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# E-Bike Speed Control Using Microcontroller

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**ABSTRACT**

Man has used bicycles as a practical means of transportation for centuries. Future technological developments necessitated the development of more advanced, comfortable options that required less effort and time. In this case, upgrading a standard bicycle to an electric one is also the solution. You can use this electric bike motor speed controller on both bikes and bicycles. The primary goal of the paper is to measure the variance in the input that the throttle manually derives in order to control the speed of the electric motor. The main benefit of riding an electric bike is that it emits no carbon dioxide, leaving no carbon footprint. This helps India achieve its goal of being carbon free by 2070 and the global goal of being carbon free as well as significantly lowering overall pollution levels. This is not only cost-effective but also environmentally friendly, making it an excellent option for crowded cities, expansive college campuses, parks, and other areas. This can be used in addition to regular cycling, with the option to switch to battery mode to power the vehicle using batteries and make it an electric vehicle if the rider runs out of gas. Regenerative braking and pedalling generation are a couple of methods that can be employed to recharge the batteries in parallel.

**Key word:** Speed, E-Bike, Carbon Emission, Electric Motor, Battery status

## Introduction.

Electric motors are the driving force behind electric vehicles (EVs), and their significance is multifaceted. These motors are not just a means of propulsion; they are at the core of what makes EVs cleaner and more efficient than their internal combustion engine counterparts. First and foremost, electric motors deliver a level of efficiency that is unparalleled, converting a substantial portion of electrical energy into forward motion while minimizing energy wastage. This efficiency translates into a reduced environmental footprint, with EVs producing zero tailpipe emissions, leading to cleaner air and a healthier environment. Moreover, the regenerative braking capabilities of these motors enable the conversion of kinetic energy into electricity during deceleration, thereby extending the vehicle's range and maximizing energy use. In addition to their environmental benefits, electric motors offer numerous practical advantages. They provide instantaneous torque, resulting in rapid a0cceleration and responsive driving experiences. The simplicity of their design, with fewer moving parts than internal combustion engines, leads to lower maintenance costs and increased longevity. Furthermore, their quiet operation enhances urban tranquility and their flexibility allows for innovative vehicle designs. Overall, electric motors are pivotal in reducing our dependence on fossil fuels, cutting operating costs, and advancing the cause of global sustainability by ushering in a new era of cleaner and more efficient transportation. To drive the motors efficiently and in more control manner, motor speed controller is important.

## Survey and Specification

1. Designing an e-bike controlled by a microcontroller involves selecting a suitable microcontroller, electric motor, and rechargeable lithium-ion battery. Integration of a motor controller, pedal assist system (PAS), and throttle control is essential for efficient operation0
2. Additionally, incorporating regenerative braking, a display unit, and safety features like overcurrent protection is crucial. The overall frame design should accommodate chosen components, considering comfort and stability.
3. Ensure compliance with local regulations, and thoroughly test the prototype for safety and performance before deployment.

## Literature Review

- A literature review on e-bikes controlled by microcontrollers explores the existing research and developments in this field. Researchers have investigated various aspects, including the choice of microcontrollers, motor technologies, battery management, and user interface design

- The choice of microcontroller plays a crucial role in e-bike control systems. Studies have explored the application of popular platforms like Arduino and Raspberry Pi, considering their programmability, compatibility with sensors, and overall system integration capabilities.
- Motor control strategies have been a focal point in the literature. Researchers have examined different methods of controlling electric motors, such as pulse-width modulation (PWM) techniques, sensor-based control, and algorithms for optimizing energy efficiency during various riding conditions**.**

## Discussion and Methodology

The proposed methodology for addressing the identified problem of enhancing e-bike speed control through the integration of a microcontroller involves a multifaceted approach aimed at achieving precision, safety, and user-friendliness. Here are the key components of this methodology:

