

## E-BIKE WITH REGENERATION

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**Abstract-** Every time a new vehicle is added to the roads, we are burning an immense quantity of fossil fuel that cannot be restored. The Petrol/diesel that we burn adds on pollution to a mass amount of air pollution. To control pollution, the source of it must be changed. An electric bike uses an electric motor to move. On this bike, people do not have to use their muscular force to move. It uses electrical energy for motion. They are also known as E-bikes. There are many varieties of electric bicycles. Some of these bikes have a rechargeable battery. This makes it easy to power the bike whenever you want. They make use of stored electrical energy in some other forms. Due to this form of energy, the bikes have more power and speed. These bikes are more convenient than regular ones. Brushed and brush less are two important types of motors used in these bikes. An electric power-assist system is also attached to these bikes to make them additional practical. E-bikes use rechargeable batteries, and the lighter varieties can travel up to 25 to 32 km/h, depending on the laws of the country in which they are sold. Batteries used in this vehicle are lithium-ion batteries, nickel-cadmium batteries. A dynamo meter is used for regeneration of energy which is capable of generating the power to the bike.

**Keywords:** electric bike, batteries, automotive, clean energy, regeneration.

### 1. INTRODUCTION

Nowadays, many researchers show their concerns for the significance of sustainable energy, mostly it has been noticed that fossil fuels are at peaking prices and have a pessimistic impact on the environment. Non-conventional energy sources such as fossil fuels, coal, and natural gases are limited and cannot be reused. Climate change from an increased concentration of carbon dioxide in the atmosphere was acknowledged already back in the year 1896 (Arrhenius, 1896). It is however not until recent decades that discussions have emerged and plans been developed, on how our emissions of greenhouse gasses (GHG) should be reduced. Our transportation options have an immense impact on air quality. What we drive and how we drive impacts the environmental conditions. Motor vehicles release more than half of all carbon monoxide and hydrocarbon emissions. These emissions, including microscopic particles, can contribute to breathing and heart problems along with a high risk of cancer. Recent developments on pedal-assisted electrical bikes (E-bikes) and regulations surrounding them have to a growing market of E-bikes all around the world. E-bikes could potentially be one of the first types of electric vehicles to reach large-scale diffusion. Introducing bike-sharing systems with E-bikes (E-BSS) could open up their use to a broader audience. The potential for modal shift from fossil fuel power transport modes would thus increase.

#### 1.1 ENERGY REQUIREMENTS OF E-BIKES:

There are numerous different things that will affect the energy use of the E-bikes. The energy requirements will vary heavily depending on the choice of route, rider's weight, the E-bike specifications, etc. a few of these was identified in the literature review but some are dependent on actual design. to get further insight on how BSS are being used, data from running BSS was collected and analysed.



FIGURE: 1- DESIGN AND FABRICATION OF E-BIKE

**1.2 SYSTEM DESIGN OF CHARGING STATIONS:**

By combining the simulation results of available energy from the solar panels with the energy requirements of E-bikes it is possible to study different options of system design. Independent of the amount of data collected, some things cannot be determined with great certainty as this report is exploratory. This means that some results might not apply to a real system. To deal with this problem, it was tired throughout the report to analyze the system carefully to ensure that the drawn conclusion, in the end, will be relevant for a deal case despite changes.

**1.3 DIFFERENCE BETWEEN FUEL BIKE AND E-BIKE**

FUEL BIKE	E-BIKE WITH REGENERATION
Require fuel for power generation.	Does not required any type of fuel.
Generates high power.	Generates low power.
High initial cost.	Low initial cost.
Efficiency is less.	Efficiency is more.
Life span of system is less.	Life span of system is more.
Requires high maintenance.	Require less maintenance.
If system is not working no power will be generated.	If one system is not working than other system generate power as a stand by unit such as solar energy.
Less economical and more bad environmental effects.	More economical and environmental friendly.
sNon-renewable sources of energy requires here.	Renewable energy source is utilizing here.

**2. COMPONENTS:**

2.1 BATTERIES: the battery is an essential component of almost all the electrical systems. Batteries are used to start the engines and auxiliary power units, to provide emergency backup. Other important obligations include environmental toughness, a wide operating temperature range, ease of maintenance, swift recharge capability, and tolerance to misemploy. Lead-acid cells are composed of alternating positive and negative plates, interleaved with single and multiple layers of separator material. Plates are made by pasting active material on the grid structure made of lead and lead alloy. The electrolyte is a mixture of sulphuric acid and water. In flooded cells, the separator material is porous rubber, cellulose fiber, or microporous plastic. In recombinant cells with starved electrolyte technology, a glass fiber mat separator is used, periodically with an added layer of microporous polypropylene. Gell cells, the other type of recombinant cell, are made by absorbing the electrolyte with silica gel that is layered between the electrodes and separators.

