Archives available at journals.mriindia.com

International Journal of Electrical, Electronics and Computer Systems

ISSN: 2347-2820

Volume 14 Issue 01, 2025

Development Of Electrical Motor Bicycle

[1]Prof.M.S.Gophane, [2]Kawale Yashraj Jalendar, [3]Raut Vishwajeet Vinod

[1]Assistant Professor
Savitribai Phule Pune University
S.B.Patil College Of Engineering
[2 3] Department Of Electrical Engineering
Savitribai Phule Pune University
Email: mayuri14gophane@gmail.com, Yashrajkawale2001@gmail.com, Vishwajeetraut77095@gmail.com

Peer Review Information

Submission: 11 Sept 2025

Revision: 10 Oct 2025

Acceptance: 22 Oct 2025

Keywords

Electric Motor Bicycle
BLDC Motor
Intelligent Controller
Electric Bike Simulator
Cost-Effective Design

Abstract

There is growing demand for Electric Motor Bicycle in India as there will be less air pollution,lower maintenance cost and reduced noise using Electric Motor Bicycle. The motive of this research work is to design a simple, cost-effective model of Electric MotorBicycle with intelligent controller. The Electric Motor Bicycle is consisting of motor, battery and controller. In this BLDC motor is fixed in the rim of the rare wheel. The controller is connected to the motor and battery to control speed of motor and current.
The Electric Motor Bicycle can be run with battery charge and also by pedalling. ELECTRIC BIKE SIMULATOR was used to generate the simulation results. The results of the experiments are also shown in a hardware assembly kit.

INTRODUCTION

GENERAL INTRODUCTION

The term "electric vehicle" refers to a vehicle that is propelled by one or more electric motors or traction motors (EV). A self-contained electric vehicle can convert gasoline to energy using a battery, solar panels, fuel cells, or an electric generator, or it can be powered by electricity from off-vehicle sources using a collector system. E Cycle is an electric and power-assisted bicycle that is one of the bicycle industry's fastest-growing technologies. This bicycle has an electric motor to assist you in moving forward. As a result, you can ride it like a regular bicycle while exerting less effort. An E-Cycle motor works by turning on automatically when you peddle or throttle. There are two main types of E-Cycle

- Throttle assist
- Pedal assist

CLASSIFICATION OF ELECTRIC BICYCLE

TYPE 1 E-Bike

An electric bicycle with Pedal Assist requires you to pedal in order to run the motor. It looks like an ordinary bicycle except that it contains a motor that recognises when you're pedalling and assists you. It's as though you've always had a strong tailwind behind you. This class/type of E-bike may or may not have a throttle.

TYPE 2 E-Bike

Throttle Only is a throttle-controlled electric bicycle. These electrics do not require pedalling to benefit from the motor. You'll be on your way in no time if you simply push the throttle. Accelerating in the middle of a corner will allow you to gain more traction. Naturally, the less you cycle, the faster the battery drains.

TYPE 3 E-Bike
With Pedal Assist, you can go up to 28 mph. This Class/Type is the fastest "legal" E-bike, with a top speed of 28 mph. It is still deemed a "bicycle," and no driver's licence, licence plate, or other documentation is required. It's technically a bicycle, and it's a lot of fun! Helmets are required by law. his category is best for someone who rides their bike to work.

ADVANTAGES OF E-BICYCLE

• An E-bike is a bicycle that is environmentally friendly. It's the same as our regular bicycle. E-Cycle, on the other hand, is powered by electricity rather than gasoline. No harmful emissions are emitted into the atmosphere. For the same reason, electric bikes don't produce any additional noise.
• Electric bicycles, in general, do not require any maintenance. Lubricate the drive system and inspect the chain and wheels on a regular basis to keep it clean.
• Riding an electric bike is fashionable and popular right now. It's also the most efficient approach to cut down on pollution.

OBJECTIVE

• To create an efficient E-cycle that can be used on many types of roadways.
• To adapt the E-cycle to various requirements.
• To design an E-cycle using 3Rs (Reduce, Reuse and recycle). -Reduce: Electric cycle can reduce the emissions. -Reuse: The cycle can be reused from old condition. -Recycle: The cycle has been recycled from scrap condition.

