

# Electric Cycle

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**Abstract:** *The increased demand for electric bikes is the subject of this study. Our main focus is in the automobile industry, where we are converting outdated bicycles to electric bicycles. The major goal of this study is to present an accurate picture by linking the many energy sources that humankind has access to humanity. In order for humanity to progress in today's civilized environment, they must travel. And in order to accomplish this, his journey should be as quick and painless as possible. The Electric Bike, which is powered by a battery and so supplies voltage to the motor, is the subject of this study. This study is concerned with the design and construction of an electric bike that runs on electricity as primary energy. In the main system, there is a setting for a rechargeable battery. When compared to a traditional car, the bike's electrical power can deliver better fuel economy, performance, and pollution reduction.*

**Keywords:** electric bikes.

## I. INTRODUCTION

The energy crisis is one of the biggest problems in today's globe, due to the rapidly dwindling resources of fuel, diesel, and natural gas. Furthermore, environmental degradation is a factor in resource depletion, which is a worrying warning. Our study offers a remedy to the aforementioned dangerous issues. The system that we invented is the Electric Bike. This project has a number of advantages for team members as well as the broader public, and it raises awareness of the necessity of using alternative forms of transportation. For a short trip, the electric bike, which is powered by a battery, is the most frequent means of transportation. Fuel cells and petrol-electric hybrids, both of which are under development, might be added to increase the variety of e-bikes available and increase manufacturing, hence increasing the efficiency of the electric drive system. Electric bikes have proven to be a viable means of reducing pollution to a greater extent. The electric bike will be powered by a battery, and the power will be supplied by the motor, which will drive the other gear components. The main reason for using this E-bike is that it is user-friendly, economical, and relatively inexpensive.

The search and evolution of electrical vehicles is growing more and more as the days go by. New technological breakthroughs allied with growing concerns with the environment and physical health had led to huge developments around this concept. Electrical vehicles are claiming a place in several industries, especially in the fields of transportation. The application of electrical motors in bicycles and cars opens up new possibilities and a large number of advantages. Electric motor vehicles are a concept to take into account in the present and even more in the future, as they can open new possibilities or even replace the possibilities given nowadays by the common internal combustion engines. In the current days, fully electrical cars can already directly compete with an internal combustion car or even overcome and make them look obsolete in several aspects. The application of electrical motors in bicycles has several benefits linked to it. It can provide assistance to the rider through tough climbs, to help rapidly achieve higher speeds or just to let the rider rest along the way, allowing him to do longer and tougher routes with less effort. This concept can reveal to be also very beneficial to people with locomotion difficulties, as it can transform and upgrade a common bicycle or similar vehicle to meet people's needs, helping them on transportation and increasing its mobility. A foldable electrically assisted power cycle has many advantages, it doesn't pollute the environment, it's good for the health, allowing to exercise and to manage the effort with the amount of power produced by the motor. In a metropolis environment it represents great mobility, it can be folded up and carry it into public transportation to get near the destiny. Or otherwise, to ride it to the destiny, with the electrical motor assisting through the route. As a bicycle, it is

very advantageous in traffic jams, as it allows to pass by stopped traffic and reach the destiny possibly even faster than in a car or public transportation. It presents a very small ecological footprint, specially comparing with cars, once that they are less or virtually non-pollutant. Another feature that increases this variation are the considerable different occupation rates. Cars usually present occupation rates around 1 and 2 persons, representing 20 to 40 percent of its total capacity while bicycles employ all its capacity rate, increasing efficiency and reducing the footprint. One usual problem associated with the use of bicycles in big cities are the robbery's, leaving the bike chained in the outside it's always a risk, even the best locker can be overcome. With a folding bicycle, this problem doesn't exist anymore as it can just be folded and taken inside with the rider, ensuring its safety. Comparing with a moped or motorcycle, it's cheaper to buy in most of the cases and cheaper to maintain. You don't need any kind of documentation or requirements to apply and they have very similar mobility characteristics through traffic and in a metropolis environment in general.

