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ELECTRIC BICYCLE BY USING BLDC MOTOR

A. Rakshitha[1], Deepthi.M[2], Nischitha Mahanthina Matt[3], Vanajakshi.M[4]

Student, Department of Electrical and Electronics Engineering, Rao Bahadur Y Mahabaleswarappa Engineering College, Ballari, India[1-3]

Assistant Professor, Department of Electrical and Electonics Engineering, Rao Bahadur Y Mahabaleswarappa Engineering College, Ballari, India[4]

Abstract: This study presents the design and implementation of an electric bicycle powered by a Brushless DC (BLDC) motor operating at 36 volts. The aim is to create a sustainable and efficient mode of transportation by integrating modern electric propulsion technology into conventional bicycles. The project focuses on optimizing the performance, efficiency, and usability of the electric bicycle while ensuring safety and reliability. Key components include the BLDC motor, battery pack, motor controller, and user interface. The system is designed to provide smooth acceleration, adequate range, and easy control for riders of varying skill levels. The project also considers factors such as cost-effectiveness, environmental impact, and regulatory compliance. Experimental validation and field testing are conducted to assess the performance and practicality of the electric bicycle in real-world conditions. The results demonstrate the feasibility and potential benefits of electric bicycles as a sustainable transportation solution.

I. INTRODUCTION

In modern societies, the increasing demand for mobility often results in more vehicles on the road, raising environmental concerns. One promising solution is electric bicycles (e-bikes) as urban transportation. E-bikes offer a cleaner alternative to traditional vehicles, reducing dependency on oil and gas. Unlike conventional automobiles, e-bikes do not require fuel or coolant, makingthem more eco-friendly.

Electric bicycles provide safe and comfortable transportation without fuel costs and do not emit pollutants, benefiting the environment. Consequently, environmental considerations increasingly influence technical decisions for all types of vehicles. The key component of an e-bike is its propulsion system, consisting of an electric motor, alternator, and battery. Riders generate electricity by pedaling, which is stored in the battery and powers the bicycle.

Electric bicycles serve various purposes, offering practical and sustainable transportation. Initially, propulsion relied on DC micro engines turning a sprocket to transmit rotational motion between shafts.

Given the need for alternatives to internal combustion engines, electric vehicles, including e-bikes, are appealing. E-bikes run on clean electric power and can recharge their batteries, making them viable for reducing oil dependence and promoting cleaner development. This shift to electric propulsion contributes to a greener, more sustainable planet.

II. LITERATURE SURVEY

The function of bicycles in urban transportation networks is gaining popularity. The combination of increasingly bike-friendly communities and quick technological advancements has resulted in a significant growth in the purchase and use of e-bikes (MacArthur, Dill, & Person, 2014).

Commercially available e-bikes first appeared in Japan in the early 1980s (Rose, 2012), but market appeal was restricted until the early 2000s due to technology and economic concerns (Jamerson & Benjamin, 2013). E-bikes can now ride longer distances, are quicker, and are more inexpensive than ever before because to advances in battery and motor technology, component modularity, and economies of scale.

Researchers and practitioners in a range of sectors, including transportation planning, engineering, traffic safety, public policy, and the bicycle market, should be aware of the tremendous increase in e-bike use. Since the mid-2000s, a growing corpus of research has looked at a wide range of e-bike-related issues (E. Fishman and C. Cherry). [1]
In 2006, e-bikes accounted for just 1% of new bike sales (3,200 units), but by 2019 (Velosuisse 2020), this had risen to

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36% (133,000), with 7% of Swiss homes owning at least one e-bike (OFS, and ARE 2017). Most other European countries have also had record- breaking growth. The majority of adult bikes sold in the Netherlands - the country with the highest modal share of cycling are now e-bikes (Reid 2019). In 2017, the European Cyclists' Federation predicted that 50 million e-bikes would be sold in the EU between 2018 and 2030, a prediction that has since been increased to at least 150 million e-bike by 2030

III. METHODOLOGY

The working of an electric bicycle involves the integration of several key components to provide electric assistance to the rider.

