

# Cost effective solution for hybrid E-bicycle with HUB motor

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## ABSTRACT

In today's generation vehicle is the basic need in day-to-day life at present the cities are living each day an accumulation of excessive traffic and noise, the fossil fuel based vehicle are the main cause of air pollution. Owing to all above problems and in order to develop environmental friendly vehicle, the concept of E-bicycle is the best option. These E-bicycles comprises of BLDC motor, battery, controller. Cycle is driven with the help of motor and motor is fed through battery supply which is rechargeable. The per km cost of E-bicycle is Rs.0.15 and that of per km cost of conventional vehicle is Rs.1.14. Hence these electric bicycles are beneficial in all aspects i.e. economical, environmental friendly, efficient and convenient for all.

**KEYWORDS:** BLDC motor, battery, controller.

## ARTICLE INFO

### Article History

Received: 1<sup>st</sup> June 2019

Received in revised form :  
1<sup>st</sup> June 2019

Accepted: 4<sup>th</sup> June 2019

**Published online :**

**5<sup>th</sup> June 2019**

## I. INTRODUCTION

A vehicle, which is powered by put away electrical energy, is called an Electric Vehicle. The claim to fame of these electric vehicles is that they are zero discharge vehicles. Thinking about the need of plan and advancement of electric vehicles, investigate exercises in the field of eco-accommodating vehicles substitute to existing vehicles is going on[1]. We live now in an emergency of the car business brought about by high oil costs and out of date structures. It is a need to radically change the vehicle innovation. Because of the progression in the innovation of intensity hardware, electric machines, and control strategies, the electric vehicle and hybrid vehicle are an ideal arrangement. This paper is expected to plan an electric drive framework for the vehicle, which ought to be upgraded for most extreme proficiency utilizing propelled control strategies for electric motor[2]. To drive this electric vehicle an appropriate electric motor is utilized as a prime mover. To control this electric motor an electronic controller is utilized. A battery bank is utilized to store the electrical energy which is put alongside the vehicle. The battery worked electric vehicle is left for 3 to 5 hours for charging the battery pack. A different battery charger is given which take the power from A.C. Mains. At that point the charged battery pack is utilized to drive the motor, which is constrained by an appropriate motor controller. The electric

motor builds up the required tractive exertion. The battery bank, controller and motor must have astounding proficiency, satisfactory limit and low weight alongside regenerative similarity.

### GENERAL PRVIEW

All conventional vehicle producers are fabricating oil and diesel worked vehicles. These vehicles utilize Internal Combustion Engines as prime movers. The cooling arrangement of these units is complicated. Attributable to warm misfortunes because of high working temperatures, the effectiveness of these engine is poor. The engines are intended to work at an exceptionally thin scope of speed, so there is no adaptability in speed variety. Gearbox is additionally to be utilized for further speed-control balance. This makes the general productivity of I.C. engines poor. Electrical machines show better efficiencies over the I.C. engine. Ordinary DC motor are exceedingly effective and their qualities highlights make them reasonable for electric vehicles. The expense of controller utilized for DC motor is generally less expensive than controller utilized for three stage enlistment engine.[3] At the point when the elements of commutator and brushes were executed by strong state switches, support free motor were figured it out. These motors are currently known as brushless dc motor.

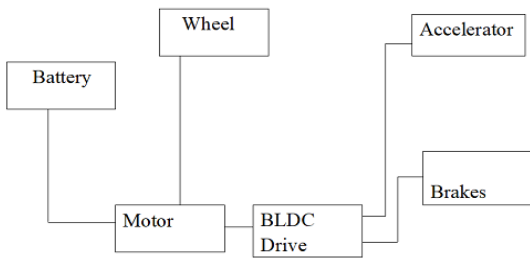
In electric traction, as in different applications, a wide range in speed and torque control for the electric motor is needed.

The dc machine satisfies these necessities, yet this machine needs intermittent upkeep. The ac machines like induction motors and brushless permanent magnet motors don't have brushes and their rotors are robust since commutator and ring are absent[5]. That implies exceptionally low support. This likewise builds the ability-to-weight proportion and the proficiency. Consequently new pattern is to utilize brushless DC motor; vector controlled three stage acceptance motor and doubly nourished enlistment motor. There is huge extension for research particularly in choice of fitting drive for electric vehicles.

