Literature Review on Solar Powered Tricycle for Handicapped Person

Abhishek K. Saw
PG Student
Department of Mechanical Engineering
K.D.K.C.E., Nagpur

Pratik Dhote
PG Student
Department of Mechanical Engineering
K.D.K.C.E., Nagpur

Mrunal Gaidhani
Student
Department of Mechanical Engineering
K.D.K.C.E., Nagpur

Pratik Pande
Assistant Professor
Department of Mechanical Engineering
K.D.K.C.E., Nagpur

Sandesh G. Ughade
Assistant Professor
Department of Mechanical Engineering
K.D.K.C.E., Nagpur

Abstract

This paper gives the details about the research papers related to the solar power tricycle project and includes the methods and considerations regarding the proper working of the tricycle. The main content of this paper is Solar PV panel, Brushless PMDC motor, Charge controller and battery. This paper will discuss about the main idea of the component and here we compared the different component.

Keywords: Research Paper, Solar Tricycle, DC Motor, Battery

I. INTRODUCTION

In this we are discussing about the various component which we will use. As we know that there are different types of components are available in market. The components we are using are brushless DC motor, Solar panel, Battery, charge controller throttle. Hand-powered tricycles are presently being used to provide mobility for disabled persons. With this project we designed and manufactured a system to convert the hand powered tricycle to an electric motor powered version. Solar-powered vehicles (SPVs) use photovoltaic (PV) cells to convert sunlight into electricity. The electricity goes either directly to an electric motor powering the vehicle, or to a special storage battery. PV cells produce electricity only when the sun is shining. Without sunlight, a solar powered car depends on electricity stored in its batteries. There are several types of tricycle that can be categories that is paddle tricycle, motorized tricycle, and electric tricycle. The weakness of the tricycle make people do not like to used tricycle. First, paddle tricycle needs a lot of energy to paddle the tricycle. Next, motorize tricycle that used fuel as it prime mover. The tricycle use fuel that is costly. Besides that, motorize tricycle will make pollution that can be very bad for our environment especially in this period that global warming happen to the earth. Lastly, electric tricycle that generate by battery can be only be sufficient for about an hour. The user needs to find power supply to recharge the battery or else they need to paddle the tricycle that used more energy compare to the normal tricycle because of the weight.

II. OBJECTIVE

To overcome the problem and the weakness, this project need to do some research and studying to develop better technology. To make it success there are several thing that we need to know such as what will be the prime mover, how to stored it and the advantages of this new vehicle. In that case, these are the list of the

Objective to be conduct before continue to proceed on this project:

- To develop a vehicle that uses renewable energy, environmentally friendly and cheap.
- To develop an electrical tricycle that can charge the battery when it is not in used.
- To develop low speed tricycle, but for a longer distance.

III. COMPONENT DESCRIPTION

A. Solar Panel:

Photovoltaic's is the field of technology and research related to the devices which directly convert sunlight into electricity. The solar cell is the elementary building block of the photovoltaic technology. Solar cells are made of semiconductor materials, such as silicon. One of the properties of semiconductors that makes them most useful is that their conductivity may easily be modified by introducing impurities into their crystal lattice. For instance, in the fabrication of a photovoltaic solar cell, silicon, which has four valence electrons, is treated to increase its conductivity. On one side of the cell, the impurities, which are phosphorus atoms with five valence electrons (n-donor), donate weakly bound valence electrons to the silicon material, creating excess negative charge carriers. On the other side, atoms of boron with three valence electrons (p-donor) create a greater affinity than silicon to attract electrons. Because the-type silicon is in intimate contact with the n-type silicone p-n junction is established and a diffusion of electrons occurs from the region of high electron concentration (the n type side) into the region of low electron concentration (p-type side). When the electrons diffuse across the p-n junction, they recombine with holes on the p-type side. However, the diffusion of carriers does not occur indefinitely, because the imbalance of charge immediately on either sides of the junction originates an electric field. This electric field forms a diode that promotes current to flow in only one direction. Ohm metal semiconductor contacts are made to both the n-type and p-type sides of the solar cell, and the electrodes are ready to be connected to an external load. When photons of light fall on the cell, they transfer their energy to the charge carriers. The electric field across the junction separates photo-generated positive charge carriers (holes).

From their negative counterpart (electrons). In this way an electrical current is extracted once the circuit is closed on an external load. There are several types of solar cells. However, more than 90 % of the solar cells currently made worldwide consist of wafer-based silicon cells. They are either cut from a single crystal rod or from a block composed of many crystals and are correspondingly called mono-crystalline or multi-crystalline silicon solar cells. Wafer-based silicon solar cells are approximately 200 μm thick. Another important family of solar cells is based on thin-films, which are approximately 1-2 μm thick and therefore require significantly less active, semiconducting material. Thin-film solar cells can be manufactured at lower cost in large production quantities; hence their market share will likely increase in the future. However, they indicate lower efficiencies than wafer based silicon solar cells, which means that more exposure. A number of solar cells electrically connected to each other and mounted in a single support structure or frame is called a "photovoltaic module". Modules are designed to supply electricity at a certain voltage, such as a common 12 volt system. The current produced is directly dependent on the intensity of light reaching the module. Several modules can be wired together to form an array. Photovoltaic modules and arrays produce

Direct - current electricity. They can be connected in both series and parallel electrical arrangements to produce any required voltage and current combination. There are two main types of photovoltaic system. Grid connected systems (on-grid systems) are connected to the grid and inject the electricity into the grid. For this reason; the direct current produced by the solar modules is converted into a grid-compatible alternating current. However, solar power plants can also be operated without the grid and are then called autonomous systems (off-grid systems). More than 90 % of photovoltaic systems worldwide are currently implemented as grid-connected systems. The power conditioning unit also monitors the functioning of the system and the grid and switches off the system in case of fault.

