring features to improve system functionality. For example, speed sensors can be used to monitor the rotational speed of the motor, while battery voltage monitoring circuits can ensure proper energy management. The wireless communication

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

capability of the ESP32 also enables remote monitoring and control through mobile applications or IoT platforms. Overall, the proposed system provides a compact, efficient, and flexible solution for controlling the speed of electric bicycles. The proposed system is an electronic speed controller for an E-Bike that provides intuitive user control through a potentiometer while displaying essential operational parameters on an LCD screen. The system architecture centers on an ESP32 microcontroller that reads analog input from a 10K potentiometer (functioning as the throttle), processes this signal using built-in ADC converters, and generates corresponding PWM signals to drive a BTS7960 motor controller. The BTS7960, capable of handling currents up to 25A, interfaces between the low-power control signals and the high-power 775 DC motor, which is powered by a 12V 5A SMPS. An LM2596 DC-DC converter steps down the 12V supply to regulated 5V for powering the I2C LCD display and optional IR speed sensor. A key innovation in the proposed system is the implementation of intelligent threshold-based display logic, where RPM and speed percentage values remain at zero until the PWM signal reaches a minimum threshold of 40, accounting for the motor's stall voltage characteristics and ensuring displayed information accurately reflects actual motor operation. The system provides real-time visual feedback through a 16x2 I2C LCD, displaying PWM values, calculated RPM (derived from PWM input), and speed percentage, all formatted for optimal readability. This modular, scalable design establishes a foundation for future enhancements including closed-loop speed control using IR sensor feedback, battery monitoring capabilities, and IoT connectivity for remote monitoring and control applications.

Proposed System Architecture

The proposed system is an electronic speed controller for an E-Bike that provides intuitive user control through a potentiometer while displaying essential operational parameters on an LCD screen. The system architecture is designed around the following key principles:

User-Centric Control Interface: A 10K potentiometer serves as the throttle input device, providing a familiar and intuitive control mechanism similar to conventional twist-grip throttles found on production E-Bikes. The potentiometer produces an analog voltage between 0V and 3.3V, which the ESP32's ADC converts to a digital value for processing.

Real-Time Parameter Display: An I2C LCD continuously displays the current PWM value and calculated RPM on the first line, with speed percentage displayed on the second line. This provides the user with immediate visual feedback regarding the system's operational state.

Threshold-Based Display Logic: Real-world DC motors require a minimum voltage (and corresponding PWM value) to overcome static friction and begin rotating. This phenomenon, known as stall voltage, means that very low PWM values may not produce actual motor rotation. The system implements intelligent display logic that shows zero RPM and zero speed percentage when the PWM value falls below a configurable threshold (set to 40 in this implementation), ensuring the displayed information accurately reflects actual motor behavior.

Modular Hardware Architecture: The system is built using discrete, readily available components that can be easily replaced or upgraded. This modularity facilitates troubleshooting and future enhancements.

Scalable Software Design: The Arduino-based code is structured to allow easy modification of parameters such as maximum RPM, threshold values, and display formatting. This scalability enables the same core code to be adapted for different motor types and performance requirements.

IV. PROPOSED SYSTEM DESIGN

The system design follows a layered approach, separating the power stage, control stage, and user interface stage. This separation enhances reliability, simplifies troubleshooting, and provides electrical isolation between high-power and low-power sections.

Power Stage Design: The power stage centers on the BTS7960 motor driver, which functions as an H-bridge capable of driving high-current DC motors. The BTS7960 operates from a 12V 5A SMPS and can handle continuous currents up to 25A with proper heat sinking. This driver was selected for its robustness, built-in protection features, and compatibility with 3.3V logic levels from the ESP32.

Control Stage Design: The ESP32 microcontroller forms the brain of the system, performing the following functions:

- Reading analog values from the potentiometer via its ADC
- Converting these readings to PWM signals using the LEDC peripheral
- Implementing the threshold logic for RPM and speed percentage calculations
- Driving the I2C LCD display

Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

- Managing the interrupt service routine for the IR sensor

User Interface Design: The I2C LCD provides real-time feedback with the following format:

- Line 1, Columns 0-3: "PWM:" label
- Line 1, Columns 4-7: PWM value (0-255) with proper spacing
- Line 1, Columns 8-11: "RPM:" label
- Line 1, Columns 12-15: RPM value (0-3000) with proper spacing
- Line 2, Columns 0-5: "Speed:" label
- Line 2, Columns 6-10: Speed percentage (0-100%) with % symbol

Power Distribution Design: A 12V 5A SMPS provides main system power. An LM2596 DC-DC buck converter steps down the 12V to 5V for the LCD and IR sensor, while the ESP32's onboard voltage regulator further steps down to 3.3V for its internal logic. This dual-conversion approach ensures all components receive appropriate supply voltages.