1. Motor: An electric bicycle is equipped with an electric motor, typically located in the hub of the wheel (hub motor) or near the pedal crank (mid-drive motor). The motor is powered by an attached battery and is responsible for providing additional propulsion to the bicycle.

2.Battery: The battery is a crucial component that stores electrical energy to power the electric motor. Most electric bicycles use lithium-ion batteries due to their high energy density, lightweight design, and long cycle life. The battery is rechargeable and can be easily removed or charged while still attached to the bicycle.

3.Controller: The controller is the brain of the electric bicycle system, managing the flow of electrical energy between the battery and the motor. It regulates the speed, power output, and overall performance of the electric motor, ensuring a smooth and efficient riding experience.

5.Throttle control: Some electric bicycles come with a throttle control, similar to a motorcycle or scooter. The rider can use the throttle to control the speed of the electric motor independently of pedaling. Throttle control is typically found in electric bicycles designed for more relaxed or variable-speed rvariable-speed riding.

6.User interface: An electric bicycle often includes a user interface or display unit mounted on the handlebars. The display provides information such as speed, remaining battery charge, distance traveled, and selected assistance level. Some advanced electric bicycles may also integrate with mobile applications for additional features and connectivity.

7.Regenerative braking: Certain electric bicycles may feature regenerative braking systems. When the rider applies the brakes, the electric motor operates in reverse, converting kinetic energy back into electrical energy and recharging the battery.

8.Mechanical integration: The electric components, including the motor, battery, and controller, are seamlessly integrated into the bicycle frame. Mounting brackets and connectors ensure a secure and stable installation while maintaining the overall aesthetics and functionality of the bicycle.

9.Charging: The battery can be charged using a standard electrical outlet. Charging times vary depending on the battery capacity and charger specifications.

10.Safety features: Electric bicycles often include safety features such as automatic power cutoff in the event of a malfunction, overcharge protection, and short circuit prevention.

IV. COMPONENTS USED

1. Dynamo - Converts mechanical energy into electrical energy. The dynamo is made up of stationary magnets (stator) which create a powerful magnetic field, and a rotating magnet (rotor) which distortsand cuts through the magnetic lines of flux of the stator. When the rotor cuts through lines of magnetic flux it makes electricity.

2. Battery (Lithium-ion) - A lithium-ion battery or Li-ion battery is a type of rechargeable battery in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge, and back when charging.

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3. Hub-motor - The wheel hub motor (also called wheel motor, wheel hub diver or in-wheel motor) is an electric motor that is incorporated into the hub of a wheel usd driver it directly.

4. Throttle-Throttle on an electric bike is similar to a motorcycle of electric scooter, it is engaged the motor provides power and propel the bike forward.

5. Controller-It is used to drive and control the motor. It is analogous to the human brain, processing information and feeding it back to end user.

6. Brushless DC motor-Brushless DC-motor have been in commercial use. This motor develops a maximum torque when stationary.

