Self Charging Electrical Bike

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Abstract - *Today's Automobile world is influenced by the invent of modern electric cars. Generally these types of cars are driven by a battery powered electric motor. But these batteries can be charged only during the static condition and the process is more time consuming. So there is a need to create a sustainable means of energy source for these cars.*

This project aims at developing a self-charging electric vehicle which generates the electric power required to drive the bike during the running condition by the means of auxiliary power sources. Power source is Electrical Generator, which is directly connect to the front wheel of Electrical bike. . These power sources are managed by the means of a current regulator for charging the battery simultaneously. Other one is a External plugging system is given for the Charging Electrical Bike in standstill condition.

Key words - Electric Bike, DC Generator, Batteries

1.INTRODUCTION

There are so many types of Bike that came to influence in this existing world. Their operating systems are based on the fossil fuel systems. At present, the fossil fuel can exceed only for a certain period and it also becomes costlier, scares and creates environmental issues. Due to these constraints, alternate fuels and other source of energy such as solar, wind, etc., bringing the automobile industry to the next level. Hybrid vehicles are becoming more now-a-days. Their performances are more than the existing conventional vehicles. Also the electric vehicles are developing rapidly. These electric cars have both pros and cons. The main advantage is that it does not require gas, doesn't cause emissions and also more cost effective. Its disadvantages are that longer recharge time**,** battery replacement**,** recharge points are less. Due to these problems in this vehicle, we have made an attempt to design and fabricate a self charging electric vehicle. Generally the electric motor driven vehicles draw power from a battery and will run based on the charging capacity of the battery. It have to be charged at the time only when vehicle is in stationary condition. To break through, we have designed our vehicle which will generate power by itself while the vehicle is in running condition and the battery is getting charged simultaneously. This is done by connect a Electrical Generator with motor which generate current when the vehicle is in running condition and will be stored in the battery.

Usually a vehicle consists of four wheels and it will be powered by an internal engine. Automobiles are used to transport from one location to another. Automobiles generally use gasoline to fuel the internal engine, but technological advances have led to the design of cars that run on electricity and even water.

It will not add turban Department of Management Studies, MSRIT Consumer Awareness and Perception towards E-bikes pollution. The only thing required is to keep this bike charged with a battery .Electric bike manufacturing is considered as a grass root movement away from fossil fuels. Definitely, electric bikes are not the only answer to our environment problem, but it definitely will help us to treat environment better.

This electric bike will not make pollution worse and that makes e bikes environmentally safe vehicle .It can be charged with the help of inverter and generator too. It also makes no noise while under operation. The best part of electric vehicles is that they can be run with no registration and license.

Major Problem Faced By "IC Engine" & "Electrical Charging Bike"

1. Main problem is pollution, which is very complicated and hard to deal with .Large amounts of harmful pollution : Nox, Sox, CHn, O_3
2. Lack of fossil fuels that is mineral oils are running out in next 50 to 80years.
3. Less efficient (30% to40% for petrol or diesel engines)
4. High need for maintenance (oil, abrasion, friction, etc…..)
5. It's quite difficult to fast-charge your bike
6. The range of an E-bike is the distance that the bike will run on a single charge E-bike have low rang

2. LITERATURE REVIEW

Haw wang and **Arish Balasubramani,** in the year 2018 published the paper titled as "Optimal Planning of Renewable Generations for Electric vehicle charging Station". This paper has reviewed that electric vehicles (EVs) have grown rapidly and are widely deployed to enable a sustainable transportation system. One of the key challenges is how to optimize the sizing and operation of the charging stations to meet the ever-increasing EV demands. Renewable energy resources from solar and wind can provide clean power to meet the EV charging demand. The proposed framework can determine the optimal capacity of renewable energy generation, and the optimal scheduling for power supply, in two stages. The arrival patterns and demand profiles of EVs using real-world data to facilitate a practical EV request model. Numerical results demonstrate the optimal planning for a renewable-powered EV charging station.

Kartik S Mishra, Shubham V Gadhawe and **S. B. Barve,** in the year 2016 published the paper titled as "Design and Development of Solar vehicle" and has reviewed that a solar bicycle is an electric vehicle that provides that alternative by harnessing solar energy to charge the battery and thus provide required voltage to run the motor. India is blessed with nine months of sunny climate thus concept of solar bicycle is very friendly in India. Hybrid bicycle combines the use of solar energy as well as the dynamo that runs through pedal to charge the battery to run the bicycle. Two or more Photovoltaic cells may be used to harness solar energy to generate voltage to charge the battery. Thus solar hybrid bicycle can become a very vital alternative to the fueled automobile thus its manufacturing is essential.