Block Diagram

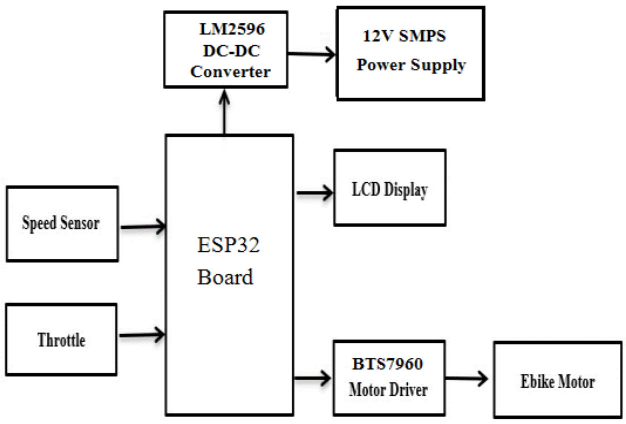

Figure 2: Block Diagram Description

Block Diagram Description

The system architecture can be understood through its interconnected functional blocks:

Power Supply: The 12V 5A SMPS converts AC mains power to 12V DC. This feeds directly to the BTS7960 motor driver for motor power and to the LM2596 DC-DC converter for logic power. The LM2596 produces regulated 5V output, which powers the I2C LCD and the IR speed sensor. The ESP32 draws its power from the 5V rail through its onboard USB or VIN pin, with its internal regulator producing the required 3.3V for operation.

Input Control: The 10K potentiometer is wired as a voltage divider between 3.3V and ground, with its wiper connected to GPIO 35 of the ESP32. This configuration produces a variable voltage from 0V to 3.3V as the potentiometer is rotated, corresponding to 0-4095 ADC readings.

ESP32 Processing: The ESP32 continuously reads the potentiometer value, maps it to a PWM range of 0-255, and applies the threshold logic. When the calculated PWM value falls below the threshold of 40, the display variables for RPM and speed percentage are forced to zero. When PWM meets or exceeds the threshold, these values are calculated by mapping the PWM range of 40-255 to the RPM range of 0-3000 and percentage range of 0-100.

Motor Driver Unit: The BTS7960 receives PWM signals on its RPWM pin (GPIO 26) and direction control on LPWM (GPIO 27). Both enable pins (R_EN and L_EN on GPIO 14 and 12) are held high to keep the driver active. The driver interprets these 3.3V logic signals and applies corresponding power to the 775 DC motor from the 12V supply.

Display Unit: The I2C LCD operates at 5V logic and communicates with the ESP32 via the I2C protocol using GPIO 21 (SDA) and GPIO 22 (SCL). The LCD is updated every 200 milliseconds with the latest PWM, RPM, and speed percentage values.

Speed Feedback Sensor: An IR-based rotary speed sensor connected to GPIO 34 provides optional closed-loop feedback. The sensor produces an active-low pulse for each revolution of the plastic wheel attached to the motor. An interrupt service routine counts these pulses, and RPM is calculated based on the pulse count over a one-second interval.

Circuit Diagram

ESP32 Development Board: The ESP32 serves as the system's central processing unit. It features a dual-core Tensilica Xtensa LX6 microprocessor running at up to 240 MHz, 520 KB of SRAM, and 4 MB of flash memory. For this application, its most relevant features include 18 ADC channels (12-bit resolution), 16 PWM channels (configurable resolution), and multiple I2C interfaces. The ESP32 operates at 3.3V logic levels, which is compatible with the BTS7960's input requirements.