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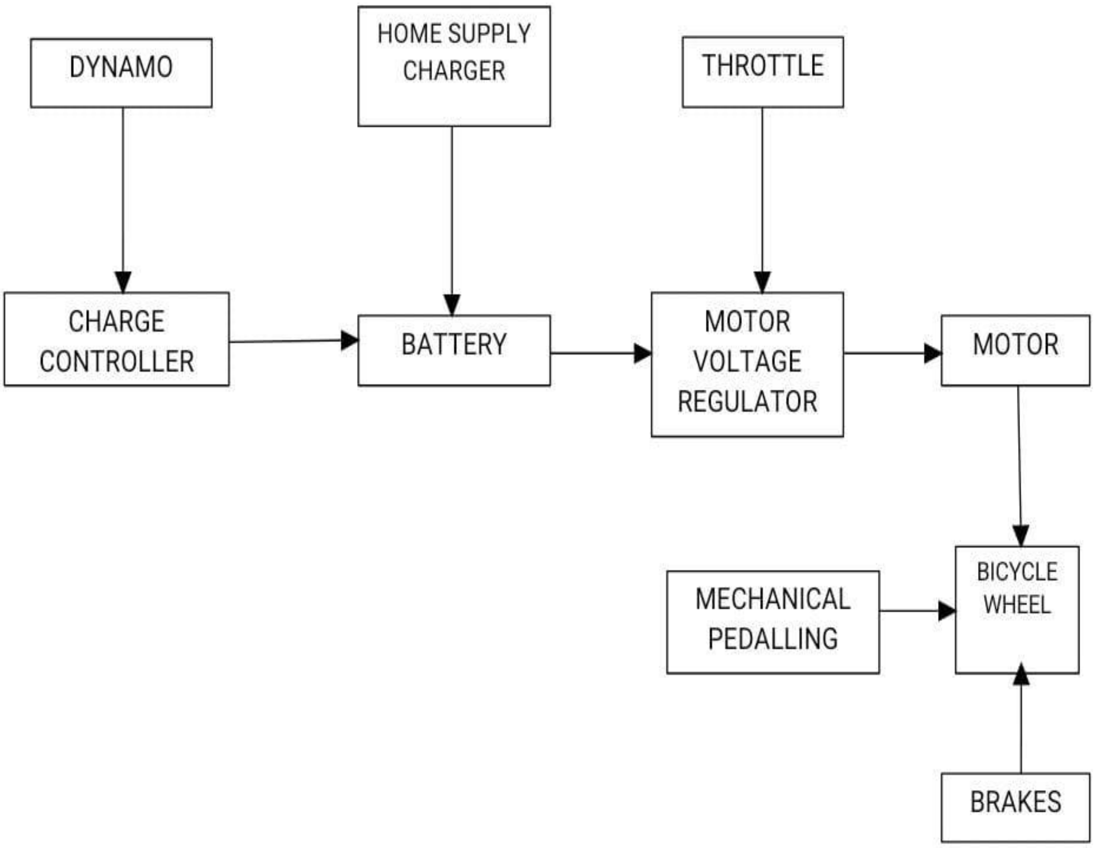
Block Diagram :



V. RESULTS

The electric bicycle, or e-bike, has rapidly gained popularity since its inception, offering a convenient, eco-friendly, and efficient mode of transportation that has transformed urban commuting and recreational cycling. By combining electric motors with traditional bicycle designs, e-bikes provide pedal assistance, enabling riders to cover longer distances with less effort.

This accessibility has attracted a diverse range of users, from commuters seeking a faster and sweat-free journey to fitness enthusiasts looking to extend their cycling range. Additionally, e-bikes have been embraced by individuals with mobility limitations, allowing them to enjoy the freedom of cycling with minimal physical strain.

The adoption of e-bikes has also contributed to reducing traffic congestion and lowering carbon emissions in urban areas. However, challenges such as infrastructure development, regulations, and safety concerns remain areas of focus for further advancement and integration of e-bikes into transportation systems.

Overall, the electric bicycle represents a transformative innovation in personal mobility, offering a sustainable solution for urban transportation while promoting physical activity and environmental stewardship. Its continued evolution and integration into mainstream transportation systems are expected to positively shape the future of urban mobility

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VI. CONCLUSION

Electric bikes are becoming a vital part of our future, making transportation affordable, quick, easy, and convenient. One key reason for the increase in electric bike usage is the advancement in battery and motor technology, making them highly efficient, durable, and lightweight. Additionally, there is no need to charge the battery externally, as an inbuilt dynamo charges the battery while you ride. However, if you prefer external charging, you can use an adapter or eliminator, and even add a solar panel if you can afford the expense. Another advantage of electric bikes is that you don't need to worry about paying for any special license or registration. As one of the cheapest ways to travel, electric bikes also allow riders to tailor the difficulty level of their rides to meet their unique health and fitness needs.

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