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Fabrication of Electric Bike

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ABSTRACT

Solar powered electric bikes are replacing the heavily polluting internal combustion engines nowadays, provided zero emission transportation in many parts of the world. Tremendous economic growth resulting in increased authorization and spatial expansion of cities are becoming longer and more difficult to make. As a result, our electric powered two wheelers tend to be more efficient and produce less air pollution per km than any other modes, hence it will increase mobility and accessibility to opportunities due to increase in speed and range. Battery powered vehicles are nowadays replacing heavily polluting bikes with 4 stroke engines, provide zero emission transportation just because of time required to charge batteries and lack of charging infrastructure it is not accepted by many people till date. Sustainable and practical personal mobility solutions for cities environments have traditionally revolved around the use of two wheelers, or provision of pedestrian facilities. The main objective of the project is to use outgoing solar energy as a source to run a two wheeled motor bike. This project aims to create a pollution free solar powered vehicle. The main aim of this project is to make a hardware model of Solar Electric Vehicle, with an intention to reduce total carbon emission created by fossil fuel vehicles. We have tried our best to make the vehicle the symbol of greener surroundings. This project is a way of using the outgoing power and producing from solar panel. This project consists of a rechargeable battery pack which powers a light weighted motor unit over the wheel. The solar electric two-wheeler approach is different. To overcome the problem and the weakness, this project needs to do some research and studying to develop better technology. The main aim of this project is to make a hardware model of Electric Vehicle, with an intention to reduce total carbon emission created by fossil fuel vehicles. We have tried our best to make the vehicle the symbol of greener surroundings. It also aims to showcase this vehicle enhances in rapid growing steps towards a green future. The electric vehicle uses Batteries, Motor, Controller, Speed Control Unit, Battery Charger Unit and throttle. To make it success there are several things that we need to know such as what will be the prime mover, how to store it and the advantages of this new vehicle.

Keywords : Batteries, Motor, Controller, Speed Control Unit, Battery Charger Unit

I. INTRODUCTION

Powered electric bikes are replacing the heavily polluting internal combustion engines nowadays, provided zero emission transportation in many parts of the world. Tremendous economic growth resulting in increased authorization and spatial expansion of cities are becoming longer and more difficult to make. As a result, our electric powered two wheelers tend to be more efficient and produce less air pollution per km than any other modes, hence it will increase mobility and accessibility to opportunities due to increase in speed and range. Battery powered vehicles are nowadays replacing heavily polluting bikes with 4 stroke engines, provide zero emission transportation just because of time required to charge batteries and lack of charging infrastructure it is not accepted by many people till date. Sustainable and practical personal mobility solutions for cities environments have traditionally revolved around the use of two wheelers, or provision of pedestrian facilities. However, many cities also experience traffic congestion, parking difficulties and pollution from fossil-fueled vehicles. It appears that pedal power alone has not been sufficient to supplant the use of petrol and diesel vehicles to date, and therefore it is opportune to investigate both the reasons behind the continual use of environmentally unfriendly transport, and consider potential solutions. Two wheeled motor bike. This project aims to create a pollution free solar powered vehicle. The main aim of this project is to make a hardware model of Solar Electric Vehicle, with an intention to reduce total carbon emission created by fossil fuel vehicles. We have tried our best to make the vehicle the symbol of greener surroundings. This project is a way of using the outgoing power and producing from solar panel.

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The solar bike approach is different. The PV panels have enough power and give the two-wheeler an infinite range. The battery is small, and saves weight. Without sun however, the battery can be fast charged en route in about 30 minutes because 12V 12 Ah * 2 Li-ion batteries and 220V AC, 50 Hz, 1.0A charger allow fast charging. Although, we need a location, for instance a cafe that allow us to use the mains. Another method is by charging the battery through a homemade windmill using a fan or a 24V DC fan (a prototype of the fan has been shown in the two-wheeler. The fan is placed above the front wheel of the two-wheeler and is connected to one of the 12V battery placed in the two-wheeler. The battery will be charged while the two-wheeler is running. This way of charging the battery will be very useful during cloudy day. The purpose of the solar bike is not energy saving. A bike is very energy efficient. The cost of the electrical energy that would be needed to cycle a whole day is very less. In terms of energy savings, this is negligible. A solar two-wheeler or tricycle has the advantage of very low weight and can use the riders foot power to supplement the power generated by the solar panel roof. In this way, a comparatively simple and inexpensive vehicle can be driven without the use of any fossil fuels.