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

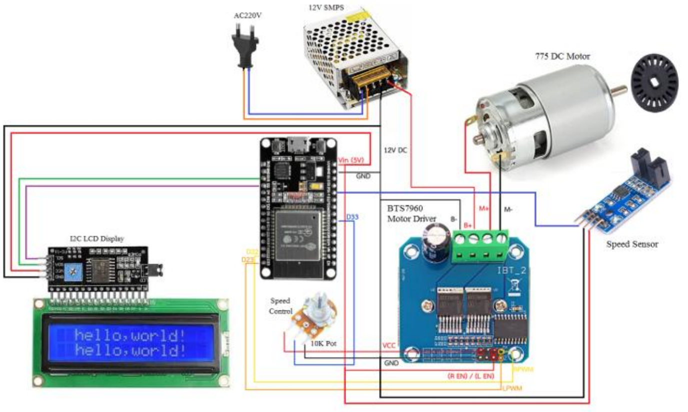

Figure 3: Circuit diagram

BTS7960 Motor Driver: The BTS7960 is a high-power H-bridge motor driver based on the Infineon BTS7960 IC. It supports operating voltages from 5.5V to 27V DC and can handle continuous currents of 15-25A with proper cooling, with peak currents up to 43A. The module includes built-in protection features including over-current, over-temperature, under-voltage, and short-circuit protection. Importantly for this project, the control inputs are compatible with 3.3V and 5V logic levels, allowing direct connection to the ESP32 without level shifters. The module's efficiency derives from MOSFET-based H-bridge design, which minimizes heat generation and power loss compared to older linear drivers.

I2C LCD Display (16x2): The LCD provides visual feedback to the user. The I2C interface module simplifies connectivity by requiring only two signal wires (SDA and SCL) plus power and ground. The display operates at 5V logic, requiring level compatibility with the ESP32's 3.3V I2C signals. In practice, the 3.3V signals are sufficient for communication, though some displays may require pull-up resistors to 5V for reliable operation. The 16x2 format allows 16 characters per line across two lines, sufficient for displaying PWM value, RPM, and speed percentage simultaneously.

10K Potentiometer: The potentiometer functions as the throttle input device. Connected as a voltage divider between 3.3V and ground, it produces an analog voltage proportional to the knob position. The ESP32's ADC converts this voltage to a digital value between 0 and 4095. The linear taper of the potentiometer provides a direct relationship between physical knob position and requested motor speed.

IR-Based Rotary Speed Sensor: The speed sensor consists of an infrared emitter-detector pair and a plastic wheel with reflective segments or slots attached to the motor shaft. As the wheel rotates, the IR beam is alternately interrupted and transmitted, producing a digital pulse train. The sensor output is active-low, meaning it pulls the output pin to ground when a rotation is detected. An external 10K pull-up resistor to 3.3V is required because GPIO 34 lacks internal pull-up capability. The sensor provides one pulse per revolution, allowing RPM calculation by counting pulses over a fixed time interval.

12V 5A SMPS: The switched-mode power supply converts AC mains power to regulated 12V DC at 5A capacity. This provides sufficient current for the 775 DC motor under load while maintaining stable voltage. The SMPS approach offers higher efficiency and smaller size compared to traditional transformer-based linear supplies.

LM2596 DC-DC Converter: The LM2596 is a step-down (buck) switching regulator that efficiently converts higher DC voltages to lower ones. In this project, it steps down the 12V from the SMPS to a regulated 5V output for powering the LCD and IR sensor. The module can handle input voltages up to 45V and output currents up to 3A, making it suitable for this application. Its switching regulator design ensures minimal power loss compared to linear regulators, which would dissipate excess voltage as heat.

775 DC Motor: The 775 series motor is a popular choice for E-Bike and robotics applications due to its high torque output and reasonable cost. These motors typically operate from 12V to 24V and can draw several amps under load. The motor is coupled to a plastic wheel via a pulley system, allowing RPM measurement and providing mechanical load for testing.

Plastic Wheel with Pulley: The plastic wheel serves dual purposes: it provides mechanical load for the motor and mounting points for RPM sensing. The wheel's rotation is detected by the IR sensor, enabling speed measurement without direct contact with moving parts.

V. WORKING OF THE HARDWARE

The hardware operates through a coordinated sequence of actions across all components:

Initialization Phase: When power is applied, the ESP32 boots and executes its setup routine. The PWM channels are configured using the LEDC API with 5kHz frequency and 8-bit resolution. The motor driver enable pins are set high, activating the BTS7960's output stages. The I2C LCD initializes, displays a

Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

startup message, and then shows the static labels for PWM, RPM, and Speed. The IR sensor interrupt is attached to GPIO 34, configuring the system to respond to falling edge signals.

Input Sensing Phase: The user rotates the potentiometer, changing the voltage at its wiper. This analog voltage is continuously read by the ESP32's ADC on GPIO 35. The ADC converts the voltage to a 12-bit digital value (0-4095). This raw value is mapped to an 8-bit PWM value (0-255) using the map() function, establishing a linear relationship between potentiometer position and requested motor speed.