Ajit B. Bachche and **N. S. Hanapure, ,** in the year 2019 published the paper titled as "Smart Self Charging in Electrical Vehicle" have studied the fuel prices is rising steadily day by day. The pollution due to vehicles in heavy traffic cities and urban areas is increasing steadily. To overcome these troubles, an effort regarding this is made to search some other alternative sources of energy for the vehicles. It is not possible to purchase costly vehicles by poor peoples. Keeping this in mind, a search for some way to provide these economically poor people and also to provide a solution for the environmental pollution was in progress. The solar panels placed on the carriage will charge the battery and which in turn drives the wiper motor. When the vehicle is idle, the solar panel charges the battery. This arrangement is used to replace the arrangement of petrol engine, the gear box and the fuel tank.

M. Bilal Chouhary, in the year 2016 published the paper titled as "Solar Powered Electric vehicle" the solar powered electric bike will be demand of near future. As by using solar powered bike, it will save non-renewable sources. The basic principle of this solar powered electric bike is to store energy in battery and used it after charging. Nearby all electric bikes uses AC powered to charge. First AC power is converted into DC power through inverter and it includes power losses. By replacing AC Drive to DC Drives, the charging time is reduced and maintenance of AC drive is more difficult as compare to DC Drive.

R. D. Belekar, in the year 2017 published the paper titled as "alternator charging system for electric vehicle". IRJET paper of Yash Khandekar and Prathamesh Kulkarni introduces the concept of generator based alternate charging and discharging system. In this concept the generator is used as charging system. Initially there is some power stored in the batteries which will supply energy to the motor and hence the rear wheels will be operated and the car will run. Due to the car's motion, generator which is placed in the front will supply electricity to the batteries via a DC to DC Boost Converter to the batteries. Battery will get charged and provide power to the motor hence completing the cycle.

Józef Gromba, in the year 2017 published the paper titled as "Torque Control of BLDC Motor for Electric Bicycle" 2018 European Union, the paper focuses on using the BLDC motor as electrical bike drive. As of today on the market there are already different methods of controlling electrical motor of a bike. The most common is setting the motor's speed with a lever mounted on handlebars. Controlling motors torque instead of speed makes new principle of how the drive works. Proposed method of control is based on controlling the motor torque in such a way that allows the user to set a desired torque value keeping the force on bike pedals constant. This article covers different methods of controlling the BLDC motor, analysis of electrical bike movement, methods of calculating the load torque, controlling electromagnetic torque of the motor, simulations and laboratory research.

3.PROJECT OBJECTIVES

We will do,

- Range Extension of Electrical Bike with self charging system.
- Automated electric Bike.
- Self-generating and self-charging Bike.

4. PROJECT OUTCOMES

- With the help of self charging Bike the range is extended.
- By use of Automatic Change over switch,it can automatically select the battery between the fully charged and discharged battery while vehicle is in running condition.
- With the help of help of self charging we reduced the time it took to charge the battery at the charging station.

