



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: V Month of publication: May 2019

DOI: <https://doi.org/10.22214/ijraset.2019.5190>

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Design and Control of Electric Bicycle

Avdhoot Gode¹, Raturaj Bokil², Swapnil Kharate³, Prof. Saurabh Shingare⁴

^{1, 2, 3}UG Students, ⁴Professor, Department of Electrical Engineering, AISSMS Institute of Information Technology, Pune

Abstract: In present scenario petrol and other non-renewable sources are depleting day by day because of increase in usage these sources. This will cause increase of fuel price and causes carbon emission and degrades environment. Mostly these sources are petrol and diesel which is used by vehicles. For travelling longer distance there is no other alternative. But for shorter distance conventional bicycle can be use. These conventional bicycles can be modified with the help of motor and battery which can used for longer distance and these bicycles are called as electric bicycle. Further with the help of dynamo, battery can be charge with the rotation of wheel. This type of electric bicycle can be helpful in rural areas for farmers and students for travelling to their schools.

Keywords: Electric Bicycle, Battery, Charging, Dynamo.

I. INTRODUCTION

In India fuel is imported from western countries and made available for public at high price. Petrol is nearly 80 Rupees per liter where in countries like America it is 10-15 Rupees per liter. For shorter distance conventional bicycle can be use, but if rider is exhausted by continuous peddling or he is more than 50 years old then external driving force is required. This can be achieved with the help of battery powered motor. Motor provides external driving force to bicycle and assist the rider to travel further. This electric bicycle is useful in hilly areas where more force is required for propulsion of the bicycle. This electric bicycle can useful in rural areas for farmers for reaching their farms and for students for reaching their school which will save their time. Further by using dynamo batteries can be charged by using dynamo when rear wheel starts rotating. [2] By using electric bicycle where it is possible will reduce burden on the motorcycles, will reduce the carbon emission and improve quality of air. For electric bicycle there is no need to purchase whole bicycle, if person is having conventional bicycle, he can attach the components to bicycle can convert it into electric bicycle.

II. OBJECTIVES

These are the objectives which are obtained by competition of the project: -

- A. Upgrading the conventional bicycle
- B. Charging of the battery while using it
- C. Cost Effective
- D. Reduction in traffic
- E. Reduction in pollution and use of petroleum products

III. WORKING OF BLOCK DIAGRAM

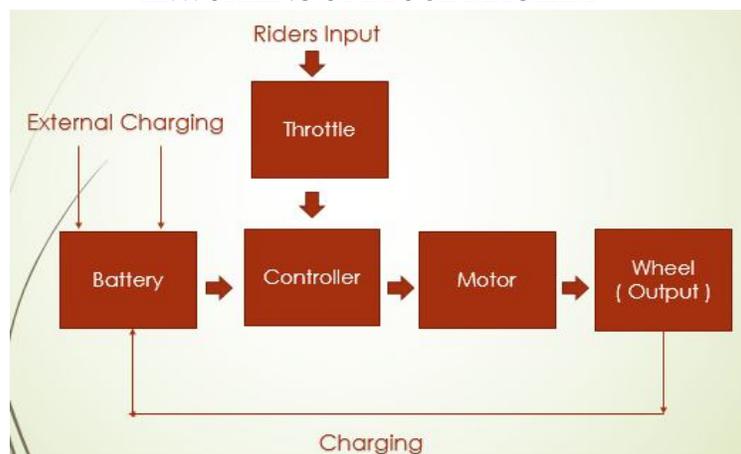


Fig. I: Block Diagram of Electric Bicycle

Rider gives input to the controller by twisting the throttle. Supply is given to the motor through controller. As per input given by rider, controller will give or adjust input to the motor. Motor is connected to the rear wheel of the bicycle which is connected by gear and chain. Dynamo is connected to the rear wheel of bicycle. As the rear wheel rotates dynamo generates electricity, which is use for charging the battery. Battery also ca be charged externally.

IV. METHODOLOGY

These methodologies can be used for fabrication of electric bicycle: -

Design Part	Methodology Available
1. Motor	1. Brushed DC Motor
	2. Brush less DC Motor
2. Motor Assembly	1. Gear Type
	2. Hub Motor
3. Battery Type	1. Lead-Acid
	2. Lithium-Iron
4. Throttle Type	1. Twist Type
	2. Push Button Type

V. SPECIFICATIONS

Assumptions made are: -

Total Mass of bicycle including rider = 10Kg

Diameter of Wheel = 26 Inches / 0.6604 Meter

Velocity = 20 Km/Hr

Component	Rating
1. Motor	250 W, 24V, 10A, 11.4 Nm,
2. Battery	12 V, 7.5 AHr (2 Nos.)
3. Charger	24 V, 1.5-2 AHr
4. Dynamo	12V, 6W (2Nos.)

Battery Related Specifications:

Time Required to Discharge the Battery	43 Min
Time Required to Charge the Battery with Charger	225 Min (3 Hours 45 Min)
Time Required to Charge the Battery with Dynamo	900 Min (15 Hours)
For Velocity of 20 Km/Hr Speed of the Motor is 161 RPM.	Therefore, bicycle will run for 14 Km in one full charge of the battery.

VI. WORKING OF EACH COMPONENTS

A. Permanent Magnet DC Motor

In PMDC (Permanent Magnet DC) Motor, stator is consisting of permanent magnet and rotor/armature having n copper winding. When supply is given to armature, current will start flowing through winding. This will cause current carrying conductor placed in magnet field and force will get apply on the conductor, this will cause armature starts rotating. Depending on voltage applied to the armature speed and torque will get changed.

