DEVELOPMENT AND FABRICATION OF REGENRATIVEELECRTIC BICYCLE

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Abstract: This paper gives an outline of the new work of electric vehicle in the locale Electric vehicles are a significant choice for diminishing outflows of ozone harming substances. Electric vehicles not only lessen thereliance on fossil fuels, but they also lessen the impact of substances that deplete the ozone layer and encouragethe widespread use of renewable energy sources. The design, analysis, and production of the regenerative EVbicycle body and chassis are discussed in this paper. The design, analysis, and production of an EV bicycle's body and chassis are the project's goals in order to achieve the lightest and lowest-cost design possible. The software Solid Works is used to design the bicycle's chassis. The greatest relocation size, anxiety is analyzedbetween EV bike suspension. The bicycle that refuels itself. Planning and manufacturing space outline suspension structure requires a bunch of information particularly in plan, material choice, metal joining and creation which bring about unbending, tough, and serious body plan. This undertaking just spotlights on the investigating the underlying frame plan and examination. Solid Works software is used for the modeling. However, ANSYS is used for the analysis. The integrated chassis of a two-wheel electric vehicle, which should be more aerodynamic and capable of traveling long distances, is the primary focus of this project.

Keywords: Fabrication, EV bicycle, analysis, and SolidWorks software

I. Introduction:

India is one of the main ten auto markets in this present reality and has an exceptionally expanding working class populace with purchasing potential and consistent financial development. However, over the past two years, the price of gasoline has increased by more than 50% in 13 distinct steps. As a result, India may have a demand for alternative automotive technologies like electric vehicles (EVs). There are a few natural and financial factors contributing to the growing interest in alternative vehicle innovations. According to the tests, there is a limited supply of non- renewable energy sources like oil, flammable gas, and coal. Additionally, the cost of fuel, particularly gasoline, is skyrocketing to approximately 100 rupees per liter [1]. In a similar vein, the contamination caused by gasoline-powered automobiles in urban areas and communities continues to grow. As a result,novel approaches have recently been developed to address this issue, such as the electric bicycle transformation, orconversion of electric power intomechanical power. In 1999, Karen et al. [2] had developed an electric vehicle that combined a conventional internal combustion engine with a comparable HEV framework by employing a simulation package. He then presented a simulation and modeling package at Texas A&M College that was written in the MATLAB graphical reproduction tool. Where fuel consumption, carbon outflow, and unpredictability have been taken into account, they are all examined for each vehicle. The total cost per kilometer traveled by an electric bicycle—which includes the cost of energy, purchases, andupkeep—is less than 0.7 cents, compared toRs. for a gasoline scooter, 2.5/km

A novel design scheme for the design of electric vehicle propulsion systems that require a high-power density was developed by Ma Xianmin[3]. The proposed numerical models for an electric vehicle are based on the vehicle's dynamic characteristics. The entire structure has been divided into seven capacity blocks according to the power stream. The models are then recreated usingthe MATLAB tool, and the results have been successfully demonstrated for EVs. Nitipong Somchaiwong and Wirot Ponglangka [4] proposed "Regenerative Power Control for Electric Bicycle," which uses a PM brushless dc motor inside the wheel establishment. The regenerative force prevented a DC-connect overvoltage condition, resulting in this framework. This method is used to check the motor's remaining energy while the motor was suspended to brake off. This suggests using the motor's reflected voltage to evaluate the voltage that is supplied to the motor. Cuddy and Keith [5] conducted a similar experiment, and an adaptable Propelled Vehicle Test system (Guide) isused to characterize and evaluate hybrid vehicles that may become available in the coming decade. An innovation diesel-powered internal combustion engine is compared to the fuel economy of two diesel-controlled hybrid vehicles. The comparable crossover is 4 percent more fuel efficient than the series hybrid and 24% more fuel efficient than the internal combustion engine. A hybrid electric vehicle was designed and developed by Daniel [6].The suggested name of "Hybrid Electric Vehicle Design" suggested that it worked well in electric mode and left the possibility of a hybrid conversion open. He did a reproduction on PSCAD/EMTDCand approved the recreated results utilizing the equipment. Ch. G. Adinarayana A hybrid petrol-electric vehicle with electric start and gasoline run is the subject of an article by Ashok Kumar and M. Ramakrishna [7]. A hybrid vehicle is one that can run on two or more power sources at the same time. TVS Scooty is the vehiclethat is used for the hybrid system. It has internal combustion engines, connects the front wheel motor to the forks through arc welding, and a power booster connected to an ultra-saver kit regulates the voltage. Additionally, a series of four batteries housed between the engine and seat. A pilot project, a solar charging station, was designed by Fred Chiou [8] and has been implemented on the Weber State University campus. The primary objective of this project is to construct a demonstration solar- powered charging station for electric bicycles and electric cruisers. It will also provide the student with hands-on training in solar-based energyapplications and create maintainability by utilizinga renewable power source.