5.BLOCK DIAGRAM

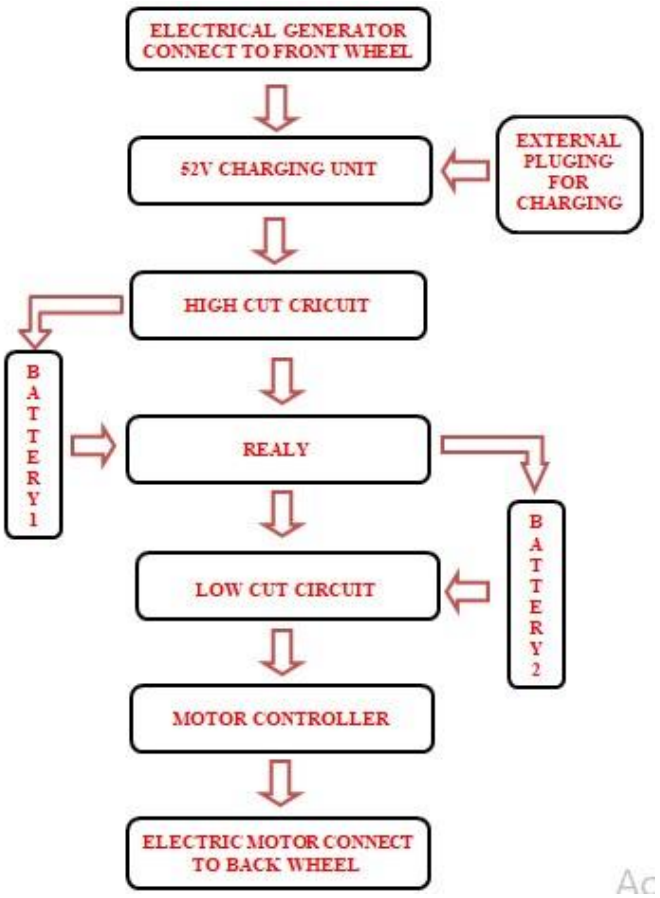

Fig.1 Main Block Diagram

6.WORKING

As per black diagram there are two hub motors are used. One for generation of electric power which is connected to the front wheel of and another motor is condrive which is used as drive which is connected to the back wheel.Back wheel is directly of works on battery 1 or battery 2 through motor controller unit as per battery voltage.

Front wheel generates 52 v. DX supply which is given to the charging unit.Another external charging socket is provided to change battery when both batteries are discharged.When bike not used for long time it may discharges both batteries,at that time external charging socket is used for charge the battery. Charging unit converts the 52v supply in smooth DC which is given to the charging controller unit.

Charging controller unit consists of High cut circuit, Relay and Low cut circuit.

i.High cut circuit:- At the time of charging of battery, it prevents the battery from over Charging.

ii.Relay: - It automatically selects bettery as vtg level of both batteries.
iii.Low cut circuit:- when bikes running, only that time,this unit prevents prevents the battery deep discharging.

Both batteries are connected to high cut circuit and low cut circuit thorough relay to avoid over charging & deep discharging.Motor controlter is used to regulate speed in proper manner. It controlles motor voltage to increase or decrease the speed of bike.

6.BIKE AUTOCAD DESIGN

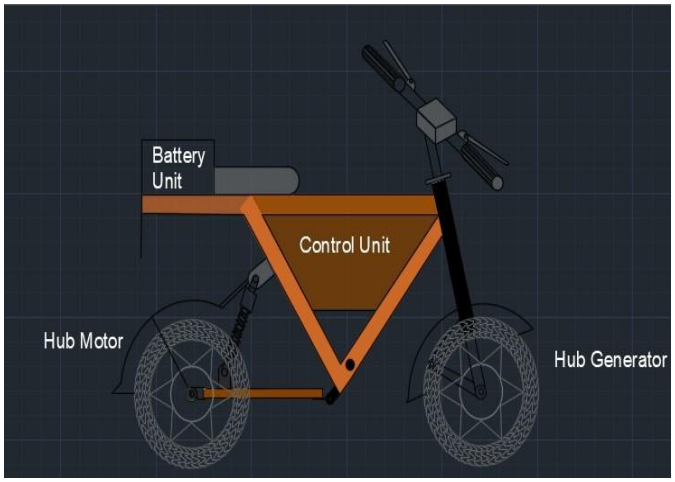

Fig.2 AutoCADD Design

7. COMPONENTS DETAILS

7.1 Electronic Components

- **E-Bike Charging Unit**

Fig.3 Charging Unit

The MPSB005 is an evaluation board for Lithium-ion chargers typically used in the e-Mobility applications. It also can be used as general Power Supply Unit with minimum

changes. The solution is based on a PFC+LLC combo solution from a single integrated circuit with digital control (PFC). This solution offers an excellent relation performance-cost-space by avoiding the use of low frequency filters. Synchronous Rectification (SR) is included instead of diodes to increase the efficiency, besides, a constant current constant voltage control (CC-CV) that operates to guaranty a proper charge of the battery.

Combining HR1203, MP6924, MP26085 and the MPS LLC-Design web tool all system requirements can be accomplished. Also, high power density and excellent performance with low cost BOM are shown.