The solar electric two-wheeler is easily accessible, safe and practical with limited maintenance requirements due to a minimum of mechanical parts used. It is ideal not only for the experienced cyclists but also for those non-athletes, the elderly and individuals with health problems. A solar vehicle is an electric vehicle powered completely or significantly by direct solar energy. Usually, photovoltaic (PV) cells contained in solar panels convert the suns energy directly into electric energy. Solar power may be also used to provide power for communications or controls or other auxiliary functions. Solar vehicles are not sold as practical day-to-day transportation devices at present, but are primarily demonstration vehicles and engineering exercises, often sponsored by government agencies. However, indirectly solar-charged vehicles are widespread and solar boats are available commercially.

1.1 Electric-Bike:

A brushless DC motor (BLDC) is a synchronous electric motor which is powered by direct-current electricity (DC) and which has an electronically controlled commutation system, instead of a mechanical commutation system based on brushes. In such motors, current and torque, voltage and rpm are linearly related. BLDC has its own advantages such as higher efficiency and reliability, reduced noise, longer lifetime, elimination of ionizing sparks from the commutator, and overall reduction of electromagnetic interference (EMI). With no windings on the rotor, they are not subjected to centrifugal forces, and because the electromagnets are located around the perimeter, the electromagnets can be cooled by conduction to the motor casing, requiring no airflow inside the motor for cooling. The disadvantage is higher cost, because of two issues. First, it requires complex electronic speed controller to run.

1.2 Components Required

- Solar panel
- Two-wheeler frame
- BLDC Motor
- Battery
- Motor controller

1.3 Advantages & Disadvantages

Advantages:

- Maximum output can be obtained.
- It does not cause any environmental pollution like the fossil fuels and nuclear power.
- Solar cells last a longer time and have low running costs
- Low power consumption.
- Conservation of energy
- Utilization of free available source of energy from sun
- Storage of energy into rechargeable battery
- . ¬ Stored energy is used for running hub motor.
- High efficiency can be achieved using inverter

Disadvantages

- Periodic Monitoring and Maintenance is required.
- A drastic environmental change cannot be tolerated by the equipment.
- The entire process of manufacture is still very expensive as silver is used for interconnection of these cells in the solar panel, which is a very expensive metal.

II. Literature Review

Research on e-bikes is adapted based on social-geographical motivations and according to the experiences in those societies. Research mainly emphasizes self-reported beliefs or estimations and information collected from the users. The analyses in Asian countries, mainly China, focus further on safety, market growth and operations among a large volume of e-bikes. Western European studies investigate the impact of e-bikes on human health and the environment (e.g., studies in European countries).

Additionally, there are studies that focus on the impact of e-bikes on emerging markets and the behaviour of this new market (e.g., studies conducted in North-America). Nevertheless, research with survey data is not typical. Recently conducted field studies on e-bikes, mostly in Europe and in the United States, are presented. Most of those analyses focus on the use of the e-bike by users and on the trips' safety conditions. The duration of the studies ranges from two weeks to four years. The typical sample of bikes ranges from just 12 users up to several hundred users. This could be considered a very small number of statistics compared to the millions of e-bike users worldwide. As such, a lot of research might be needed to cover this new field of interest.

Gorenflo et al., **Kiefer and Behrendt**, **Fyhri and Fearnley** Fluchter and Wortmann as well as Paefgen and Michahelles focused, for instance, on usage patterns. Gorenflo et al.conducted a 3-year field trial with 33 sensor equipped e-bikes The so-called WeBike field trial analyzed the usage of the e-bike and the charging status of its battery Results show that e-bikes are mainly used for commuting. Regarding users' charging habits, results showed that participants usually charge their e-bike's batteries just after they return home. It was also noticed that some participants chose to charge their e-bike's batteries later in the evening, just before they go to bed. Moreover, measurements showed that some participants charge their e-bikes while they are at work. Gorenflo et al. (2017) found that the students that participated in this field trial usually let their e-bike's batteries to get totally empty and charged them when the battery status was around 15–45%, while university staff members usually charged their batteries when they were above 70%. Kiefer and Behrendt (2016) used GPS and motor assistance level data.