Charge methods:

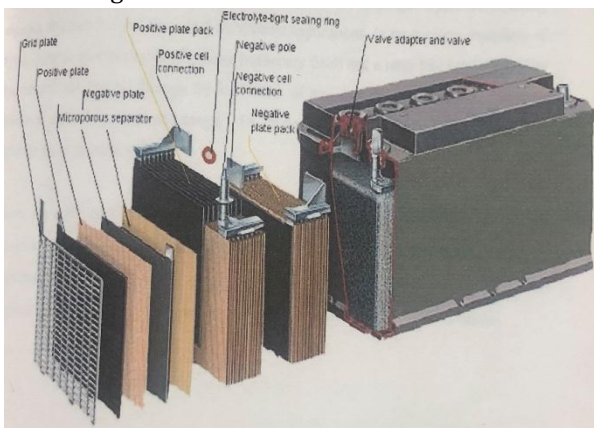


Figure: 2.1- lead acid battery

Constant voltage charging at 2.3 to 2.4V per cell is the preferred method of charging lead-acid batteries. For a 12-cell battery, this equates to 27.6-28.8V which generally compatible with the voltage available from 28 V bus. Thus lead-acid batteries normally can be charged by direct connection to the DC bus, avoiding the dedicated need for a battery charger. If the voltage regulation on the DC bus is not controlled sufficiently, however, the battery will be overcharged or uncharged causing premature failure. In this case, a regulated voltage source may be required to reach an acceptable battery life. Some voltage regulators that to compose again, either manually or automatically, for the battery temperature by increasing the voltage when it is cold and decreasing the voltage when it is hot.

2.2 DC MOTOR:

Almost every mechanical movement that we see around us is proficient by an electric motor. Electric machines are the means of converting energy. Motors take electrical energy and provide mechanical energy. Electric motors are of two types  
i) DC (direct current)

ii) AC (alternating current)

Principle of operation:

Consider a coil in a magnetic field of flux density figure (2.2.1). When the two ends of the coils are connected across a DC voltage source, current  $I$  flow through it. A force is exerted on the coil as a result of the magnetic field and electric current. The force on the opposite sides of the coil is such that the coil starts to move in the direction of a force. In an actual DC motor, several such coils are wound on the rotor, all of which meet force, resulting in rotation. The considerable the current in the wire, or the greater the magnetic field, the faster the wire moves since the greater force created.

At the same time, this torque is being processed, the conductors are moving in a magnetic field. At different positions, the flux linked with it changes, which causes an emf to be induced ( $e=d\phi/dt$ ) as shown I figure (2.2.1). This voltage is in opposition to the voltage that causes current flow through the conductor and is referred to as a counter-voltage or back emf.

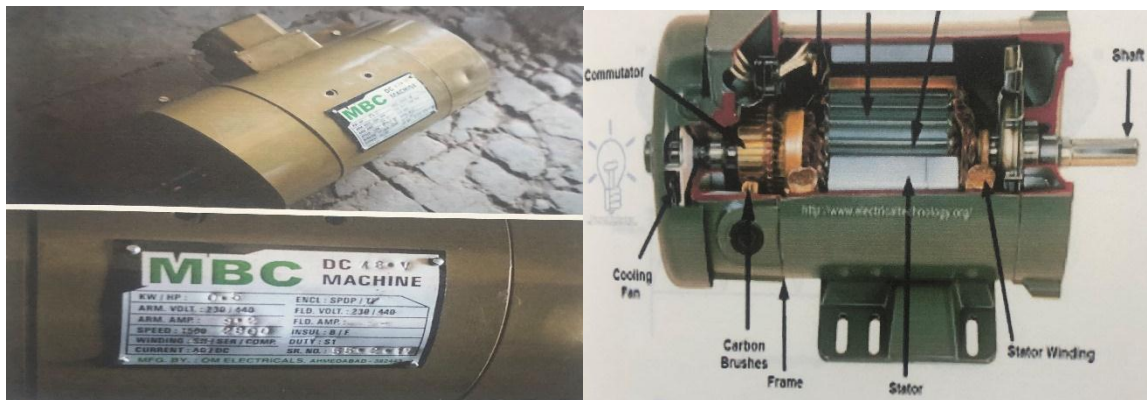
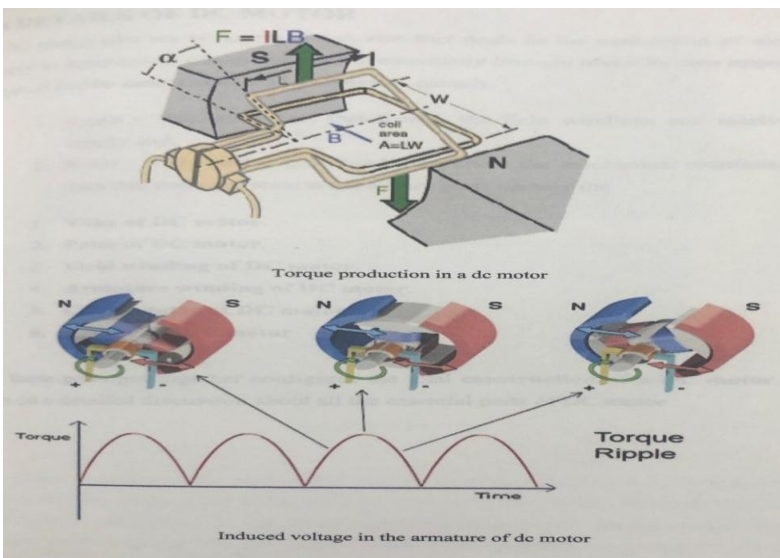