Lithium-Ion batteries usually bring a Battery Management System (BMS) to maintain the battery in its safe operating area. This charger can interact with this type of system through a 5V output presence signal. MPSB005 also implements a Soft Connection Control (SCC), with minimum components, to avoid high current spikes in the output connection. This spikes typically triggers the BMS over current protection. SCC is achieved by balancing the converter voltage with the battery one before closing the relay. If extra control is needed the user can solder J4 connector and attach an MCU. Then direct interaction with current and voltage sensing signals as well as the relay control are possible..

Features

-Wide operating input range (from 90V to 265V)
-350W rated power and constant voltage output
-High efficiency up to 93%
-High power factor (PF)
-Overload protection (auto-restart mode)
-Over-voltage protection (OVP)
-Anti-capacititive mode protection
-Soft connection control (SCC)

- **Motor Controller**

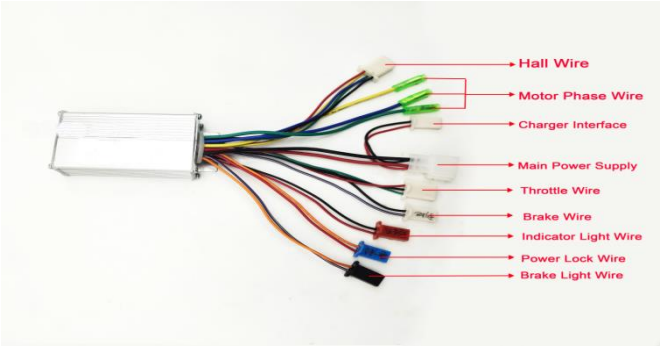

Fig.4 Motor Controller

This application note describes a controller for a 350 W, 48 V Brushless DC Hub motor used to power an electric bike Microcontroller unit(MCU) and associated circuitry to implement motoring control, regenerative braking, and fault protection. As its name suggests, the controller controls the amount of power supplied to the motor.

The controller is rated at 48 v and 30 a and was included in the ebike conversion kit. A delay chip supplies power to the motor at timed intervals, and different coils in the motor are powered each time as the motor turns to align with the permanent magnets in the housing. Note that this controller has a one-way relationship with the battery and motor, meaning that it does not do regenerative braking.

- **Throttle**

Fig.5 Throttle

The throttle was included in the controller kit. It is a half-twist throttle. Throttles can work in several ways, but the most common and simple way is as follows. Inside the handle is a Hall-effect sensor which can supply some voltage in response to change in magnetic field. As the handle is twisted it changes the Hall-effect sensor's proximity to a magnet, thereby changing the voltage produced by the sensor. This is interpreted by the controller and the power supplied to the motor is varied.

7.2 Electrical Components

- **Electrical Hub Motor**

Fig. 5(a) Electrical Hub Motor with Wheel

Fig. 5(b) Internal Parts of Electrical Hub Motor

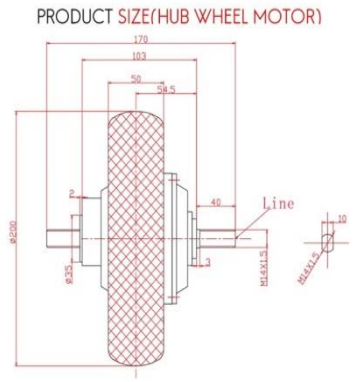

Fig. 5(c) Elevation of Electrical Hub Motor

Fig. 5 Electrical Hub Motor

Hub Motor Principle: (Fleming' s right-hand rule):

" A rule stating that if the thumb of a right hand is oriented along the same axisas the current flow through a conducting wire,that the fingers of this hand will curl along the same direction as the magnetic field produced by the wire. For a conducting wire moving through a magnetic field, a rule stating that if the middle finger,indexfinger, and thumb of a left hand are extended at right angles to each other, that the middle finger will indicate the current flow, the index finger the direction of the magnetic field, and the thumb will indicate the direction of the movement of the wire. This rule also applies if the conducting wire is substituted by an electronbeam."

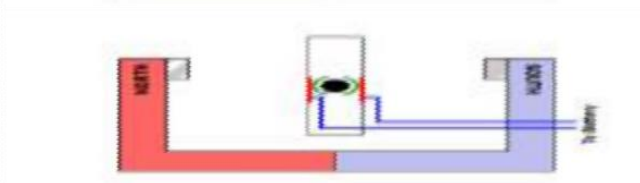

Fig. 6 Working and Operation Of Hub motor

Working and Operation Of Hub motor

The wheel hub motor (also called wheel motor, wheel hub drive, hub motor or in-wheel motor) is an electric motor that is incorporated into the hub of a wheel and drives it directly. In a typical DC motor, there are permanent magnets on the outside and a spinning armature on the inside. The permanent magnets are stationary, so they are called the stator. The armature rotates, so it is called the rotor.

