iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 Issue: IV Month of publication: April 2024

DOI: https://doi.org/10.22214/ijraset.2024.59902

Electric Bicycle

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***Abstract:** This project proposes a regenerative braking system for electric bicycle based on DSP. The proposed method is used to adjust the switching sequence of the inverter, so that the braking energy can be used to charge the battery. With the cooperation of braking energy recovery technology and a digital signal processor as the control unit, the braking energy is transformed to electrical energy for battery charging.*
***Keywords:** Electric bicycle, Battery, Traffic safety.*

I. INTRODUTION

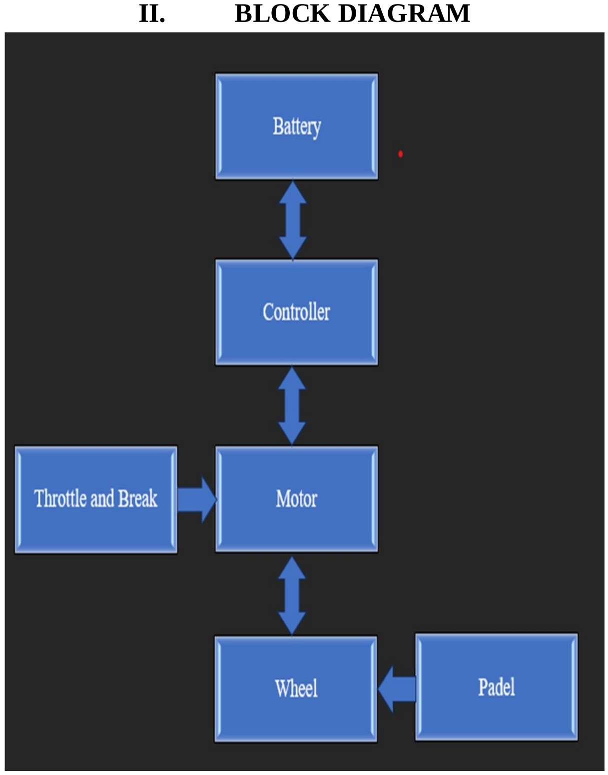
According to the traffic administrative department of the results show that the number of electric bicycles is growing up, at the same time, traffic accident occurred in electric bicycle becoming more and more. The electric bicycle's growth brings new difficulty to urban traffic management. [1].

16 out of 30 top polluted cities in the world are in India. The air in these cities contains high levels of dangerous particulate matter, small enough to enter the human bloodstream through the lungs a problem that contributes to an estimated 7 million premature deaths each year. Irrespective of various efforts of alternative fuel and technology, emissions are not observed to be in control [2].

This Bicycle is designed and made in very less cost as compared to original cost, so any one can afford this Bicycle. As we know that due fuel powered vehicles, the emission of toxic gases is increasing day by day, due to this 4.3 million people [3].

The Regenerative method of adding a converter not only increases cost but also reduces conversion efficiency. This project proposes a DSP (digital signal processor) controlled bicycle with regenerative braking. When the system controller receives the braking signal, the motor can work as a generator, and the energy generated from braking can charge the battery. This project proposes a DSP controlled electric bicycles with regenerative braking control. The kinetic energy is converted into electric energy and stored in batteries when braking, thus improve the driving range and performance of electric bicycles. [4].

II. BLOCK DIAGRAM



III. METHODOLOGY

1) Define Objectives: Clearly outline the project goals, such as speed, range, and target audience.
2) Market Research: Understand user preferences, competition, and existing technologies in the electric bicycle market.
3) Regulatory Compliance: Familiarize yourself with local regulations for electric bicycles to ensure your design adheres to safety and legal standards.
4) Frame Selection: Choose or design a bicycle frame that accommodates the electric components while maintaining structural integrity.
5) Motor and Battery Selection: Select a suitable electric motor and battery based on power requirements, weight considerations, and desired range.
6) Controller System: Implement a control system that manages the interaction between the motor, battery, and user inputs for optimal performance.
7) Charging System: Develop or integrate a charging system compatible with the chosen battery technology.
8) User Interface: Design an intuitive interface for users to control the electric assistance level and monitor battery status.
9) Safety Features: Implement safety mechanisms, such as overcurrent protection and braking systems, to enhance rider safety.
10) Testing and Optimization: Conduct thorough testing to identify and address any issues.
11) Documentation: Create comprehensive documentation outlining the design, assembly, and maintenance procedures for the electric bicycle.