Dozza et al. (2016) studied e-cyclist behavior and safety issues with e-bikes during trips. The main conclusion of this study was that e-bikes are faster than regular bikes and, consequently, new safety issues might arise during the interaction of the e-bikes with other vehicles on the road. Haustein and Moller (2016) also investigated the e-bike's safety and its involvement in safety critical incidents in Denmark . They conclude that user's attitude, age, sex, education level, e-bike excitement, excitement about speed, riding style and experience on the e-bike, are factors closely related to perceived safety and incident immersion. Furthermore,

Behrendt (2017) investigated evelomobility, based on a field trial with e-bikes conducted in the UK . Kroesen (2017) addressed the question of whether e-bikes can substitute travel by other transportation modes, and to what extent, using data from OViN (Onderzoek Verplaatsingen in Nederland), in The Netherlands. He concluded that e-bike ownership can mainly replace the conventional bikes in The Netherlands, followed by the car or other transportation modes. Wolf and Seebauer (2014) studied the e-bikes' technology adoption, exploring the use of the ebike in different contexts: work, leisure, and shopping. The results of their analysis show that most early adopters are aged above 60 years, and they mainly use the e-bike for leisure trips. Motivations to use the e-bike depend on the user's age.

Mouli et al. (2016) showed that in The Netherlands, there would be a reduction in CO2 emissions from 109 g/km to 70.5 g/km by replacing gasoline vehicles with EVs. Photovoltaic (PV) solar cells have numerous applications in products, and are called 'product integrated photovoltaics' (PIPV).

A commuter's choice for a specific transportation mode for his/her trip is based on the direct benefits that this transportation mode can offer to him/her; namely, in terms of time, comfort, and Other benefits offered to the individual by cycling include improved health, a cheap form of transportation, and even being faster than other transport modes, especially in urban areas, where traffic jams can be avoided. A Danish case study by Haustein and Møller (2016) confirms that people use e-bikes because it is cheaper than other modes, or because it is environmentally friendly

Other reasons why people use e-bikes include their enjoyment of cycling and exercise . Bicycle mode choices of individuals can be explained by weather conditions and climate, socioeconomic factors, trip distance and attitudes towards cycling. Actual differences between e-commuters and regular commuters cannot be found in the literature; nonetheless, important factors playing a role in transportation mode choices can be found. Heinen et al. (2010) claim that the utility theory explains that people's transport mode decisions rely on cost, time, and effort

The negative influence of hilliness, which affects the effort of cycling, is lower for ecommuting than for regular commuting, since e-commuting requires less effort due to the electric support. In terms of time, e-commuting should have a higher probability, since the mean travel speed of e-commuters is higher.

III. Methodology

Solar energy is obtained from the sun using solar panels installed on the rear end of two wheeler. These solar panels are connected to a boost converter thus to step up the voltage to their required capacity. The arrangement is further connected to a DC motor. The battery can also be charged using a wall charger in case of absence of sun. A brushless DC motor is used here because of zero maintenance, high efficiency, and less noise and also the brushes are not being used so sparking in a BLDC motor is avoided. A motor controller is used here for controlling the operation of the motor. Also a throttle is used to raise the speed of the solar two wheeler. This accelerator is directly coupled to the motor controller which controls the speed of the motor. In the absence of sunlight the solar two wheeler can be driven using pedaling.

3.1 Fabrication of Vehicle

Mode of fabrication is that, the bldc motor is fixed to the back wheel of the vehicle which gets charged by the batteries through solar panels. Controllers are placed in between the solar panels and batteries, so that current will not flow in reverse direction. Solar panels are fixed to the vehicle by welding and Revit joints. However this electric vehicle depends not only on batteries but also on gasoline. Initially the vehicle starts with the gasoline and when it reaches certain speed the vehicle is switched from gasoline to electric power.

This process involves fixing the different components to the frame of the two wheeler. The motor is fixed to the rear wheel shaft with proper alignment so that the weights are perfectly balanced. A battery casing in which 4 LA batteries of 12 V and 15Ah are fixed to frame and wirings are drawn from battery to motor so as to transmit power from battery to motor. Also wiring for speed control is also incorporated. Two solar panels are mounted on the either side of the vehicle. A solar charge controller is connected between the battery and solar panel. This charge controller ensures the charging of the battery. The solar charge controller stops charging the battery which it reaches its maximum voltage

3.2 Solar Panel:

When light shines on a photovoltaic (PV) cell, it may be reflected, absorbed, or pass right through it. The PV cell is composed of semiconductor material, which combines some properties of metals and some properties of insulators. That makes it uniquely capable of converting light into electricity. When light is absorbed by a semiconductor, photons of light can transfer their energy to electrons, allowing the electrons to flow through the material as electrical current. This current flows out of the semiconductor to metal contacts.