LITERATURE SURVEY

The constant news concerning the demise of fossil fuels, according to Adithya Kumar et al., (2016), has enhanced the importance of using electricity in the future.
Electric bicycles will be used more frequently. The electric bike will be beneficial to office workers and those who ride short distances. The electric bike has a motor that assists the vehicle in moving ahead, and it is powered by a variety of sources. The batteries power the motor, which in turn drives the vehicle.
Once the battery has been fully exhausted, it is recharged using a battery charger.
We used a DC motor/generator mounted to the bicycle's rear wheel for this project. Two sets of batteries, labelled A and B, are used to power the system.
When one of the batteries runs out, the remaining batteries will step in to fill the void. During this period, the wheel revolves, rotating the shaft of the dc motor/generator, which produces a voltage output. This voltage aids in the charging of the battery, improving the electric bike's range. It is environmentfriendly and pollution-free because it produces no emissions. Furthermore, it is silent and can be recharged using an AC converter in the event of an emergency or gloomy weather. It is ideal for young and elderly individuals, and it meets the needs of the economically disadvantaged.The most important feature of this bicycle is that it does not consume valuable fossil fuels thereby saving the money.
Annette Muetze, et. al.,(2008) suggests that More emphasis should be devoted to the deregulation of electric bicycles. A common standard/guideline for electric bicycle designers/manufacturers will stimulate growing popularity while also guaranteeing that electric bicycle quality is not compromised. Customdesigned bicycles that are most efficient in a given operating cycle, such as city, hill, and distance, as well as "speedy bicycles," might assist to offset the additional cost and weight of larger components. More study into battery and drive technologies, as well as their use with electric bicycles, would be advantageous to the electric bicycle industry in this regard. Even if the technological maturity ofelectric bicycles has increased and continues to improve, more effort is needed to make them competitive with other vehicles.
Carlos Tovar, et. al.,(2009) proposes Novel The cities are living each day an accumulation of excessive traffic and noise. The air quality and health are two more components of city traffic that are badly damaged. Many air contaminants, like as carbon monoxide mono-oxide and suspended suspension particles, are primarily caused by transportation. It's a fantastic car that is both speedy and efficient while still being environmentally friendly. It is possible to enjoy a leisurely and enjoyable cruise while also arriving at locations (such as work) using this vehicle.
Surprisingly, an e-bike costs the same as a regular bicycle. This means that when you buy this vehicle, you have all of the features of a standard bicycle plus the added power of the battery, which allows you to go faster and for longer than you could on your own. The bicycle's electricity is designed to help the rider maintain a steady, safe speed on or off the road. Furthermore, the law considers this vehicle to be equivalent to a standard bicycle. That is to say, the user does not need a licence to ride an electric bicycle.
Ravina More, et. al.,(2011) proposes different models of calorie measurement need to be reviewed and tested to find which one is the most suitable to be adopted for a range of

bicycles. For more information, To reduce the number of calibrations required for each particular cycle, researchers can look into developing a single model that fits all bicycles. Incentive-based ways for e-bikes can be tested, such as switching the bicycle from manual to electric mode once the calories burned goal has been met. It is necessary to consider a circuit that can accomplish the same. The anti-theft system is reliant on battery power. To do this, a more stable battery supply is required. The features will be implemented using the bicycle's existing power supply. The end product will be cushioned, waterproof, and temperature insensitive for a specific temperature range to protect it from harsh environmental elements. As a result, the project attempts to reestablish the bicycle as a more user-friendly and low-cost mode of transportation. For the simple bicycles, an attempt will be made to model a similar design.

SCOPE

The price of fuel is rapidly rising as the supply of fossil fuels decreases. We can save a lot of money in the long run and reduce global warming by converting to an electric bicycle. It also aids in our physical fitness. Electric Motor Bicycles are in high demand in India because they produce less pollution, have fewer maintenance costs, and produce less noise.

METHODOLOGY

Insert the key and turn on the ignition. Long press the power button in the instrument console, then the power supply will be active.
When werotate the accelerator to our desired amount, the controller takes the input and give the limited power to the motor and runs accordingly.

WORKINGOFAUTO-CUTOFFBRAKES

- Brakes
- Battery
- Controller
- accelerator
- E-Cycle Wheel Rotation
- BLDCHub
- Motor
- Chain and sprocket

When the brakes are applied during running/idle conditions, the controller cuts off the power supply to the motor till the brakes are engaged.

Working of cruise control:
When the E-cycle is running under a constant speed for 5 sec, the bike is changed to cruise mode and maintains the same speed. For changing back to normal mode, you can accelerate or slightly engage brake.

WORKING OF INSTRUMENT CLUSTER

- Instrument Console
- Battery
- Controller

The instrument console displays speed, battery level, odometer. It has three buttons (power button, motor power up button and motor power down button). Power button has two function, long press- for turning on ignition. Short press- for toggling between voltage level, trip meter and odometer.

WORKING OF LIGHT AND HORN

- Switches
- Battery
- Controller
- Light/Horn

There are two switches in handle bar one is for light and another is for horn. When the switches are pressed the controller reads it and sends the output to light/horn.