### **Objectives**

This thesis has the objective to consider the best alternatives to be used as a daily mean of transportation to commute to work. We should come up with a solution able to solve the problems inherent to the common urban means of transportation, as public transports, private cars or common bicycles and thus create a better alternative for this specific purpose. For such, we will be considering and study the best alternatives from the several hypothesis for an electrically assisted bicycle. This thesis also has the end of building a fully working prototype within the possibilities that are given, this is, taking into consideration the time, capital available, access to building methods and materials among other constraints. This bicycle or, electrically assisted power cycle, is meant and designed for a very specific use and application: it is designed to be used as a daily mean of transportation to cover the distance between house to work and vice versa. It should be adapted to urban transportation, creating an alternative to other usual and less attractive means of transportation in a metropolis environment. It should be the perfect choice to be applied in the "last mile" concept. This is a concept that refers to the last section of your daily work route. Whether it is directly from house to work or from the public transport or private car. The bicycle has the objective of making your way to work easier, effortless and eliminating the problems inherent in the use of a common bicycle. Nowadays we also have a growing concern with the environment and the pollution, by using an electrical vehicle, you would have a vehicle with virtually no pollution inherent to it, making the way to work cleaner and greener and thus reducing the ecological footprint both of the rider as of the city itself. Let's envisage the following scenario where you live relatively near to your workstation (about 5 km or more). This would leave you with a small distance to cover to go to work but still a large distance to cover by foot. Therefore the common alternatives would be a public transport, a common bicycle or a private car, but all these alternatives can represent problems. Using the public transportation, more likely a bus in this situation, you would always have variables that you can't and won't control or overcome and that could lead to make you arrive late to the destiny. Variables such as the schedule of the bus, possible but still common delays or even just the traffic, which is quite usual in big cities. With public transportation you also would have more expenses, just to go to work. The common bicycle would be a good alternative as it has more maneuverability and can easily overcome traffic or other urban obstacles. Even so, using a common bicycle with hot weather or in hilly paths can be exhausting, tiring down the rider and making him sweat and uncomfortable, even before arriving to the workstation. This probably would have a negative effect on the performance and well-being throughout the work day. Another problem inherent to the use of bicycles in city environments is the safety, daily dozens of bicycles are stolen and never retrieved. Taking your private car would also be a good alternative but this also raises practical problems. Problems such as traffic or finding a spot to park. Another common scenario, is the one of people that work in a big city but live in its surroundings. These often take the public transport to get to the city, as a train, boat or bus, but this transport doesn't take them to the final destination. Therefore they still have a distance to cover within the city. The alternatives to this last part of the route, or "last mile", would be taking a second public transport, to near the destination or to use a common bicycle, preferably foldable so that you could take in the public transport with any problems. These alternatives would raise problems, just like the ones described before. A foldable electrically assisted bicycle would solve all these problems. Traffic wouldn't be a problem, as a bicycle, it can easily overtake stopped traffic or go to an alternative route where cars or public transports can't go. Comparing to a common bicycle, it would keep its main features as its maneuverability and

practicability, but would make the route easier and requiring less effort from the rider, as the motor would do most of the work, allowing him to arrive to work fresh and rested. Such problems as robberies wouldn't be a problem once the bicycle can be foldable and taken into the inside of the building or workstation. This work intends therefore to create an alternative mean of transportation. One alternative that is better in most aspects than the common transports and able to solve and overcome the problems and obstacles that can often be found in a metropolis environment.



Fig1. Electric Cycle

## II. COMPONENTS

### a) 24 v Lithium Battery :



Fig 2. Lithium Battery

A lithium-ion battery, sometimes known as a Li-ion battery, is a rechargeable battery type.

Lithium-ion batteries are widely used in portable electronics and electric vehicles, and their use in military and aerospace applications is growing.

### b) DC Geared Motor :



Fig 3. DC Geared Motor

E bike 24V Geared DC motor is a popular reduction dc motor & its simply the most commonly used motor for scooters, bikes, and quads available in the market! Also due to its robustness, it is also in many DIY projects like Segway, e-cars, etc and in many robots like ATV robots, combat robots, etc.

**c) Controller:**

The controller, which comes in a number of forms, allows you to regulate the electric assistance on your electric bike and is a crucial aspect of how they work. For convenience, the controller is mounted on the handlebar. Throttle-based controllers use a basic throttle mechanism to operate. The throttle will be either a thumb-press or a twist-grip style. To gain electric help with a throttle, simply pull back or press the throttle. Some electric bikes only require you to activate the throttle, allowing you to ride without pedaling. Electric bikes are, for the most part, simple to operate, ride, and maintain. In general, they require less maintenance than a regular bicycle.

**What is the E-bike controller?**

The motor controller is also known as the electric e-bike controller or electric speed controller. It is a circuit board in a sealed protective box with several connection wires sticking out.