Fig: 3.1 Photovoltaic (PV) Cell

3.2.1 Solar Cell Performance and Efficiency

The efficiency of a cell is simply the amount of electrical power coming out of a cell divided by the energy from sunlight coming in. The amount of electricity produced from PV cells depends on the quality (intensity and wavelengths) of the light available and multiple performance characteristics of the cell. Learn more about conversion efficiency.

A solar panel (photovoltaic module or photovoltaic panel) is a packaged, connected assembly of solar cells, also known as photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications.Because a single solar panel can produce only a limited amount of power, many installations contain several panels. A photovoltaic system typically includes an array of solar panels, an inverter, and sometimes a battery and interconnection wiring.

In this project two solar panels of 25Watts each which is connected to a 12V battery which helps in continuous charging of the battery. Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The structural (load carrying) member of a module can either be the top layer or the back layer. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The conducting wires that take the current off the panels may contain silver, copper or other non-magnetic conductive transition metals.

3.2.2 Solar Photovoltaic:

Solar photovoltaic (PV) panels are the most common solution for people interested in harnessing the suns energy. Not only are photovoltaic panels the ideal solution for generating renewable energy in the home or workplace but they are also ideal for generating a source of electricity in areas where electricity supplies don't currently exist (such as remote communities). The best example of the harnessing solar energy to provide electricity in remote locations can be found in space as for many years, satellites have been using solar panels to catch the sun's rays to provide power to the equipment on board.

Fig: 3.2 Solar Photovoltaic (PV) Panels

Photovoltaic panels can be installed as single devices or as part of what is called an array. The big advantage of installing solar PV panels in an array is dowIVn.to the ability to generate more power from one system instead of having to install complete separate solar PV systems for each panel used. The installation of a solar electricity system is still a viable option to provide a substantial amount of electricity helping to reduce energy bills over the period of operation for a home or business.

Therefore, a solar panel of 80w which produces 5A per hour is selected for our 15Ah battery which gets charged in 3 hrs. Due to size considerations two solar panels of 40w each are used in our solar bike. The PV panel is the part of the PV prototype system which generates electrical energy by using the irradiance of the sun. The maximum power (or peak power indicated with Wp) of a PV panel depends basically on the type of panel and on the dimensions and is given for an irradiance of 1000W/mÂ².

Figure 3. 3: Solar Panel Used In The Solar Electric Two Wheeler

Some producer dependent parameters affect the efficiency of a new panel. Due to degradation of the active material, soiling and other influences the peak power of PV panels decreases with the years. The power PPV [W] which a PV panel can generate always depends on the peak power Ppeak [W] and on the prevailing irradiance G [W/mÂ²]: For Ppeak = 55W; G = 200W/mÂ² (barley enough irradiance to effect shadings)Ppv=PpeakÃ— (G/1000w/m2).That means, at a prevailing irradiance of 200W/mÂ² a 55Wp module generates in maximum about 11W.

Another important fact is that (in most cases of mono crystalline Si panels) the whole panel has to be illuminated with the same irradiance to deliver the assumed power. If only one cell (part) of the panel has an area of less irradiance due to partial shading this has a disproportionate impact on its power production (Deline, 2009). This effect has a big influence on the possible electricity generation on the bike because the panel often is shaded by the driver or the surrounding. The PV panel which is used in the PV prototype system is a 55Wp module which is built of Si mono crystalline cells. It has 2 bypass diodes build in the connection box to improve the performance when it comes to partial shading on a half of the panel. It is chosen because its dimension fits with 985mm times 440mm very good on the available space of the bike.

3.2.3 Solar Two Wheeler-Battery Type Selection of the Battery:

Voltage Battery packs are made up of individual cells connected together. Each cell has a more or less constant voltage dependent on its chemistry. For NiCad/NiMH, this is about 1.2V, for lead acid it is 2.0V, and for lithium cells it is on the order of 3.7V. Typical ebikes and scooters are designed to run on 24, 36, or 48 Volts, so a number of cells have to be series connected into a 'battery' that has the desired net voltage. A nominal 36V pack could be made from 10 lithium cells, 18 lead acid cells, or 30 NiMH cells.