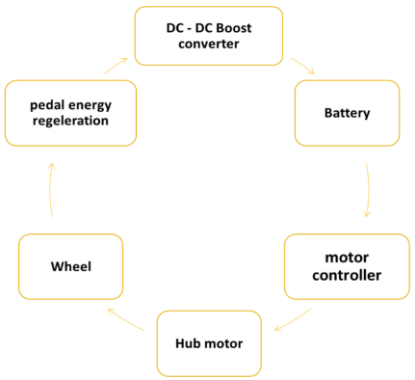
REQUIREMENT CALCULATIONS

1. Mass Range Calculations
Person Weight = 100kg
Battery Pack = 6kg
Motor & Controller = 4kg
Cycle weight = 10kg----------
Total =----------
120kg----------
So, Battery & Motor are required to propel the Bicycle with the weight of 120kg.
2. Motor Load calculation
Fp = PropulsionForce
Fwf = Windage&Friction Drag
Fd = DownforcefromGravity
Consider the Grad @ 3.14%
α = tan-1(slope)
= tan-1(3.14/100)
= tan-1(0.0314)
α = 1.8degree
3. To Finding Fd (Gradient Resistance)
Fd = m*sinα
= 120 * 9.81 * sin 1.8
= 37 N
4. To Find Fwf(Aero Resistance)

Cd =>Aerodynamic Area Co-efficient = 0.74
ρ =Density
A =Frontal Area of Bicycle
V =Velocity of Bicycle
Fwf = ½*Cd*ρ*A*V2
= ½*0.74 *1.225 * 0.37 * (6.94)2
Fwf = 8.07 N
5. To Find FR (Rolling Resistance)
CR=Rolling CO-efficient => 0.0041(for cycle)
FR =CR*mgcosα
= 0.0041*120*9.81*cos1.8
= 4.8 N
6. Total Propulsion Force, FP
Fp = Fd+FWF+FR
= 37+8.07+4.8
= 49.8 N
Propulsion Power = FP * Velocity
= 49.8 N * 6.94 m/s
= 345.6 W
Thus, The Motor is to be 350 W

SELECTION OF BATTERY PACK
Range required: 30km
SPEED OFCYCLE:25km/hr
25 kmfor 1hr
30km for 1.2hr
➢345WPowerto be extracted for 1.2hrs, to cover 30km distance
➢ Therefore,
345*1.2h= 414wh
➢414whbattery Pack is required
36v*11.5 ah=414wh
(or)
48v*8.62 ah=414 wh
1. Considering Cycle Applications and Safety
36V* 11.5Ah is selected
Howmanyseries? How many parallel?
Single cell=3.6v Normal Voltage
2.5Ah capacity
➢5cells in Parallel
= 1.225kg/m3
= 0.37 m3
= 5*25Ah
= 12.5Ah
➢ 10cell group in series =10*3.6v
=36v
= 25 km/h=> 6.94m/s
❖10S, 5P configuration will yeild 36v 12.5Ah.
C Rating =37.5(7.5*5) /12.5
= 3CFor Discharge
Charging allowed is 0.5C = 05*12.5
= 6.25 Amps
Safe current is 0.2C
= 0.2* 12.5
= 12.5AMPS
So, 42 V 2.5A Charger needed
2.CONTROLLER SPECIFICATIONS
36V*xA = 350W
X=9.7Ama
❖ 9.7< 37.5- Battery is safe
❖9.7<13 +_– controller is safe
So 36v, 13 +_1A controller needed– normal voltage
FULL CHARGE(42V)
→42V*xA=350W
→
X =8.3A
3.How Controller Works
42V * (0 to 8.3A) = 350W
41V * (0 to 8.5A) = 350W
40V * (0 to 8.75A) = 350W
31V * (0 to 11.3A = 350W
So Required Voltage, A = 11.3 < 13 ± 1 Amp
So, find Spec arrived
350W motor
36V 12.5Ah (450Wh) battery pack
36V <13±1A controller
42V 2.5Amp charger is suitable for:
30Km range
25Km/hr
3.14% grade
120Kg cycle load

BLOCK DIAGRAM



ADVANTAGES

1. Converting mechanical energy from wheel rotation to electrical energy.
2. The design of an energy efficient bicycle.
3. Reducing the required pedeling effort by utilizing a motor.
4. Iincreasing the validity period of brakes.

APPLICATION

It is useful for riding electrical bicycle faster than normal cycle.

CONCLUSION

From this project we have done the conversion of scrapcycle to a good condition E-cycle which has almost every featurecompared to every cycle in market. It is cost efficient and follows all the 3Rs of theeco system.
We got a goodlithium-ion battery whichgives

the range 40km (or evenmore, depends on thedriving conditions.) and atop speed of 30 km/h.

FUTURESCOPE

In future this cycle can be developed and can addadditional feature like bidirectional controller which can regenerate batterypower by peddling. Since ourproject has single directional converter but it can't berecharged while riding. So,the regenerative braking system won't be available. Wecan change tobidirectional converter and add that feature. We caneven make an attempt to convert other vehicles like handicapped tricycle andcycle rickshaws.

REFERENCES

Annette Muetzen & ying C.Tan 2007-2008,the basic configuration of an electric bicycle.

Xinmiao,2009,Comparative Environmental Impact of E-Bick.

Dill J & Rose G,2012,E-Bick & Transpotation Policy.

Rahul Mane– Deshmukh , working from co-generation he is the junior engineering. He is the invented a E-Bikes a selfhand.