It's mounted inside of an e-bike connecting and putting all key components together, like motor, battery, paddle assistant, LCD display, sensors, and throttle, to control the motor's speed, start, and stop.

If the motor acts as the "heart" of an e-bike, then the controller is their "brain," which is the main factor to determine the performance of an e-bike.

The controller serves two main purposes:

It controls and regulates the flow of current from the battery to the motor in an e-Bike

Most controllers have the capability to provide regenerative braking. The resting power is going to be sent back from the motor to the battery to save energy when it works.



Fig 4. Controller

**Voltage and Power of eBike motor controller:**

The higher current and voltage the controller has, the more powerful eBike it can drive. 36V, 48V, and 60V are the most common controllers for electric scooters and e-bikes among the common kinds from 12 volts to 72 volts.

High-performance eBike are usually equipped with high voltage controllers, such as 52V, 25A, 60V 40A, and 100V, 400A.

Most commute scooters or eBike just have a single controller while extreme performance versions typically have dual motors to get more power.

**How does the controller works:**

The motor, as we know, translates the electrical energy into mechanical energy, and the controller is the bridge that takes power from the battery and delivery it to the motor depending on the sensors and rider's input.

As the central hub, the controller receives signals from the throttle regulated by the users then give instructions on how much power is going to be sent to the motor to control the speed of the e-bike



Fig 5. Controller Working

**The principle behind the controller is simple:**

The motor controller is made of a processor that receives orders or requests signals from the battery, motor speed sensor, or brake sensor and gives a correct output signal such as to set the motor running at a specific speed.

The hall sensors on the circuit board of the controller can monitor and control the motor speed.

**What is the microprocessor do?**

A microprocessor is rather like a computer running firmware. It sends weak signals to the FETs network, which in turn controls and drives the motor. Usually, the processor forces the FETs to switch on and off quickly by using a high-frequency signal, which makes the controller spin slower or faster

The processor or microchips can also control the timing of power delivery for the motor which makes sense at it is just how brushless DC motor works.

**How the processor affect the motor’s performance**

More and more brushless DC motors are being used nowadays instead of brushed motors.

To know how the process affects the motor’s performance, let’s get into a shallow knowledge of brushless DC motors first.

**Brushless DC motor**

For brushless DC motor, there are permanent magnets on the rotor and electromagnets are on the stator. Permanent magnets are usually made of hard materials like steel that has and show their own magnetic field forever, while electromagnet is the coil of the iron core that only release its magnetic when an electric current pass through it.

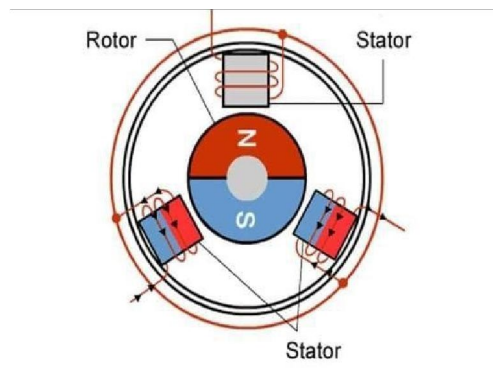


Fig 6. Brushless DC Motor

So in order to make the motor work, you need to make the permanent magnet rotate, and to control the rotation, you need to adjust the current into the coils on these fixed electromagnets around.

And processor will do the work to active the electromagnets with precise timing depending on the rotation speed to control the timing of power delivery.

**What are the functions of an electric bike controller?**

The controller accepts all inputs from the motor, battery, paddle assistant, LCD display, sensors.

The controller gives feedback depending on the above inputs to control every aspect of the e-bike. Things like speed of the motor, amount of pedal assistance, and the brake system.

The controller monitors acceleration, speed, power, voltage, pedaling level, and more The controller protects inner circuit systems, such as over-voltage and current protection, low-voltage protection, and overheating protection.