Specification Of Hub Motor

Power	:	750W
Volts	:	48 V
Amps	:	7 Amp
Speed	:	650 rpm
Type	:	brushless motor
Poles	:	4
Weight	:	15kg

- **Electrical Hub Generator**

Fig.7 Electrical Hub Generator

Mechanical energy is changed into electrical energy in case of dynamo. When a coil of wire is rotated in the vicinity of magnetic field then magnetic flux will be cut. This would cause an induced Emf in the coil and this phenomenon is known as electromagnetic induction.

The movement of another body is transmitted to a rectangular coil of wire that is inside a U-Shaped magnet. The motion of this coil of wire cuts the magnetic flux in the magnet. Faraday once stated that-Whenever there is a change in magnetic flux linked with a circuit there is an induced current and the strength of this induced current is directly proportional to the rate ofmagneticflux-.So according to this rule when the magnet is in motion it is constantly cutting the magnetic flux, and as it does this there is a current that is induced (eddy currents). However a dynamo can either be A.C or D.C according to the brushes and number of commentators used (Fle mings Right- hand rule). If we refer back to Faraday's rule it says that the strength of this induced current is directly proportional to the rate of magnetic flux. This rule can be seen practically in a bicycle that has a dynamo. The faster the rider rides the

faster the change in magnetic flux and hence the brighter the light.

Dynamo is just the opposite/reverse action of motor operation. When a conductor is moved across a magnetic field, there induces an Emf (voltage) across conductor terminals so as it opposes the change of flux (Lenz rule). Dynamo is constructed with a cylindrical permanent magnet (which rotates at the center) amidst windings that we take the voltage output from. when the magnet rotates its flux path changes relative to the windings and across the winding there exists an electro-motive-force as a voltage.

- **Electrical Battery (Lithium-Ion)**

Fig.8 Electrical Battery (Lithium-Ion)

A type of a battery composed of Lithium, the lightest metal and the metal that has the highestelectrochemical potential. Lithium, however, is an unstable metal, so Lithium-Ion batteries are made from Lithium ions from chemicals. Because of its lightness and high energy density, Lithium-Ion batteries are ideal for portable devices, such as notebook computers.In addition, Lithium-Ion batteries have no memory effectand do not use poisonous metals, such as lead, mercury or cadmium. The only disadvantage to Lithium-Ion batteries is that they are currently more expensive than NiCad and NiMH battery packs

Principle And Working Of Lithium-Ion Battery

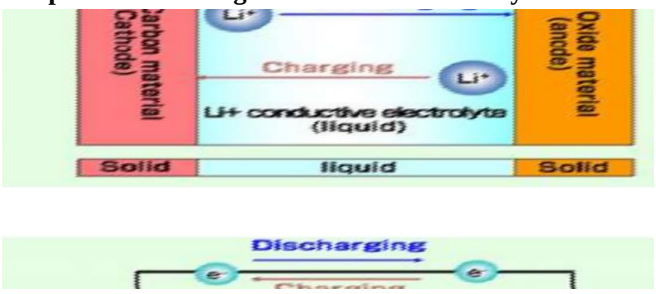

Fig.9 Principle And Working Of Lithium-Ion Battery

The working principle of lithium-ion battery is that its charging and discharging. When charging the battery, the battery on the positive ion generation, generation oflithium-ion movement through the electrolyte to the cathode. As the carbon cathode layered structure, it has many pores, to reach the negative electrode of lithium-ion embedded inporouscarbonlayer,the more embedded lithium-ion, the higher the charge capacity.

When the battery discharge, embedded in the negative ion of carbon layer prolapsed, and movement back to positive. Back to the cathode of lithium-ion more discharge capacity is higher. Commonly referred to as battery capacity refers to the discharge capacity. Lithium-ion battery charge and discharge process is positive→ negative→ positive.

- **External Charging Socket :**

An Electric Vehicle charging system comprises of a charging cable from main power inlet to the charging socket mounted on the Vehicle, with an in-built RCD for protecting the Driver, Vehicle Charger & other electrical parts from different failure modes. The Vehicle Side Socket is internally connected to the Charger with a harness specific to the vehicle requirements.

