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Electric Tricycle for Physically Challenged Person

Pooja Kumbhar[1], Pratiksha Khabale[2], Pratik Bubane[3], Ankush Koli[4], S.S. Parve[5]

Department of Electrical Engineering, Annasaheb Dange College of Engineering, Ashta, India [1,2,3,4,]

Guide, Department of Electrical Engineering, Annasaheb Dange College of Engineering & Technology, Ashta, India [5]

ABSTRACT: The main aim of the electric tricycle is to bring increased mobility to disable persons. Now a day, hand powered tricycle are used by many of the physically challenged persons and it is also useful for the old people. The Electrical Tricycle Project purpose is to give disabled people more mobility. Many of the disabled in this community currently utilize hand-powered tricycle, but some of them do not have the physical strength or coordination to drive themselves on the tricycle with their arms and hands. The goal of this project is to add an electric power train and control system to the current hand powered tricycle in order to give tricycle riders with increased mobility, freedom of movement, and contribution to the community.

KEYWORDS: BLDC Motor, Motor Controller, Battery, Charger, Throttle.

I. INTRODUCTION

One of the most significant factors in enhancing human mobility is transportation. In the transportation industry, automobiles are extremely important. While a disabled person finds using these cars extremely uncomfortable, normal people use them with great ease. These days, there are many different hand-driven tricycles available for them, but the majority of them are made primarily for the fundamental functional purpose of moving on the road without taking many significant factors, aesthetics, or applicability into consideration. Several techniques have been studied and applied to improve the mobility of those with disabilities.

The Significance of the electric tricycle project is to improve the mobility of the disabled in India by optimizing the use of renewable energy. Many disabled people now use manual tricycles. Electric tricycles are more stable than traditional bicycles, making them safer for seniors. They are less likely to tip over or lose balance, reducing the risk of accidents. Electric tricycles come equipped with a variety of safety features that make them an excellent choice for seniors. E-trikes are typically powered by electric motors, reducing reliance on fossil fuels and lowering emissions, contributing to a cleaner environment.

II. OBJECTIVES

I. To develop a tricycle that uses electrical energy which is environmentally friendly and cheap.

III. LITERATURE REVIEW

Research was done online as well as in magazine articles in search of presently available solutions to our problem. There were plenty of items on the market, not all of them fully addressed the demands of our particular issue. Finding these answers has the benefit of allowing us to observe what functions, what has been tried, and what is commercially available. Then, we can think of ways to create a comparable product that better suits our own requirements. [1]

E-Cycles, Empowering People Project by (IEEE) - Christen Roger Hamid El Omari Laboratories des Energies Renouvelables, FST Settat, University Hassan Ist Settat, Morocco discussed from that, we study about how to prepare an electric tricycle model. [2]

Arvind Prasad et al “Powered Wheelchairs” discussed studied report on the efficiency and durability of batteries. [3]

IV. PROPOSED DESIGN

This is the block diagram for electric tricycle for physically challenged person as shown in figure. It consists many components such as battery charger, battery, power electronic converter, motor, controller, transmission, wheels, pedal. Yellow line represents the mechanical link. Green line represents unidirectional electrical link. blue line represents user throttle demand. Orange represents feedback. violet line represents control signals.

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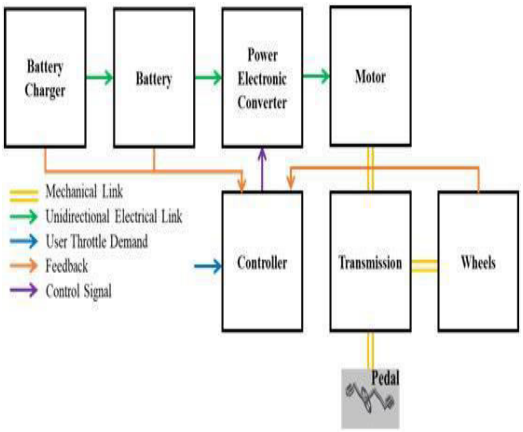

FIGURE 1 Block diagram of the proposed system

The proposed system electrical tricycle project illustrates the interconnected components and functionalities crucial for its operation. At its core is the electric motor, serving as the primary propulsion source, connected to a power control unit responsible for managing energy distribution. The power supply, typically a rechargeable battery, feeds energy to the motor through the control unit. To enhance efficiency and regulate speed, a motor controller is incorporated, adjusting the power supplied to the motor based on user input. The tricycle is equipped with sensors for monitoring parameters such as speed, battery status, and temperature, providing feedback to the control unit. Additionally, the project integrates a charging system, allowing the battery to be replenished via an external power source. For user interaction, a control interface is implemented, offering features like throttle control, braking, and potentially smart functionalities. The overall block diagram outlines a comprehensive system where each component plays a pivotal role in ensuring the reliable and efficient operation of the electrical tricycle.