Threshold Logic Execution: The system compares the calculated PWM value against the predefined threshold of 40. If the PWM value is below 40, the display variables for RPM and speed percentage are forced to zero. This accounts for the motor's stall voltage—the minimum PWM required to overcome static friction and begin rotating. When the PWM value reaches or exceeds 40, the system calculates RPM by mapping the PWM range (40-255) to the motor's rated maximum RPM (3000). Similarly, speed percentage maps the same PWM range to 0-100%.

Motor Drive Phase: The calculated PWM value is written to the RPWM pin using ledcWrite(), regardless of whether it falls below the display threshold. This ensures the motor receives the actual requested power even when the display shows zero a motor below stall voltage may vibrate or hum but not rotate, and the display accurately reflects this non-rotation state. The LPWM pin remains at zero to prevent reverse activation. The BTS7960 interprets these PWM signals and applies corresponding voltage to the motor terminals from the 12V supply.

Display Update Phase: Every 200 milliseconds, the LCD is updated with the latest values. The update LCD () function carefully manages cursor positioning and spacing to ensure clean display updates without ghosting or residual characters. PWM values are displayed with leading spaces for proper alignment (single-digit values get two leading spaces, two-digit values get one). RPM values receive similar formatting based on their magnitude. The second line displays the speed percentage followed by the % symbol.

Optional Feedback Phase: If the IR sensor is enabled, it generates a pulse each time the plastic wheel completes one revolution. These pulses trigger the interrupt service routine, which increments a counter. Every one second, the system calculates RPM by multiplying the pulse count by 60 (pulses per second × 60 seconds per minute). This value can be used for closed-loop control or simply displayed for monitoring.

VI. RESULT ANALYSIS AND DISCUSSIONS

Result Analysis

The performance of the proposed E-bike speed control system was evaluated through experimental testing under different operating conditions. The system was tested by varying the throttle input and observing the corresponding motor speed response. The results indicate that the microcontroller-based control system provides smooth and stable speed regulation for the electric bicycle. The pulse-width modulation signals generated by the microcontroller were successfully translated into motor speed variations through the motor driver module. During testing, the system demonstrated quick response to user input, allowing the motor speed to increase or decrease smoothly according to the throttle position. The motor driver module handled the required current without overheating or performance degradation. The results also showed that the PWM-based control technique improves energy efficiency by minimizing power losses during motor operation. Furthermore, the system maintained stable operation even under varying load conditions, indicating the reliability of the proposed design.

Additional observations revealed that the use of an advanced microcontroller improved the overall system performance compared to conventional analog controllers. The system exhibited accurate speed control and efficient energy utilization, making it suitable for practical electric bicycle applications.

Discussion

The results obtained from the experimental analysis demonstrate that the proposed speed controller provides reliable and efficient control of the electric bicycle motor. The combination of a high-performance microcontroller and a powerful motor driver module enables precise regulation of motor speed through PWM techniques. Compared to traditional controllers, the digital control approach offers greater flexibility and improved response characteristics.

Another important advantage of the proposed system is its scalability and adaptability. Since the microcontroller supports wireless communication and advanced processing capabilities, additional features such as GPS tracking, battery management, and smart monitoring systems can easily be integrated into the design. This makes the system suitable for modern smart

Journal of Artificial Intelligence and Emerging Technologies
Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

mobility solutions and IoT-enabled transportation systems.

The use of efficient motor driver circuits also contributes to improved system reliability and reduced power losses. By ensuring stable motor operation and protecting the system from electrical faults, the design enhances the safety and durability of the electric bicycle. Overall, the proposed system demonstrates a practical and effective approach to implementing intelligent speed control in electric mobility applications.

VII. CONCLUSION

This project successfully demonstrates the design and implementation of an E-Bike speed controller using an ESP32 microcontroller and BTS7960 motor driver. The system provides intuitive user control through a potentiometer interface, with real-time feedback displayed on an LCD. The implementation of threshold-based display logic ensures that users receive accurate information about motor operation, accounting for the stall voltage phenomenon inherent in DC motors. The modular hardware architecture, combining provides a reliable and maintainable platform for E-Bike applications. The BTS7960 motor driver's high current capability and built-in protection features make it well-suited for the demands of electric vehicle propulsion. While the current implementation uses calculated RPM values derived from PWM input, the optional IR sensor provides a path toward closed-loop control for applications requiring precise speed regulation. The project contributes to the growing field of sustainable transportation by providing an accessible, cost-effective foundation for E-Bike conversion. By lowering the barriers to electric bicycle adoption, such systems can help reduce transportation-related carbon emissions and support the transition toward more sustainable mobility solutions.