II. Basic scheme:

1. The proposed electric vehicle concept is relevant for spots where the gasoline price and diesel are high and the rate of flue gas emission is high.

2. This scheme uses an electric generator to generate electricity.[9]

III. Working operation:

The induction of an electromotive force by the motion of magnets across a conductive material by a change in magnetic flux in a magnetic field is called "Electromagnetic Induction". Based on the principle of the Electromagnetic Induction, we transform the front wheel of the EV into a system by inserting and positioning the magnetic field and the conductor in it, where the magnetic field is varying and the conductor is stationary or vice versa. When the EV is in motion, the wheel is also in motion. So, the magnetic field around the conductor varies which generates an EMF (electro motive force) and current is generated. This current can be used in recharging the same battery or the backup battery used for other purposes. This recharging of the battery will for sure increase the travel range of the EV and save the battery cycle life. Here for the motivation of prime mover the chemical reaction takes place.

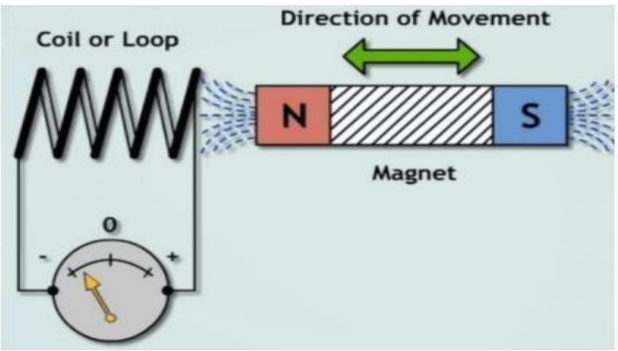

Fig:1 Magnetic Induction

The electric motor gets its power from a controller and the controller gets its power from rechargeable battery. The electric vehicle operates on an electric/current principle. It uses a battery pack (batteries) to provide power for the electric motor. The motor then uses the power (voltage) received from the batteries to rotate a transmission and the transmission turns the wheels. Four main partsmake up the electric vehicle: the potentiometer, batteries, direct current (DC) controller. The three main component of electric bike are electric motor, controller and battery. When you switch on the bike, the current is passed from the battery. The controller takes power from the battery and passingthe current to motor, before passing the current to motor.

IV. Configurations of Electric Vehicles:

The internal combustion engine, fuel tank, andelectric motor drive were all removed from the previous ICEV, leaving only the battery pack and electric motor drive.