The design of the electrical tricycle project is a well-thought-out integration of various elements to create a sustainable, efficient, and user-friendly mode of transportation. The electric motor, positioned strategically, propels the tricycle and is connected to a sophisticated control unit managing power distribution. A rechargeable battery system, designed for optimal energy density, powers the motor and is equipped with a charging interface for convenient replenishment. The inclusion of a motor controller ensures precise speed control and responsiveness to user inputs. Sensors embedded throughout the tricycle monitor key parameters, offering real-time feedback to the control unit and enhancing safety. The control interface, featuring a user-friendly dashboard and controls, allows for intuitive operation, including acceleration, braking, and potentially incorporating smart features. The overall design prioritizes efficiency, safety, and environmental sustainability, making the electrical tricycle a viable and forward-thinking solution for modern urban mobility

III. REQUIRED COMPONENTS

SR.NO.	COMPONENT	RATINGS
1.	Battery	24 volt, 9 Ah
2.	Motor	24 volt, 250 watt
3.	Controller	-
4.	Throttle	Full twist
8.	Cycle	Tricycle

Battery:

Lithium-ion batteries, which are composed of LiCoO2 and graphite, are widely used as power sources for mobile phones, laptop computers, and other electronic devices around the world. Lithium is Fast and Effective. Quick charging reduces downtime, and the fast discharge rate of lithium makes it ideal for quick power bursts. Lead-acid batteries are less adaptable than their lithium equivalents since they require staged charging over an extended period of time and function inefficiently during high discharge periods. We use the battery of Voltage (V): 24-volt Capacity (Ah): 9 Ah

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with BMS Charging unit: 2 units. Lithium-ion batteries are rechargeable batteries widely used in electronic devices. They offer high energy density, long lifespan, and are lighter than traditional batteries.

BLDC motor:

Brushed motors are significantly less effective than those with brushless motors and are more prone to mechanical breakdowns and overheating. The benefit of the BLDC motor is that these motors offer a flat speed torque characteristic, output power to frame size ratio is high, dynamic response is fast and there is no presence of slip in the motor operation. For switching the BLDC motor, a 3 phase inverter is used.

Throttle:

The portion of an electric tricycle throttle that lets you to manage the speed while riding. It is in charge of providing signals that inform the speed control and motor about the amount of power to use when riding. The throttle on electric tricycle is frequently located besides or close to the handle bars. The controller, also known as an electronic speed controller (ESC), is an electric circuit that regulates the speed of an electric tricycle motor.

Motor Controller:

Controlling an electric motor's operation is the main responsibility of a motor controller. A motor can be started and stopped manually or automatically. A BLDC (Brushless DC) motor controller in an electric tricycle is a crucial component for managing the speed and direction of the motor. The controller regulates the power supplied to the BLDC motor based on feedback from sensors, ensuring efficient and precise control. Through precise adjustments of voltage and current supplied to the motor windings, the controller manages speed control seamlessly. Directional control is achieved by determining the rotation direction of the BLDC motor, facilitating both forward and reverse movements.

Theoretical / Mathematical Analysis

Vehicle weight = 150Kg * 9.81N

= <u>1471.5N</u>

Speed of vehicle = 30km/hr.

= 30(1000/3600)

= <u>8.33 m/s (velocity)</u>

r = Revolution per min (RPM)

r = (K)/(d*0.001885)

=(30)/(75*0.001885) .... (Diameter = 75cm, K=30)

<u>r = 212.20rpm</u>

<u>Ftotal= Frolling + Fgradient + Faerodynamic</u>

- **Rolling resistance:**

Frolling = Cr*m*a

Cr = Coefficient of rolling resistance

m = mass of vehicle in kg

a = acceleration due to gravity (m/s^2)

Cr = 0.01 m =150kg a = $9.81 m/s^2$

Frolling = 0.01*150*9.81

= 14.71N

Power over come to require this rolling resistance

= Frolling * velocity of vehicle in km/s

= 14.71*30*1000/3600

= 122.53 watt

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- **Gradient Resistance**

Fgradient = m*a*sinθ

θ = 0 …….(For flat surface)