Figure: 2.2.1- DC MOTOR

Enough so that the force created by magnetic field ( $F=ILB$ ) equals to the load force applied on the shaft. Then the system moves at constant velocity.



The armature core is provided with slots build-up of the same material as the core to which the armature winding made with various turns of copper wire distributed uniformly over the entire rim of the core. The slots openings a closes with fibrous wedges to obstruct the conductor from plying out due to the high centrifugal force produced during the rotation against the armature, in the presence of supply current and field.

Figure: 2.2.1-induced voltage in armature of dc motor

### 2.3 CONTROLLER:

A motor controller is a device that serves to control in some pre-set manner the performance of an electric motor. A motor controller includes a manual or automatic approach to start and stop the motor by selecting forward/reverse rotation.

There are many types of starters:

1. Direct On-Line (DOL)
2. star delta starter
3. autotransformer starter.

Use of controller: for most applications involving a DC and BLDC (brushless DC) motor, it is advisable to use a motor controller, in actual if you are using a brushless motor, then you have to use a controller to fire the correct phase winding at an apparent time.

Motor protection: most present controllers have the following protections;

1. under-voltage
2. over-voltage
3. short circuit protection
4. current limit protection
5. thermal protection and
6. Voltage transients.

Without these protections, the motor is exposed to threats that will possibly result in permanent electrical and mechanical damage.

All DC motors will lose speed as they are loaded and increase in speed when they are unloaded, in a linear fashion, according to their speed or torque gradient. For applications where a specific speed is needed, with an unspecific load (so a final speed cannot be calculated), or a fluctuating load (conveyor belt, pump grinding tool, reel convertor, cam) a controller is a must.

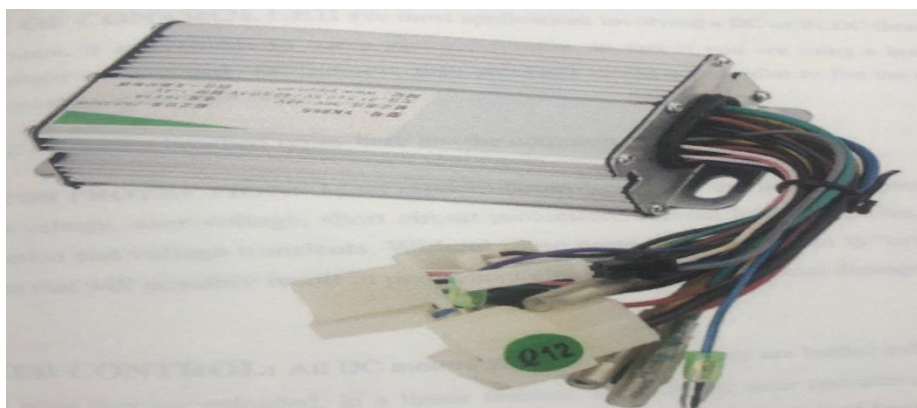


Figure: 2.3- controller

### 3. ADVANTAGES:

E-bike is more economical than fuel-powered cars, motorbike and cheaper than buying an electrical vehicle

- No pollution of burning fuel. Every time we see a vehicle pumping smoke into the air, we can feel a sense of relief that we are not contaminating the air which is common for others.

- No noise pollution. Electric bike generates less than 5 percent compared to a petrol bike. When differentiating with normal traffic noise. It goes in utmost silence.
- Speed - Electric bikes generally have a higher top speed than a normal bicycle with the same rider. Most electric bicycles in the United States are limited to a 20 mile per hour top speed, however, the rider can pedal to make it go even faster. So this makes it easy for a novice or out of shape rider to get some significant speed going.
- Great for Commuting – An electric bike can require little to no effort to ride. Just twist the throttle and steer the bike where you want to go. This makes it so the rider doesn't have to break a sweat in their work clothes on the way to work. Another huge advantage is the ability to skip the traffic. An electric bike can be ridden on a sidewalk, through a park, or down an alley. Allowing it to beat the traffic and in many cases get to a destination than a car.
- Easy on the body – An electric-powered bike allows rider who are physically less able or out of shape to keep up with younger and more in shape people. E-bikes also allow for long comfortable bike rides where the rider doesn't feel exhausted in any type of physical pain at the end. Just a comfortable ride at a pace the rider enjoys.
- E-Bikes are cool – Be ready to ask questions to the many curious onlookers that are interested in what you are riding and how it works.