3.2.4 Energy Density:

When comparing between battery chemistries, one of the most relevant metrics is the Energy Density in watt- hrs / kg. This figure says how heavy a battery pack will have to be to achieve a certain range. For Lead Acid it is 20-30 watt-hrs/kg, for NiCad it is 35-40 watt-hrs/kg, NiMH is 50- 60 watt-hrs/kg, Li-ion is ~110 watt-hrs/kg, and Li-Polymer is up to 160 watt-hrs / kg. Knowing these values makes it easy to project the weight of a pack without having to look up data from the manufacturer.

3.3 Electric Motor:-

Fig: 3.4 Electric Motor

Use the specific motor having suitable power and torque according to design.

3.4 Chain and Sprocket:-

Fig:3.5 Chain and Sprocket

A commonly used solar cell structure. In many such cells, the absorber layer and the back junction layer are both made of the same material.E-Bike 48v 400rpm 750w Bldc Geared Motor With Complete E-Bike Accessories Kit

3.5 Specifications:

3.5.1 Motor Specifications:

- Rated Operating Voltage: 48V
- Rated Power: 750W
- No Load Current: 4.0A
- No Load Speed: 500 RPM
- Rated Torque: 102Kg-cm
- Rated Speed: 400 RPM
- Rated Current: 13.4A
- Efficiency: 80%
- Gear Ratio: 6:1

3.5.2 Controller Specifications:

- Rated voltage: DC48V
- Rated power: 750W
- Rated current: 30A
- Under-voltage protection: DC41.5V+-0.5V
- Current limited:30A±0.5A
- Efficiency: ≥83%
- Consumption: <1.5W

3.5.3 Bike specifications:

- BLDC Motor For E-bike 48v 400RPM 750W
- Motor Electric Speed Controller
- Throttle with Speed Selecter Switch
- Led Head Light with Battery Level Indications
- Key Switch
- Chain 420-76 link
- Terminal socket plate, Chain sprocket.

3.6 DC Motor:

The magnetic frame or the yoke of dc motor made up of cast iron or steel and forms an integral part of the stator or the static part of the motor. Its main function is to form a protective covering over the inner sophisticated parts of the motor and provide support to the armature. It also supports the field system by housing the magnetic poles and field winding of the dc motor.

3.6.1 Construction of DC Motor

A DC motor like we all know is a device that deals in the conversion of electrical energy to mechanical energy and this is essentially brought about by two major parts required for the construction of dc motor, namely.

1) Stator – The static part that houses the field windings and receives the supply and,

2) Rotor – The rotating part that brings about the mechanical rotations.

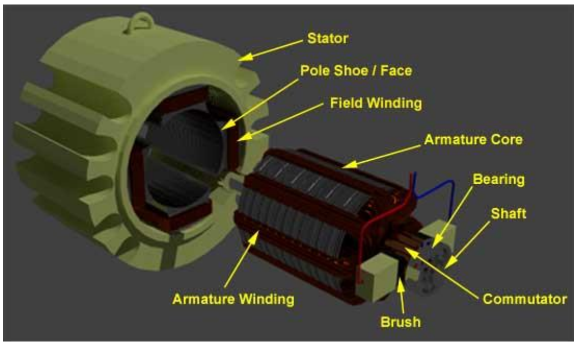

Fig: 3.6 Essential Parts of Dc Machine

3.7 Battery:

In our prototype, we use 12v battery and they have variety of uses in our daily life. From consumer electronics to robotics, from health care products to industries, almost every second device we use has one battery or the other. Batteries have become an indispensable part of our lives. We cannot comprehend living without cell phones, torches, laptop computers, music players like the iPod, but how do we power them up? Answer lies in the batteries. Similarly, cars are one of the main modern-day necessities which use batteries to power the head lamps and backlights. In electricity, a battery is a device consisting of one or more electromechanical cells that convert stored chemical energy into electrical energy. Since the invention of the first battery (or "voltaic pile") in 1800 by Alessandro Volta and especially since the technically improved Daniell cell in 1836, batteries have become a common power source for many household and industrial applications. According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year, with 6% annual growth.

There are two types of batteries: primary batteries (disposable batteries), which are designed to be used once and discarded, and secondary batteries (rechargeable batteries), which are designed to be recharged and used multiple times.

Fig:3.7 battery

A battery is a device that converts chemical energy directly to electrical energy It consists of a number of voltaic cells; each voltaic cell consists of two half-cells connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the electrode to which anions (negatively charged ions) migrate, i.e., the anode or negative electrode; the other half-cell includes electrolyte and the electrode to which cations (positively charged ions) migrate, i.e., the cathode or positive electrode.