IV. COMPONENTS AND SPECIFICATIONS

Sr. No.	components	Specifications
1	Lithium-ion Battery	36V,20Ah
2	BLDC hub motor	36V,750W
3	Controller	36V DC, 750W
4	Portable Charger	14-42V, 6Amp
5	Throttle	36V
6	Connecting wires	$1mm^2$, $1.5mm^2$

V. CALCULATION

A. Load Calculation

The total load applied to the BLDC (hub) motor is calculated based on the following weight of the vehicle and its accessories.

Vehicle weight = 20kg
Motor weight = 10kg
Battery weight = 10kg
Rider and accessories = 60 kg

Total load = 100 kg

B. Force calculation

The force required to pull the calculated load is based on the total load of the vehicle. The force required is given by the formula

$$F = Crr * M * g$$

Where,

F= force in newton

Crr= co-efficient of rolling resistance= 0.01

g=acceleration due to gravity =9.81 m/s²

M= mass of the vehicle (total load)

F = 0.01* 100 * 9.81

F = 9.81 N

C. Power calculation

Assuming the maximum velocity of 60km/hr the power required to pull the rated load is calculated by using the formula

P=F*(V/3600)

Where,

P= Power in watts

V= Velocity = 60 Km/h = 6000 m/h

P =9.81*60*(1000/3600)

P =163.5 watts

D. Battery selection:

The watt hour of the battery is given by

Ah * V=Wh

Where,

Ah = Ampere hour

V = Voltage

Wh = Watt hour

36V 20Ah battery

=36 X 20

=720Wh

E. Distance Calculation

The distance that can be travelled using this battery is given by

d = wh/F = 720/9.81

d=73.39Km

The road conditions may not be same during the whole journey so we can calculate the distance that can be travelled for double the actual load.

d=wh/F = 720/20

d =60kms

F. Charging Calculation

The charging time of a Lithium ion battery varies depending upon the charger used for it. The charging time of the Lithium-ion battery is given by ,

T=Ah/A

Where,

Ah = Ampere hour rating of battery

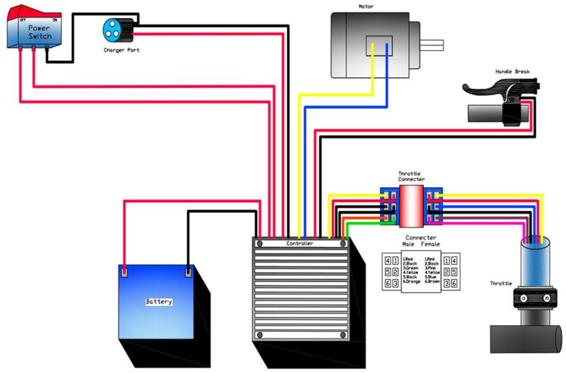
A = Current in amps (charger)

T=20/6 = 3.30Hrs

Also fast charging method can be used in future, so that the battery charges faster.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

VI. CONNECTION DIAGRAM



VII. RESULTS

About 77% of the electrical energy from the grid is converted into electrical at the wheels by e-bicycle. The Cycle can fly over 60 KMs on single charging, with a power consumption of 750W i.e. 3 units.

VIII. CONCLUSION

According to the analysis results of electric bicycle hidden safety dangers in traffic, we put forward some measures to improve the urban management of electric bicycle traffic safety performance, reduce electric bicycle to urban traffic for constructing city of interference, in order to contribute harmonious traffic. This project is designed to improve the normal bicycle and make it extra efficient. The electric bicycle is hybrid and so it can run by electrical energy, solar energy, and dynamo and can also be pedaled there by still retaining the exercise people drive from riding bicycle.

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