This equipment is suitable for the recharging of electric vehicles, at home or work, when traveling and can recharge the vehicle by plugging into the nearest available 230 VAC supply outlet.

Fig.10 External Charging Socket

The vehicle side assembly consists of the Charging Socket & the Harness connected to the Charger inside the car, & serves as the charging point for the vehicle.

Technical details.

Current	16A
Voltage	230 Vac
Type (Three wire system P,N,E)	3 pin single phase
Contact to terminal pins	Wire will be connected

7.3 Mechanical Components :

- **Two-Wheeler Chassis**

Chassis is a skeletal frame that supports all the components like motor, suspension, tires, brakes etc., Chassis/frame of an automobile is considered as one of the most significant components. It is the most significant component that provides strength and stability to the vehicle. Automobile frame provides strength and flexibility to the automobile. The supporting frame is the backbone of the automobile, was body of the motor, tires, suspensions etc., are affixed. The chassis structure must support the vehicle components and distribute the longitudinal, lateral and vertical loads. Many factors like material selection, strength, weight and stiffness are considered for the design of chassis.

The main objective of the chassis is to provide connection between the front and rear suspension without permanent deformation. In this study diamond shaped chassis is designed, analyzed and optimized. Ranctangle are used to build the chassis. Tube cross-section and material property play a major role in maintaining strength and weight of the vehicle. So, outer diameter, thickness of the tube and yield stress of the material are taken as the input design parameters. All the design parameters were chosen in three levels each based on the manufacturing conditions in the market. Strength to weight ratio is the output parameter of the chassis obtained for the different level of experiments.

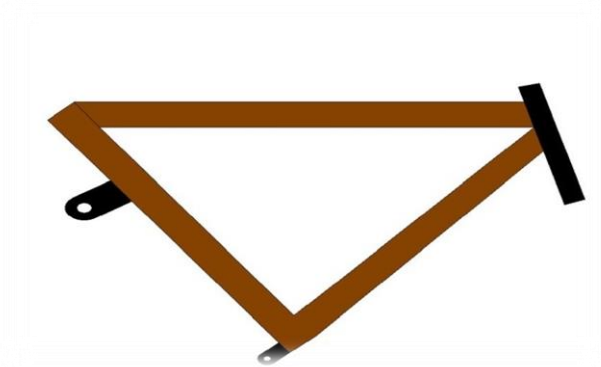

Fig. 10(a) Main Frame

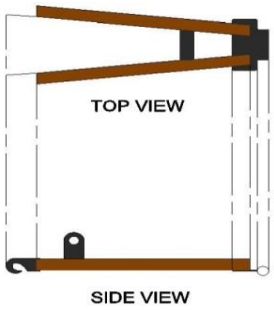

Fig.10(b) Back Wheel Connecting Support System

Fig.10 Bike Chassis

- **Braking System**

Fig.11 Braking System Attached With Hub Motor

For the braking system it is convenient to use braking system used in hand brake system which consist of spring loaded friction- shoe mechanism, which is driven with the help of hand lever.

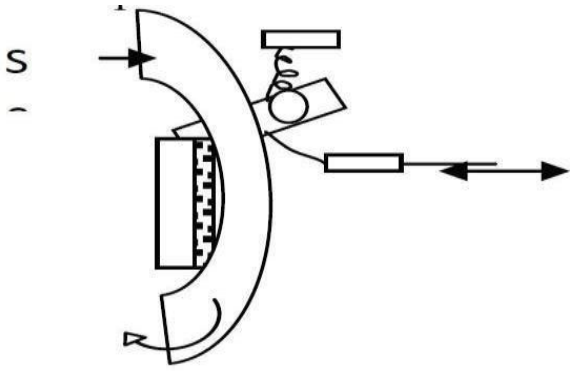

Fig.12(b) Structure of Braking System

Fig.12 Braking System

8. CONCLUSION

Thus the self-charging electric Bike was fabricated. This Bike is very feasible for day-to-day travel similar to motorbike. The Bike is much comfortable which supports the driver for easy riding. It is very less weight compared to a vehicle and provides better safety. This project provides flexibility in operation and noiseless operation. The scope of this project lies in fully determining and understanding the functioning of car. This project gives solution to the old problems, where the most common problem arising from existing electric bike is the recharging system.

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