New batteries being produced for electric cars can grow the handiness of electric bikes. For instance, a bike controlled by 27 kg of nickel-metal hydride batteries could without much of a stretch travel 200 km before the batteries need reviving. Lithium-particle and zinc-air batteries can give much more noteworthy range.[4]

**II. METHODOLOGY**

**Block diagram:**



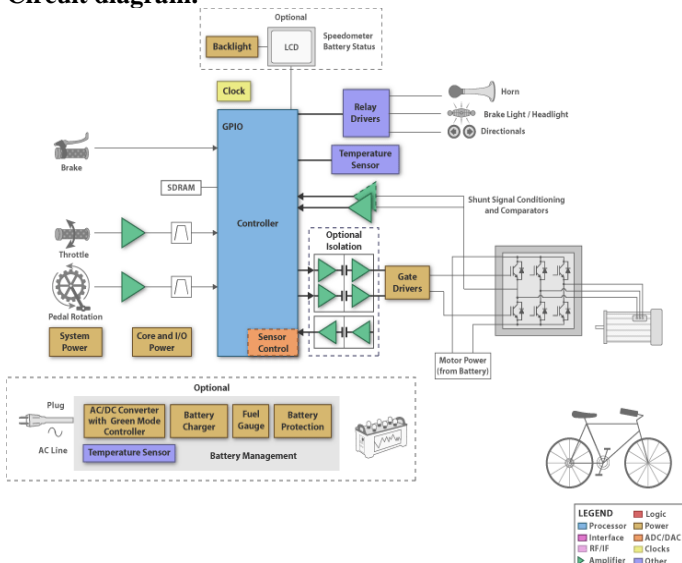
**Fig 01:-Block diagram of electrical bicycle .**

The basic configuration of an electric bicycle drive consists of a controller that controls the power flow from the battery to the electric motor. This power flow acts in parallel with the power delivered by the rider via the pedal of the bicycle.[6]

The rider of an E-bike can choose to

- rely on the motor completely
- pedal and use the motor at the same time
- pedal only (use as a conventional bicycle).

**Circuit diagram:-**



**Fig 02:circuit diagram of electric bicycle**

**Components of electric bicycle:**

**A) Motor:**

Brushless DC (BLDC) motors are synchronous motors consisting of armature windings on the stator and permanent magnets on the rotor. The stator of a BLDC motor consists of stacked steel laminations with windings placed in the slots and these stator winding can be arranged in two patterns i.e. a star pattern or delta pattern. The major difference between the two patterns is that the star pattern gives high torque at low RPM and the delta pattern gives low torque at low RPM. There are many advantages of BLDC motor such as better speed versus torque characteristics, high dynamic response, high efficiency, long operating life, noiseless operation, higher speed ranges[7].

**SPECIFICATION: 0.5 H.P.36VDC, 250Watt 2000rpm**

**B) Battery:**

The battery likewise goes about as a condenser such that it stores the electric energy created by the generator because of electrochemical change and supply it on interest. Battery is otherwise called a collector of electric charge. This happens generally while beginning the system[8].

**SPECIFICATION: 36VDC & 7Ah**

**C) Controller:**

Control can be as basic as an on-off switch however more for the most part they are control on-request, where the motor is enacted by a handlebar mounted throttle, as well as a pedal (from pedal electric), otherwise called electric help, where the electric motor is managed by pedaling[9]. These have a sensor to distinguish the accelerating speed, the accelerating power, or both. The controllers by and large give potentiometer-movable motor speed, shut circle speed control for exact speed guideline, security rationale for over-voltage, over-current and warm assurance. The controller uses beat width balance to manage the ability to the motor. The motor utilized in driving arrangement of EV ought to have the accompanying properties: basic structure, little volume, lightweight, superior, helpful upkeep, simple control, and enormous torque. The control technique for changeless magnet engine is difficult, which confines the utilization of this motor. Subsequent to utilizing square wave motor, the control and driving become simple.[10]

**Model of electric bicycle:**



**Fig03 :Electric bicycle**

**Testing:**

Battery voltage : 36 V.

Charger voltage : 41.0 V.  
Battery current : 6.74 A.



**Fig04: Testing of charge**    **Fig 05: Testing of battery**

### III. RESULTS

Parameter	Specification
Max range	15 kmph
Top speed	25 kmph
Gradiability	5 degree
Max current consumption	Validate on bicycle
Time to charge	Validate on bicycle
Battery ideal discharge(80%) time	30 days
Per km cost	0.15 Rs

### IV. CONCLUSION

The paper shows the custom design of electric bicycle. While designing the bicycle there are different consideration and calculations. As per result the maximum range is 15 kmph and per km cost of electric bicycle is 0.15Rs as compare to conventional vehicle it is 1.14Rs .for example if we travel 60km electric will cost 9 Rs where as in conventional vehicle it will be 68.4 Rs.So it will approximately save 59 Rs.Thus it is economical and also eco-friendly.

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