Fgradient = 0

- **Aerodynamic Drag**

Faerodynamic Drag = 0.5* $\rho*V^2*C_A*A_f$

ρ = Density of air medium in m/s^3

= $1.23kg/m^3$

V = velocity of vehicle in m/s

= 30*1000/3600 =8.33 m/s

C_A = coefficient of air resistance

A_f = frontal area of vehicle in (m^2)

= height*width*adjusting value

= $0.3m^2$

Faerodynamic Drag = 0.5* $\rho*V^2*C_A*A$

= $05*1.23*8.33^2*0.88*0.37$

= 13.89N

Power overcome to this resistance

= 13.89*30*1000/3600

= 115.75 watt

Total power required to overcome this resistance forces will be equal to total power required to move the vehicle

power needed for motor = 122.53 + 0 + 115

= **237 ≈ 250 watt**

- **Motor rating = 250 watt, 24 volt**
- **Torque required**

T = (P*60)/(2ΠN)

= (250*60)/(2Π*3300)

T = 0.7 N-m.

IV. OPERATION OF THE ELECTRIC TRICYCLE

Electric tricycles designed for physically challenged individuals provide a practical and accessible solution for enhanced mobility. These tricycles operate on a simple yet effective principle, featuring an electric motor powered by a rechargeable battery. User-friendly controls, such as twist-grip throttles or joystick interfaces, enable individuals with physical challenges to control the tricycle's speed and direction effortlessly. The seating is designed for comfort and support, often including safety features like anti-tip wheels, safety belts, and emergency stop buttons. Stability and balance are paramount, with low centers of gravity to reduce the risk of tipping. Safety features, including lights, turn signals, and horns, enhance rider visibility and road safety. With a built-in battery charging system, these tricycles are easy to maintain, and they may include storage options for personal belongings. The customization and durability of these tricycles cater to individual needs, providing a reliable and empowering mode of transportation for those with limited mobility. Overall, electric tricycles for physically challenged individuals are a practical solution that can significantly improve their independence and quality of life.

V. APPLICATION AND ADVANTAGES

Application:

1. It can be used in the campus for the drive for the normal persons, to move within the campus in the smooth road.
2. small city drive for anybody including the handicap.

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3. It can be used for material transportation without using fuel propulsion.
4. It can be used by the handicap for the normal transport and even for the self-employed handicap persons for their daily livelihood

Advantages:

There are some advantages of this Project. Which are listed below –

- Anyone can drive the electric tricycle used, especially physically challenged.
- Tricycles are stable in the operation and less need to balance.
- No Emission.
- Minimum maintenance.

VI. HARDWARE IMPLEMENTATION

Pic.1

Pic.2

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Pic.3

VII. FUTURE SCOPE

Regenerative Braking: Integrate regenerative braking systems to recover and store kinetic energy during braking, thus increasing the overall energy efficiency of the tricycle. However, challenges such as ensuring safety standards, scalability, and reliability of scrap-based designs, along with the need for efficient and cost-effective solar charging infrastructure, need to be addressed for widespread adoption. The future scope for these electric tricycle lies in continuous innovation, technological advancements, and strategic collaborations to create reliable, sustainable, and affordable transportation solutions for various communities worldwide

VIII. CONCLUSION

The economic, social, and environmental study sections of this website demonstrate that there are many advantages to using electric vehicles over conventional automobiles Taking into account the intended use of the electric tricycle, we believe that our idea has been successful. We think we have a mechanism that will work well to give people with disabilities mobility. One of the most important things we've learned is how difficult it may be to build technology that is acceptable. Reliability and efficiency are taken into account in addition to replication availability when determining appropriateness. An electrically driven vehicle with no carbon emissions that can be utilized for various transportations is the electric tricycle. An electric brushless direct current motor is used in the tricycle, and it is chained to the back wheels. It has been successful to design and develop the electric tricycle. In order to reduce pollution, this kind of electric tricycle can be very beneficial. Our current reliance on oil causes a host of issues, including economic, security, and environmental ones. Our reliance on oil makes us susceptible to changes in the price of petrol and oil, which poses serious problems for our foreign policy. Pollution from oil and other petroleum products is another major contributor to global warming, barely trailing coal in this regard.

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