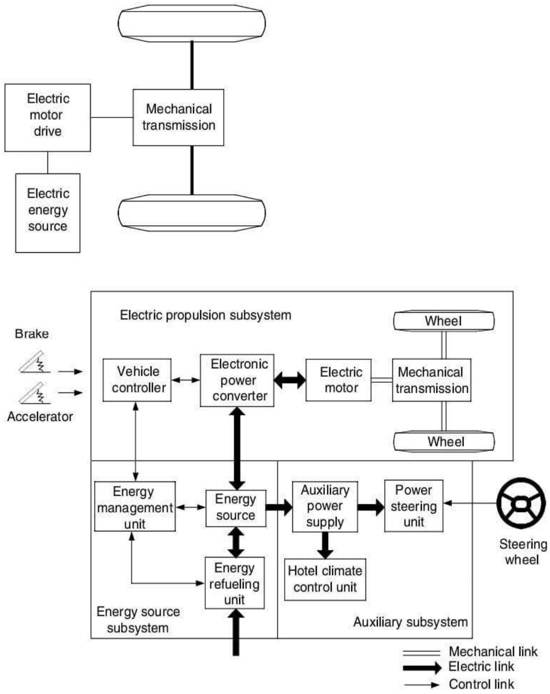

Fig:2 Conceptual Illustration of General EV Configuration

As depicted in Figure The use of this kind of electric vehicle has declined due to drawbacks like its heavy weight, decreased flexibility, and deteriorating performance. The current EV, on the other hand, is constructed using original body and frame designs. This makes use of the greater adaptability of electric propulsion and meets the structural requirements that are unique to EVs.

V. Description of parts and theirfunctions:

i. Battery Management System:

A battery-powered system's safety, effectiveness, and dependability are all guaranteed by a BMS. Over the past two decades, a lot of research has been done on BMS, and battery systems' safety, effectiveness, and dependability have all improved significantly [25,26]. However, there are still obstacles, and in this paper, we list those obstaclesand offer some suggestions for how to overcome them.

Fig:2 Battery Management System

Over time, there have been two schools of thought for battery management systems: One attempts to model the battery using electrochemical models, while the other uses electrical equivalent circuit models (ECMs) [11, 12]. However, due to them simplicity, the electrical ECM-based approaches are utilized by the majority of practical systems. The current BMS faces three types of research difficulties: reliability, efficiency, and safety Thermal runaway are an irreversible chemical process that can occur in lithium-ion batteries under a number of conditions, including high temperature and overvoltage. The effectiveness of energy storage in batteries is impacted by a wide range of factors; Particularly, applications for electric vehicles try to increase efficiency in every way possible. The percentage of total energy required for charging, for instance, is known as charging efficiency [14]. The need for fast charging causes a lot of heat to be wasted energy. In a variety of ways, BMS algorithms attempt to increase batteries' efficiency; The goal of the best charging algorithms is to reduce heat loss and health deterioration; By assisting in the creation of minimal battery pack configurations that are based on particular requirements, precise SOC estimation algorithms will help to improve efficiency. It is known that over time, individual cells in a battery pack become imbalanced, resulting in safety and reliability issues; In Li-ion batteries, short circuited cells are another common cause of safety and reliabilityissues [15].

ii. Wiring:

A high-voltage battery and motors make up most of an HEV or EV's electric drivetrain. They are associated by high-voltage wiring saddles toperform power move. These high-voltage wiring harnesses have been manufactured by Sumitomo

Electric Industries, Ltd. for nearly two decades. In addition, as part of the electrification trend, Sumitomo Electric is pushing for the creation of high-voltage wiring harnesses with the intention of increasing the motor power of HEVs, reducingweight to increase fuel economy, and expanding their use to EVs. An under-floor wiring harness is the high-voltage wiring harness that connects the inverter and high-voltage battery. The wires in this harness are quite long. A power cable is the high- voltage wiring harness that connects the inverter and motor, and its wire length is relatively short. In order to prevent electromagnetic noise from affecting the electronic devices and signal lines that surround the high-voltage harnesses, shielding is required. Because the under-floor harness ispositioned beneath a vehicle's floor, the protector that shields wires from external damage like stone chipping is crucial. The protector is made of metal pipes and resin protectors. Based on this trend, Sumitomo Electric developed two products. One is a power cable that is smaller and lighter. The power cable's wire length has been reduced from approximately 100 cm to approximately 10 cm. The other is a direct connector with high-voltage connectors that connects the motor and inverter directly. Depending on the vehicle's characteristics, these two products are used.[16]

iii. Disc Brake:

A novel type of vehicle is the electric vehicle. It is comparable to a motorcycle in terms of load and maximum speed. Currently, the front and rear wheels are equipped with drum brakes, but them braking performance is subpar. The drum brake is rapidly heated, resulting in rapid brake force and heat attenuation, difficult heat dissipation, and extremely unstable brake; at the point when drum brake is running, water will enter drum brake on blustery day or sloppy street surface, which bringsabout the decline of grinding coefficient of drum brake, however with the increment of time, it will cause water downturn; and the drum brake becauseof its unique structure.