**Chain Drive :**

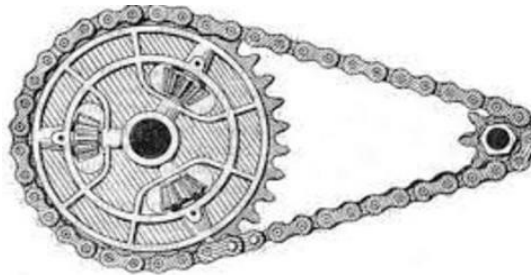


Fig 7. Chain Drive

A chain is a collection of interconnected links held together by steel pins. This configuration makes a chain more durable, long-lasting, and effective at transmitting rotary motion from one gear to the next. The main advantage of chain drive over traditional gear is that it can transmit rotary motion over a long distance using only two gears and a chain, whereas traditional gear requires many gears to be arranged in a mesh to transmit motion. Two sprockets are connected by a chain. The driver sprocket is one of the sprockets. The driven sprocket is the other type of sprocket. The chain can carry motion and force from one sprocket to the next, and so from one shaft to the next. Power transmission chains are chains that are used to convey motion and force from one sprocket to another.

**Battery Level Indicator Module:**

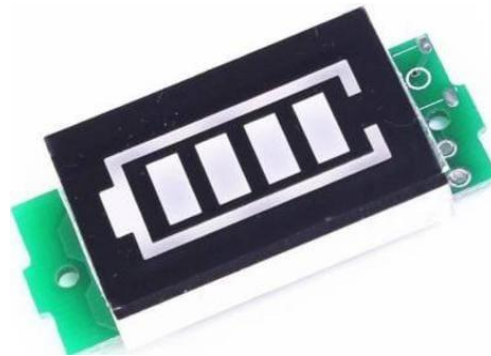


Fig 8. Battery level indicator

This battery type capacity indicator module display shows the display is more intuitive and more beautiful. A wider range of applications, nickel-metal hydride batteries, 18650 and polymer lithium battery packs, lead-acid storage, electric vehicle batteries, electric equipment can be used.

This display has a reverse connection function, even if the positive and negative connection will not burn. To use the display just connect the positive and negative terminals of the display board to the positive and negative terminals of the battery under test. The digital tube will display the realtime battery power.

**Throttle :**



Fig 9. Throttle

A handlebar-mounted device that can engage (and sometimes adjust) power output from the bike's motor. Electric bikes with throttles can be completely self-propelled, since throttles tell their motors to dispense power without the need for any pedal motion or input from the ride.

**III. BLOCK DIAGRAM**

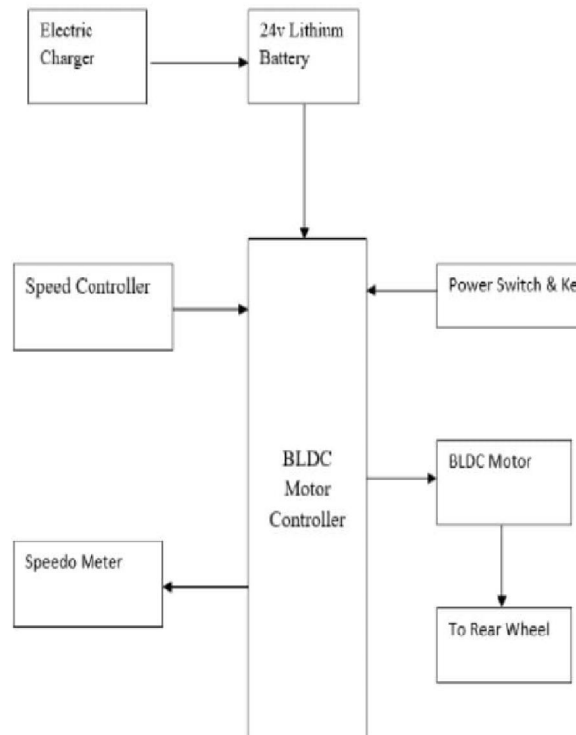


Fig 10. Block Diagram Of Electric Cycle

**IV. CONCLUSION**

With the increasing consumption of nonrenewable resources such as petroleum and diesel, we are moving toward renewable sources such as solar, hydroelectric electricity, and batteries. There are different methods for conserving

energy. One such mode of transportation is the electric bike; it is also a new mode of transportation that provides us with a convenient mode of transportation. It is also a new mode of transportation that provides us with a simple mode of transportation for people of all ages. It is a low-cost mode of transportation that everybody may afford. The motor in this bike is highly efficient, and the battery bank is light and fast. The electric bike's most important feature is that it does not use fossil fuels, which saves billions of dollars in foreign currency. The second most important feature is that it produces no pollution, is environmentally friendly, and operates quietly. The most viable solution for reducing environmental pollution is to ride an on-board electric bike. If there is an emergency, it can be charged using an AC converter

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