In the redox reaction that powers the battery, cations are reduced (electrons are added) at the cathode, while anions are oxidized (electrons are removed) at the anode.[23] The electrodes do not touch each other but are electrically connected by the electrolyte. Some cells use two half-cells with different electrolytes. A separator between half-cells allows ions to flow, but prevents mixing of the electrolytes.

During the recharging process as electricity flows through the water portion of the electrolyte and water, (H2O) is converted into its original elements, hydrogen and oxygen. These gasses are very flammable and the reason your RV or Marine batteries must be vented outside. Gassing causes water loss and therefore lead acid batteries need to have water added periodically. Sealed lead acid batteries contain most of these gasses allowing them to recombine into the electrolyte.

If the battery is overcharged pressure from these gasses will cause relief caps to open and vent, resulting in some water loss. Most sealed batteries have extra electrolyte added during the manufacturing process to compensate for some water loss.

3.8 Throttle Electric Bike Control System

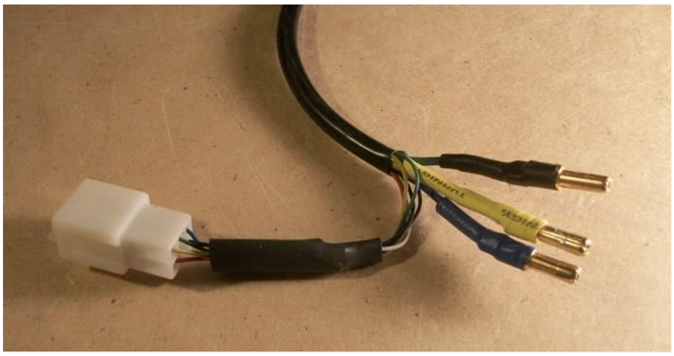

Fig: 3.8 DIY Garage; Connectors for Halls, Throttle, and Motor

Experienced builders have preferences for every part of their hot rod ebike, but…if you are new and you just want some advice on how to get started with components that work well enough, and are still reasonably affordable and available? then this article is for you.

You don't have to look long before you see that many common ebike controllers have a LOT of wires and connectors. I mention the controller first, because the controller is like the sun…around which the throttle, battery, and motor will orbit. The more powerful 18-FET controllers that are sometimes used for 2600W-8000W hot rods are often sourced from a Chinese E-moped/E-motorcycle supplier. These have added features, like a 3-way power switch, cruise control, reverse, regen-braking, speedometer, and others.

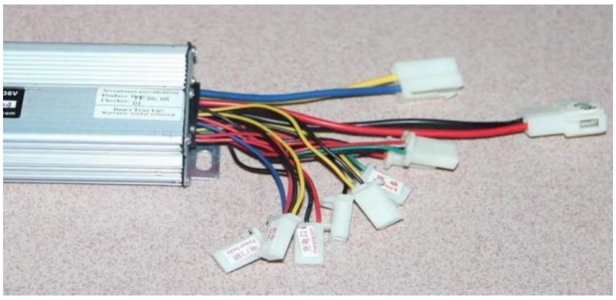

Fig:3.9 Either Hot-Wired, Or Attached To An On/Off Switch

3.8.1 Throttle Connector

The simplest ebike throttles have three pins in the connector. The controller sends a 5V power supply to the hand-throttle (positive), along with a second wire that is the ground (negative). That leaves the third wire as a signal wire that sends a signal back to the controller to tell it what you want. The signal wire can provide anything between 1V up to 4-ish volts.

Just like before (with the hall wires), the 5V positive and negative should be red and black, and they can be very thin wires. The third signal wire can be any colour you want, as long as the connectors match. Using a thicker wire won't hurt, but…it also won't help. I use 24-ga with thin and high-temp Teflon insulation, simply because I have a large roll of it for motor hall connections.

3.8.2 Ignition Wire Connector

The simplest controllers don't have an on/off switch, and they don't provide an ignition wire to connect to a switch. When you plug the battery into the controller, it is powered up. I suppose doing that saves having a 50-cent switch, but forgetting to unplug when you're done riding can drain your battery down to a damaged level, and having no "anti-spark" circuit on the power-up can wear out any on/off switch you add. But hey! They saved you 50 cents, right?

However, the 12-FET and 18-FET sized controllers in this "hot rod" category typically have an ignition wire. This means that you will need to wire it up correctly, or the system will not turn on, or run at all. IF…you have an ignition wire, make certain to find out that you bought it from how to wire it up. It's also just a 5V signal at very low amps, so a wide variety of readily available switches will work in this application.