1. Microcontroller Integration: The core of the solution lies in the integration of a microcontroller into the e-bike speed control system. The microcontroller will be responsible for real-time monitoring of motor performance, allowing for immediate adjustments to speed and power output as per rider inputs.
2. Speed Regulation Algorithm: The methodology will include the development of a sophisticated speed regulation algorithm within the microcontroller. This algorithm will consider various factors such as rider input, terrain, and battery charge to ensure that the e-bike maintains a consistent and safe speed.
3. Safety Features: The methodology will incorporate safety features within the microcontroller system, including Shortcircuit protection and thermal management. These features will ensure rider safety and prevent damage to the motor and battery.
4. Energy Efficiency Optimization: The microcontroller will play a crucial role in optimizing energy efficiency by managing power consumption and monitoring battery status. This will result in extended battery life and reduced recharging frequency.
5. Testing and Refinement: The proposed methodology will involve extensive testing to fine-tune the microcontroller's performance and ensure its seamless integration with different e-bike models and motor systems.
6. Environmental Considerations: The solution will be designed with a focus on environmental sustainability, aiming to reduce carbon emissions by maximizing energy efficiency and promoting responsible e-bike usage.

## PROBLEM STATEMENT

For electric vehicles, a motor speed controller is essential to optimize energy usage, improve performance, enhance safety, and prolong the life of critical components like the battery. Its role in managing power delivery and fine-tuning speed control is integral to the overall efficiency and functionality of electric vehicles.

## METHODOLOGY

In this system, user can control the speed of motor using twisting throttle. Throttle module will send signal to arduino board. Arduino board will measure the amount of twist and generate PWM signal proportionally. This generated PWM signal will be given to the motor driver section. Motor driver section contains MOSFET which will control the current flowing through motor. With this changing current through motor, motor speed will vary.

An IR sensor is used to measure the rotation of wheel attached to motor. IR sensors provides output pulses to arduino. Arduino counts the pulses and calculate the RPM of motor. This value will be shown on display. Complete system will be powered through DC power source of 12V.

## OBJECTIVES OF PAPER

To drive the motors efficiently and in more control manner, motor speed controller is important. In this paper, an cost effective motor speed controller will be designed for 12V, 60 watt DC motor. Major design objectives of paper are as follow:

- Change the speed of motor as per the throttle position.
- Measure the RPM of wheel and calculate the speed.
- Show the actual speed on LCD display

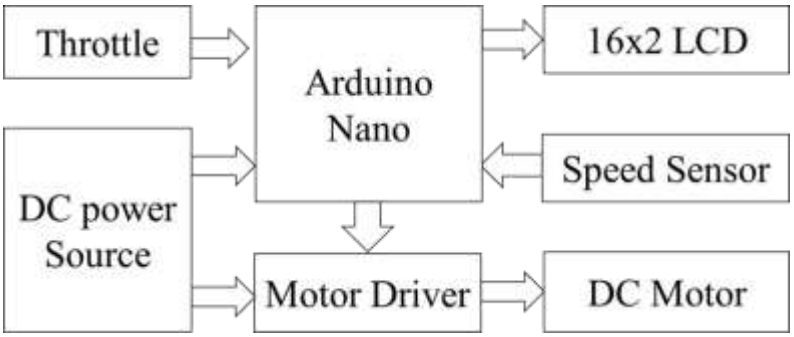


**FIG.** BLOCK DIAGRAM OF E-BIKE SPEED CONTROL USING MICRO- CONTROLLER:

## ADVANTAGES

- Variable Speed Control: Riders can adjust speed as needed.
- Extended Range: Efficient power management increases distance per charge.
- Enhanced Safety: Speed limits improve rider safety.
- Battery Efficiency: Prevents excessive power draw, preserving the battery.
- Customizable Experience: Tailor the ride to personal preferences.

## Conclusion

Remember, this paper can be as simple or complex as you desire. Start with a realistic scope and gradually expand your skills and knowledge as you progress. Building an e-bike with a microcontroller can be a challenging but rewarding journey, offering the opportunity to learn new skills, create something unique, and enjoy a sustainable and eco-friendly mode of transportation.

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