Fig:3 Brake Disc

Mud and water are difficult to remove from the differential, which is essentially installed in the wheel hub, and the drum brake is constantly in use,resulting in poor water recovery. In an electric vehicle with hydraulic disc brakes, the brake disc isdirectly attached to the wheel drum. There is no brake disc. The erosion surface of the brake circle for the most part plans a ton of intensity sink openings. The hydraulic disc brake's heat sink performance is enhanced by the motion of the vehicle because the heat sink holes are oriented in the same direction as the wheel. The hydraulic disc brake, on the other hand, uses a heat sink when braking. Drum brakes have a much larger back. The design of a drum brake is simpler than that of a disc brake, it is simpler to arrange and install, and its production cost is lower. However, it is less dependable than hydraulic disc brake and lacks the aesthetic appeal of disc brake. However, the future trend is to replace drum brakes with hydraulic disc brakes due to the industry's ongoing development and consumer demand for braking performanceand braking distance.[14]

iv. DC to DC Converter:

The main obstacles to the development of EVs were limited storage capacity, inefficiency in conventional energy conversion (fossil fuel to AC, AC to DC), and high cost. EVs increase the powersystem based on load electrical consumption, and an accumulation of a large fleet of EVs can form virtual power plants (VPPs) and supply the power system with ancillary services. All of these issues are currently being alleviated by introducing new technology-based solutions.

In AC types, the conventional sources are more prevalent. They are put in the system with loads forAC. Therefore, in order to make use of the AC energy generated by the sources, electrical vehiclesthat require DC voltage should be accompanied by AC/DC converters. Most of the time, electrical vehicles are connected to the grid through voltage sourced inverters. Although adding a converter increases total costs, AC-type distributed generations can be optimally sized and positioned within the system to reduce costs and energy losses.Additionally, distributed generations of a smaller size can be used in smaller systems with electric vehicles as loads. Additionally, these sources can be optimally placed to reduce energy losses inelectric loads and vehicles.

Fig:4 DC to DC Converter

DC/DC converters are required to connect the majority of these electric vehicles to the grid because they are of the DC type. In industrial settings, a variety of converters are utilized. They can be Buck converters, Boost converters, Flyback converters, and so forth. Two switch forward converters are suitable for use in electric vehicles because their primary function is to convert DC voltages into DC voltages. The main reason to use this converter is that it makes the system work more efficiently and costs less for industrial and commercial use. In addition, as with isolated DC/DC converters, the system's switching frequency should be increased to reduce the size ofcapacitors, inductors, and transformers in order to achieve high efficiency.[17]

V. Battery:

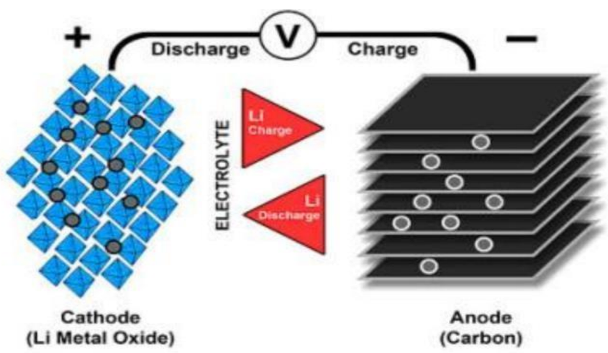

Fig:5 Charging and Discharging of Battery

EV batteries are very not the same as those utilized in shopper electronic gadgets, for example, workstations and phones. They must be able to handle a lot of power (up to 100 kW) and a lot of energy (up to tens of kWh) in a small, light, and affordable package. The Li-Ion batteries are the most usable batteries comparing the Lead-Acidbatteries.