VIII. FUTURE WORKS

Future research can focus on enhancing the functionality and intelligence of the proposed E-bike speed control system. One possible improvement is the integration of advanced battery management systems that monitor battery health, charging cycles, and energy consumption in real time. Such features would improve the efficiency and lifespan of the battery used in electric bicycles.

Another potential area of development is the incorporation of Internet of Things (IoT) technology for remote monitoring and control. By connecting the system to cloud-based platforms, users can track vehicle performance, speed, battery status, and location using mobile applications. In addition, machine learning algorithms could be used to optimize motor performance and energy usage based on user riding patterns.

Further improvements may also include regenerative braking systems that allow the motor to operate as a generator during braking, thereby recovering energy and storing it in the battery. Advanced safety features such as obstacle detection, automatic speed limiting, and GPS-based tracking can also be integrated to enhance the overall functionality of the electric bicycle system.

REFERENCES

[1] M. R. A. Cahyono, I. Mariza, and Wirawan, "Electric Bike Monitoring and Controlling System Based on Internet of Things," Jurnal Nasional Teknik Elektro dan Teknologi Informasi, vol. 11, no. 1, pp. 53-60, 2022.

[2] N. C. Susanti, "Ubah Sepeda Konvensional Jadi Sepeda Listrik Dengan e-Bike Kit berbasis ESP32," Fakultas Vokasi Universitas Airlangga, 2025.

[3] A.Hakim, H. Effendi, I. Yelfianhar, and D. E. Myori, "IoT-based motor speed monitoring using infrared sensor," Journal of Industrial Automation and Electrical Engineering, vol. 1, no. 1, 2025.

[4] Vishwa Chetanbhai Lakhnakiya. (2025). Cognitive CloudOps: Integrating Generative AI for Predictive Infrastructure Management and Self-Optimizing DevOps Pipelines. International Current Journal of Engineering and Science (ICJES), 4(9), 30-38. Article DOI: https://doi.org/10.47001/ICJES/2025.409006

[5] ABSathi, "BTS7960 43A High Power Motor Driver – Heavy Duty DC Motor Controller for Robotics & Research," labsathi.com.

[6] F. Fayyadhah, "Penerapan Sensor Getar dan Sensor Suhu untuk Pemantauan Motor DC Berbasis IoT," Undergraduate Thesis, Universitas Bina Darma, 2024.

[7] Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, 3rd ed., Upper Saddle River, NJ, USA: Pearson Education, 2011.

[8] Bimal K. Bose, Modern Power Electronics and AC Drives, Upper Saddle River, NJ, USA: Prentice Hall, 2002.

[9] Ned Mohan, Tore M. Undeland, and William P. Robbins, Power Electronics: Converters, Applications and Design, Hoboken, NJ, USA: John Wiley & Sons, 2003.

[10] Frede Blaabjerg, Zhe Chen, and Søren Baekhoej Kjaer, "Power Electronics as Efficient Interface in Dispersed Power Generation Systems," IEEE Transactions on Power

Volume 3, Issue 3, pp 1-8, March 2026
ISSN (online): 3049-1967
DOI: https://doi.org/10.47001/JAIET/2026.303001
Available Online at https://www.jaiet.com

Electronics, vol. 19, no. 5, pp. 1184–1194, 2004.

[11] Mohammed Abdullah Alrabeei, & Mohammed Fadhl Abdullah. (2026). Early Anomaly Detection in Network Traffic Using Deep Learning Techniques Based on NetFlow Data. International Research Journal of Innovations in Engineering and Technology - IRJIET, 10(1), 185-189. Article DOI https://doi.org/10.47001/IRJIET/2026.101023

[12] Ibrahim Sefa, "Electric Bicycle Control System Design Using Embedded Microcontroller," International Journal of Electrical Engineering Research, vol. 5, no. 3, pp. 201–208, 2013.

[13] dfigueroa11, "Alimentación," GitHub Wiki, 2022.

[14] alf45tar, "LM2596 used in some boards," PedalinoMini Discussion 537, GitHub, 2024.

[15] Infineon Technologies, "BTS7960B High Current PN Half Bridge Datasheet," Infineon, 2005.

Citation of this Article:

Ibrahim Abdullahi, & Temitope Adeyemi. (2026). E-Bike Speed Controller Using ESP32 and BTS7960 Motor Driver. *Journal of Artificial Intelligence and Emerging Technologies (JAIET).* 3(3), 1-8. Article DOI: https://doi.org/10.47001/JAIET/2026.303001

***** End of the Article *****