#### 4. DISADVANTAGES:

- Complexity - Electric bike has more parts than a normal bicycle, so that means more chance of something going wrong. These days the quality of electric bicycles is very good, especially what we sell at farbike.com, however whenever there is more complexity, there is a higher possibility of something going wrong. Most bicycle shops can fix electric bikes, and it is easy to swap out whatever component is faulty with a brand new one to get the bike running again. Far bike along with X-treme has gotten very good at keeping our bikes running strong for years and our customers happy with great service.
- Weight – Electric bike adds an electric motor, battery, and controller among other things, so this about doubles the weight of the bicycle when the battery is installed. This isn't a problem when the battery is charged and the rider is using the electric motor, but it can make it harder to pedal when the battery is out of juice.
- Batteries Maintenance – It is good to charge your electric bike battery after each ride. It is also important not to let your electric bike used for a long period of time because the battery capacity will fall due to its chemistry. It is best practice to use your electric bike at least once a month to keep the battery in good shape. Electric bicycle batteries don't last forever, a Lithium-Ion Battery will last 2 – 5 years and an SLA battery will last 1-2 years before the cells have to be replaced. However, with good battery maintenance, you can extend the life of the battery for as long as the bike in most cases.

#### 5. APPLICATIONS:

- The Environmental Transport Association (ETA) concluded that the bicycle provides the finest application of technology.
- In terms of price, range, and approachability the bicycle is the most practical option for those who want comfort and enjoyment by an electric vehicle today
- Electric vehicles of every category are currently in development, from aircraft to jet skis, but batteries remain costly, heavy, and inconvenient to charge without widespread charging points.
- Bicycles are easy to transform electric power and light enough to be carried into a house to be re-charged.
- Furthermore, the electrically-assisted bicycle is the ultimate hybrid; if the battery runs flat, the rider can switch to the manual in an instant.

#### 6. CONCLUSIONS:

- The electric bike uses an electric motor for the purpose of moving. On this bike, people do not have to use their muscular force to move. It uses electrical energy for motion. They are also known as e-bikes. There are many varieties of electric bicycles. Some of these bikes have a rechargeable battery. This makes it easy to power the bike

whenever you want. They make use of stored electrical energy in some of the other forms. Due to this form of energy, the bikes have more power and speed. These bikes are more convenient than regular ones.

- An electric power aided system is put on to these bikes to make them more functional. Batteries used in these vehicles are lithium-ion batteries, nickel-cadmium batteries, or any other. The parameters of the battery differ according to the voltage and capacity needed for the vehicle. There are two types of controllers used in this vehicle. The design of the bike is also very important, one of the most interesting designs is the folding bike.
- A dynamo is an electrical generator that develops direct current by utilizing a commutator. The dynamometer was the first electrical generator as a result of delivering power for industries, and it is the foundation upon which many additional electric-power conversion devices were based. Today, the basic alternator dominates extensive power generation for efficiency, reliability, and cost reasons. Also, converting AC to DC using power rectification devices is efficient and usually economical.



Figure: 6- E-bike project model

### 7. FUTURE SCOPE:

Every time a new vehicle is added to the roads, we are burning an immense quantity of fossil fuel that cannot be restored. The Petrol/diesel that we burn adds on pollution to a mass amount of air pollution. To control pollution, the source of it must be changed.

A number of vehicles grow; cities are being choked with traffic adding more oil to burning fuel. Air pollution one side and noise pollution on the other. Roaring vehicles in traffic add burden to already tensed driving.



Figure: 7-air pollution in traffic

To curb Air pollution and traffic congestion, the government will be forced to take action. For example

- An odd-even rule in Delhi, where an odd number of registered vehicles can run on odd days and even vice-versa.

- Ban of registration of BS III vehicles (Engines does not meet certain emission norms in BS – Barath stage III) in major cities.
- Additional tax on diesel vehicles with capacity in excess of 1.2 liters (where the fuel consumption will be more).
- Ban of vehicles aging for more than 15 years.

All these may reduce air pollution to some extent but the core problem will exist. The usage of the vehicle.

When we have a problem, there will be many solutions and for transport, one is an electric bike.

Electric vehicles are going to be one of the leading alternatives to today's transportation problem.

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