3.8.3 E-Brake Connectors

If (for some reason), the motor power accidentally comes on without you applying the throttle (or you turned it on, but now it won't turn off), it is good to have a large "OFF" button that can be pushed-in to cut the power (a kill switch). However, in the situation where that actually happens, a riders' first instinct is usually to apply the brakes.

An E-brake is just a regular bicycle brake handle, *but*…it adds a tiny magnet attached to the moving part of the handle, and then the mounted part of the brake has a magnetically-sensing switch in it (usually a Reed switch). When you move the magnet away from the sensor (by pulling the brake handle) a 5V signal is then sent to the controller to cut the power to the motor. These only need two wires to their connector, because it is not variable. The signal is only on or off.

The colour of the wire is unimportant; they only have to make an on/off 5V signal. However, if they are accidentally shorted somehow, the controller thinks the brakes are on all the time and the controller will not turn on

3.9 Arc Welding

Shielded Metal Arc welding is the process of joining two metal pieces using a flux covered electrode which is melted in an electric arc and becomes a fused part of the pieces being welded. This article will describe the use of flux-coated welding *rods* and a simple, transformer type cracker box welding machine.

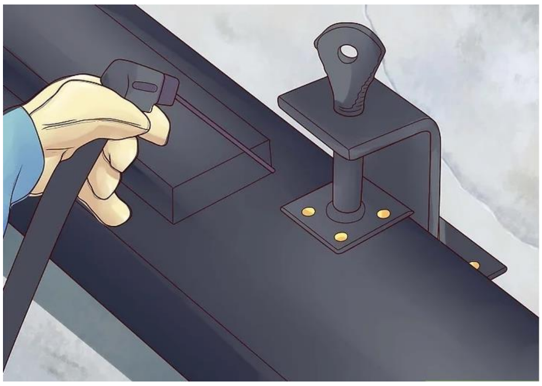

Fig: 3.10 Arc Welding

Understand the process of shielded Metal Arc Welding. An electric arc is formed at the tip of the welding rod when a current pass across an air gap and continues through the grounded metal which is being welded. Here are some of the terms and their descriptions used in this article.

Welding machine. This is the term used to describe the machine which converts 120-240-volt AC electricity to welding voltage, typically 40-70 volts AC, but also a range of DC voltages. It generally consists of a large, heavy transformer, a voltage regulator circuit, an internal cooling fan, and an amperage range selector. The term welder applies to the person doing the welding. A welding machine requires a welder to operate it. Leads, or Welding leads. These are the insulated copper conductors which carry the high amperage, low voltage electricity to the work piece that is being welded. Rod holder, or stinger is the device on the end of the lead that holds the electrode, which the person welding uses to accomplish the welding task.Ground and ground clamp. This is the lead that grounds, or completes the electrical circuit, and specifically, the clamp that is attached to the work to allow the electricity to pass through the metal being welded. Amperage, or *amps*. This is an electrical term, used to describe the electrical current supplied to the electrode.

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IV. Result

After all the electric components had been fitted on the frame and connected, the system was powered up and tested. design and fabrication of Electric Bike which makes use of Electric energy as the primary source and solar energy if possible, by attaching solar panels. It also highlights on the design aspects of the bike. There is a provision for a charging the battery by ejecting it from the main system. The electrical power generated which is used to run the bike can give better fuel economy compared to conventional vehicle, better performance and also causes less pollution

4.1Design of Electric Bike

Here we have used permanent magnet self-generating motor with 250-watt power and 2100rpm.

The motor runs on 48volts and 7.5amps power source.

$P = 2 \times 3.14 \times N \times T / 60$

$250 = 2 \times 3.14 \times 2100 \times T / 60$

$T = 1.13$ N m = 1136 N-mm

Reduction in chain drive

R chain = 66/11 = 6:1

Torque at wheel shaft = T x R chain = 1136 x 6 = 6820 N mm

Speed of wheel shaft = 2100 /6 = 350 rpm

4.2Design of Sprocket and Chain for Electric Bike

We know,

TRANSMISSION RATIO = Z2 / Z1 = 66/11 = 6

For the above transmission ratio number of teeth on pinion and the number of teeth sprocket

is in the range of 21 to 10, so we have to select number of teeth on pinion sprocket as 11 teeth.

So, Z1 = 11 teeth

4.3 Selection of Pitch of Sprocket

The pitch is decided on the basis of RPM of sprocket.