B. Types of Li-Ion Batteries

1) Lithium Cobalt Oxide ($LiCoO_2$)

2) Lithium Manganese Oxide ($LiMgO_2$)

3) Lithium Iron Phosphate

4) Lithium Nickel Manganese Cobalt Oxide

5) Lithium Nickel Cobalt Aluminum Oxide

Fig:6 Battery Pack

$LiFePO_4$ has the more cycle life than Lithium-ion polymer batteries, therefore the durability is greater. $LiFePO_4$ are less degradation and long life because their greater cycle life. Due to the chemistry of this battery its harmless to the Environment, so we can use EV's. $LiFePO_4$ has the safest lithium chemistry. This battery has excellent efficiency and performance, Chargeefficiency is great and it will reach full charge in just 2 hours or less. $LiFePO_4$ batteries are totally light-weight and small in size.[18]

X. THERMAL MANAGEMENT:

The capacity of an electric vehicle's battery and itscore temperature have a significant impact on its performance. m. The charging and discharging rates of a battery are significantly influenced by its temperature. Because of this, an EV battery pack's thermal management is very important. Energy-dense packs must use robust cooling systems, often liquid cooling loops with hundreds of channels. The cost of these systems rises due to their complexity, which accounts for between 10 and 20 percent of the battery pack's total cost. Dueto their high energy content and tendency to self- heat once the electrolyte reaches a certain temperature (70° to 130° C), lithium-ion batteries are particularly vulnerable to thermal runawayevents. Due to their operating conditions and charge state, Li-Ion cells naturally deteriorate over time. Temperature significantly affects the proficiency of practically all batteries.

The basic types of BTMS are listed below.

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1. Air cooling
2. Liquid cooling
3. Direct refrigerant cooling
4. Phase change material cooling
5. Thermoelectric cooling
6. Heat pipe cooling

AIR COOLING SYSTEM:

Air serves as the thermal medium in air systems. The intake air could come directly from the cabin or the atmosphere, or it could be conditioned air from an air conditioner's evaporator or heater. An active air system is distinct from the former, which is referred to as a passive air system. Dynamic frameworks can offer extra cooling or warming power. Because air is supplied by a blower in both cases, they are also referred to as forced air systems [19]. A passive system can provide power for cooling or heating of up to hundreds of watts, whereas an active system can only provide power of one kW.

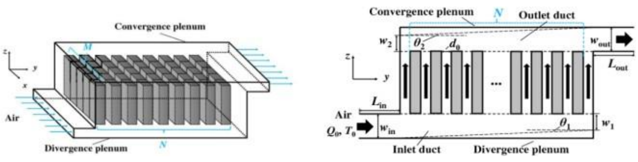

Fig:7 Battery Cell Cooling …33Arrangement

XI. DESIGNING THE REGENERATIVE SYSTEM:

Non-conventional energy or alternative fuels are required to safeguard the environment. The majority of the local electric bikes are equipped with a controller, a blonde weight chassis, a brushless DC motor for the rear wheel, and a leadacid battery pack. There has been an issue with battery charging time which is 6 to 8 hrs. and Further more normal speed of the E-bicycle is 20-25km/hr. In light of these drawbacks, the author of this paper modified a conventional gasoline vehicle with an electric DC hub motor, controller, and alternator for electricity generation. During the design and analysis, the following assumptions are taken into consideration:

- Improved battery life
- Lessen time of charging
- High Current Capacity
- High Density of power
- Simple Charging Method
- High Efficiency [20]

XII. Conclusion:

In order to find a new mode of transportation, we must switch to alternative resources like electric bikes and others as our consumption of natural resources like gasoline and diesel rises. The fact that it is environmentally friendly, noiseless, and free of pollution is the most important feature. The most practical option for mitigating environmental pollution is to use an on-board electric bike. In the event of an emergency, an AC adapter can be used to charge it. It is easier to break down into smaller pieces because it has fewer parts, so it needs less maintenance. Compared to vehicles with an internal combustion engine, electric vehicles offer numerous advantages. It works much better and cleaner; However, there are downsides to it as well. It is heavier, restricted to the distance it can go before re-energize, and costs more. The EV's future depends on its battery. In this way, the produced flow will be put away in the battery and can be utilized again to run the Electric Vehicle and for different purposes like Head light, markers and starters.

By different combinations of the windings and the strength of the magnet we can obtain the desired output. The travel range of the Electric Vehicle will increase. This will save a lot of energy with no pollution what so ever. The charging time of the battery will be reduced drastically as the battery is continuously self- recharging and it will prove to be helpful for long distances commutators as they don't have to search or stop the EV fora charging station and wait for 2 – 12 hrs., till the battery gets completelycharged.

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