B. Battery

A battery is a device that converts chemical energy directly into electrical energy. It consists of a number of voltaic cells; each voltaic cell consists of two half-cells connected in series by a conductive electrolyte containing cations and anions. Lead-acid battery is consisting of lead oxide electrode (PbO₂), sponge lead and acid (H₂SO₄). Chemical reaction: -



This chemical reaction is reversible i.e. for charging and discharging.

C. Throttle/Accelerator

Throttle works on Principle of Hall Effect. Hall effect sensor will sense the mechanical position and will gives output accordingly.

D. Dynamo

Dynamo converts mechanical energy i.e. motion into electricity like small rating generator.

VII. FUTURE SCOPE

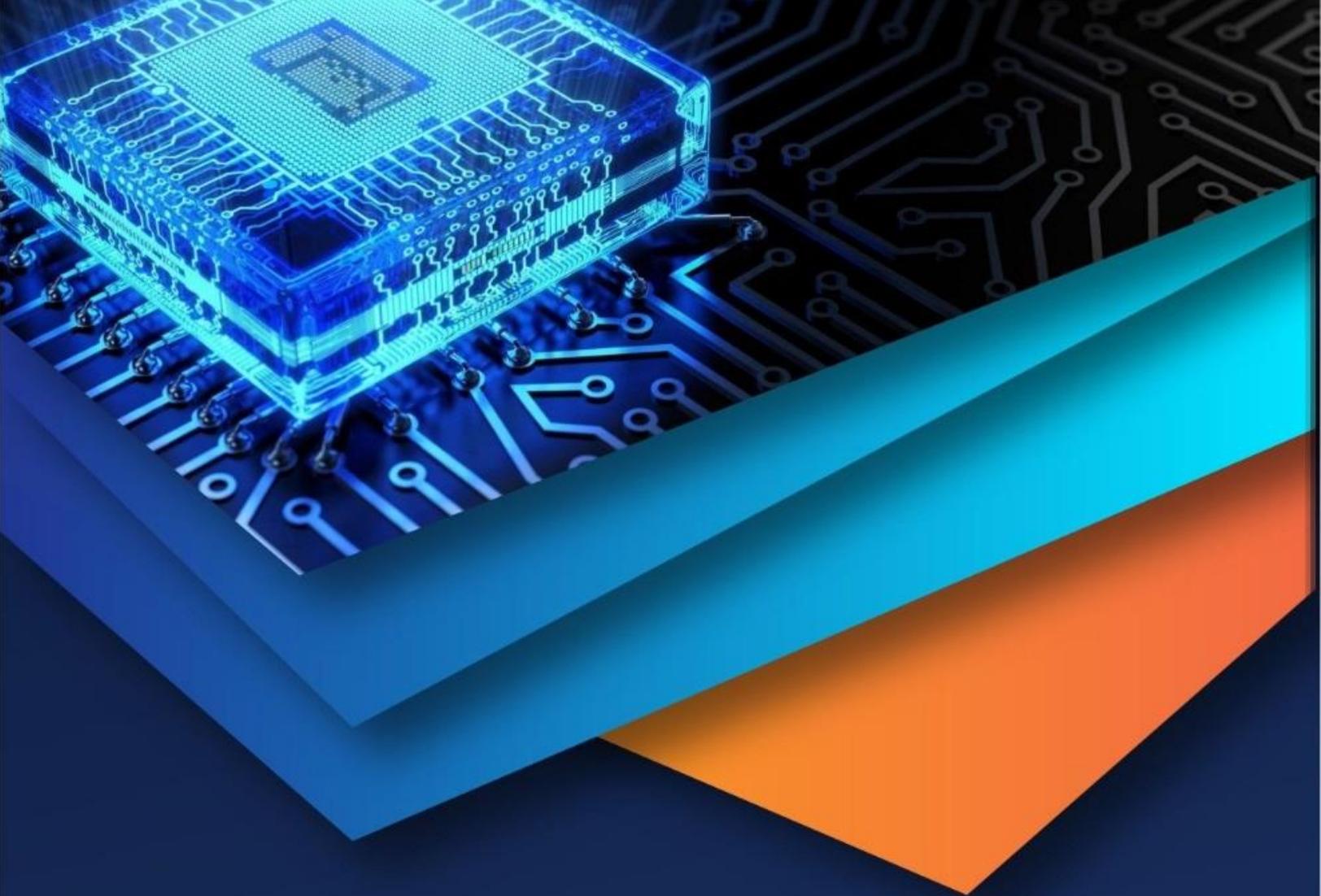
Our project "Design and Control of Electric Bicycle" is mainly focus on designing parameters of motor and battery and charging system. This bicycle further can be improved by using higher rating dynamo for charging or using additional solar panel for charging of the battery and by using Lithium-Iron battery. Lithium-Iron battery requires less space than Lead-Acid battery and having feature like fast charging, therefore Lithium-Iron battery with higher capacity will help to replace fossil fuel vehicle for travelling shorter distance.

VIII. RESULT AND TESTING

"Design and Control of Electric Bicycle" was designed for improving conventional bicycle and reducing use of fossil fuel vehicle for shorter distances. By adding dynamo for charging of the battery will improve battery performance and increase the discharging time of the battery, which will help the bicycle to travel longer distance.

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