RPM of pinion sprocket is variable in normal condition it is = 2100 rpm

For this rpm value we select pitch of sprocket as 6.35mm from table.

P = 6.35mm

4.4 Calculation of Minimum Centre Distance Between Sprocket

THE TRANSMISSION RATIO = Z2 / Z1 = 66/11 = 6 which is less than 7

Dia. of small sprocket,

Periphery = π × dia. Of sprocket

$11 \times 6.25 = \pi \times D$

$D = 11 \times 6.25 / \pi$

D = 21.8 mm

Dia. of sprocket,

Periphery = π × dia. Of sprocket

$66 \times 6.25 = \pi \times D$

$D = 66 \times 6.25/ \pi$

D = 131.3 mm

So from table, referred from PSG Design Data book

The minimum centre distance between the two sprocket = C' + (80 to 150 mm)

Where C' = Dc1 + Dc2

2

C'= 131.3 + 21.8

2

C' = 76.5 mm

MINIMUM CENTER DISTANCE = 76.5 + (30 to 150 mm) MINIMUM CENTER

DISTANCE = 170 mm

4.5Calculation of Values of Constant K1 K2 K3 K4 K5 K6 – (with help of PSG Design Data)

Load factor K1 = 1.25 (Load with mild shock)

Distance regulation factor K2 =1.25(Fixed center distance)

Center distance of sprocket factor K3 =0.8

Factor for position of sprocket K4 = 1

Lubrication factor K5 = 1.5 (periodic)

Rating factor K6 = 1.0 (single shift)

4.6Calculation of Value of Factor of Safety

For pitch = 6.35 & speed of rotation of small sprocket = 2100 rpm

Factor of Safety for this drive = 8.55

Calculation of Allowable Bearing Stress:

For pitch = 6.35 & speed of rotation of small sprocket = 2100 rpm

Allowable Bearing stress in the system = 2.87kg / cm2

=2.87 * 981/100 =28 N /mm2

4.7Calculation Maximum Tension on chain

Maximum torque on shaft = Tmax = T2 = 6820 N-mm

Where,

T1 = Tension in tight side

T2 = Tension in slack side

O1, O2 = center distance between two shaft

Sin ∝ = R1 - R2

O1O2

Sin ∝ = 65.65 - 10.9

170

Sin ∝ = 0.33

∝ = 18.78

TO FIND θ

θ = (180 –2∝) X 3.14/180

θ = (180 –2*18.78) X 3.14/180

θ = 2.48 rad

According to this relation,

T1/T2 = eμθ

T1/T2 = e0.35 x 2.48

T1 = 2.38T2

We have,

T = (T1 – T2) X R

6820 = (2.38 T2 – T2) X 65.65

T2 = 75.27 N

T1 = 2.38 X 75.27

T1 = 179.16 N

So tension in tight side = 179.16 N

We know,

Stress = force / area x 2

Stress induced = 179.16/ (3.14 * 32 / 4) x 2

Stress induced = 12.67 N /mm2

As induced stress is less than allowable stress =28N /mm2

Design of sprocket is safe.

V. CONCLUSION

Solar powered motor bike is modification of existing bike and driven by electrical energy. It is suitable for both city and country roads, that are made of cement, asphalt, or mud. This bike is cheaper, simpler in construction & can be widely used for short distance travelling especially by school children, college students, office goers, villagers, postmen etc.

It is very much suitable for young, aged, handicap people and caters the need of economically poor class of society. It can be operated throughout the year free of cost. The most important feature of this bike is that it does not consume valuable fossil fuels thereby saving a lot on fuel expenses. It is eco-friendly & pollution free, as it does not have any emissions. Moreover, it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather. Sustainable and practical personal mobility solutions for cities environments have traditionally revolved around the use of two wheelers, or provision of pedestrian facilities. However, many cities also experience traffic congestion, parking difficulties and pollution from fossil-fueled vehicles. It appears that pedal power alone has not been sufficient to supplant the use of petrol and diesel vehicles to date, and therefore it is opportune to investigate both the reasons behind the continual use of environmentally unfriendly transport, and consider potential solutions.

- The use of solar powered vehicle is the best way to reduce environmental pollution which is caused by the present-day automobile emissions.
- The motorcycle can run for 4 hours or 50 km range on full charge with an average speed of 35kmph.
- Solar power is abundant in nature and is easily available everywhere whereas fossil fuels are available at specific locations. Hence use of solar over fuels is a major advantage.

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