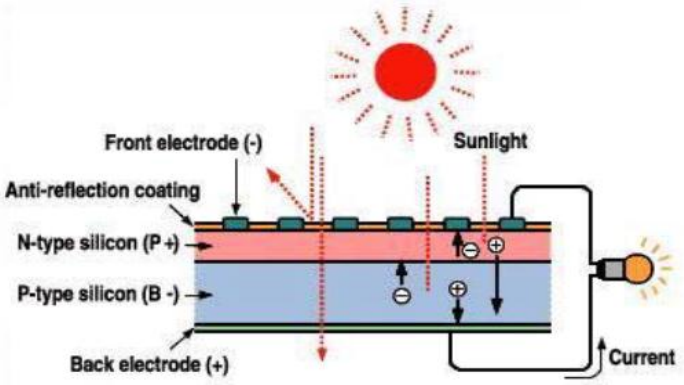

Fig.1: Solar Panel

B. Motor:

The Brushless DC (BLDC) motor is used as the drive motor for the vehicle. It's a permanent magnet square wave motor. BLDC motor uses feedback directly of the rotor angular position so that the input armature current can be switched among the motor phases in exact synchronization with the rotor motion..The reason for opting for the BLDC motor is because of its efficiency, noiseless operation, dynamic response and high torque to weight ratio. Brushless DC electric motor (BLDC motors, BL motors) also known as electronically commutated motors (ECMs, EC motors) are synchronous motors that are powered by a DC electric source via an integrated inverter/switching power supply, which produces an AC electric signal to drive the motor. In this

context, AC, alternating current, does not imply a sinusoidal waveform, but rather a bi-directional current with no restriction on waveform. Additional sensors and electronics control the inverter output amplitude and waveform (and therefore percent of DC bus usage/efficiency) and frequency (i.e. rotor speed). The rotor part of a brushless motor is often a permanent magnet synchronous motor, but can also be a switched reluctance motor, or induction motor.

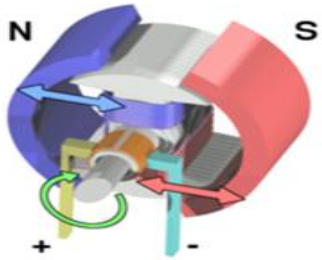

Fig. 2: Motor

C. Lead Acid Battery:

Lead acid batteries are one of the most popular types of battery in electronics. Although slightly lower in energy density than lithium metal, lead acid is safe, provided certain precautions are met when charging and discharging. This have a many advantages over other conventional types of batteries, the lead acid battery is the optimum choice for a solar assisted bicycle. Current supplied from battery indicates the flow of energy from the battery and is measured in amperes (or Amps) . The higher the current flow faster the battery will discharge. A battery is rated in ampere-hours (abbreviated Ah) and this is called the battery capacity. This project revolves around supplying and utilizing energy within a high voltage battery. It demands for a battery with longer running hours, lighter weight with respect to its high output voltage and higher energy density. Among all the existing rechargeable battery systems, the lead acid cell technology is the most efficient and practical choice for the desired application. The battery chosen for this project was a high capacity lead acid battery pack designed specifically for vehicles. Plastic casing is provided to house the internal components of the battery.

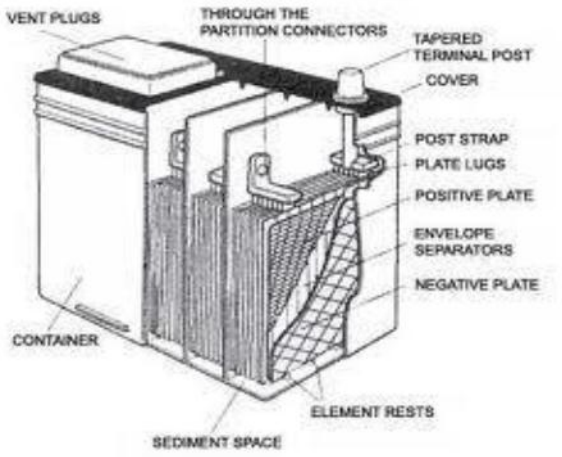

Fig. 3: Lead Acid Battery

D. Solar Charge Controller:

A MPPT solar charge controller is chosen for the solar power system of the solar three-wheeler to extract maximum power from solar panel throughout the day. This is operated by microprocessors for sensing and recording the panel voltage and current at frequent intervals for computing and adjusting the power output. This solar charge controller takes the uncertain voltage from the solar panel and conditions it to charge the lead-acid battery safely. It cuts out the batteries from the load when the lead acid batteries are depleted to prevent damage to the battery and also protect the panels from the batteries after the sun goes down. Here, it collects charges from solar panels and charges the 12 volt lead-acid battery. It has LED bar readout to show the status of the solar charging system and batteries. With the help of this MPPT solar charge controller about 20 to 30% more energy can be generated than that of a common type charge controller.

E. Throttle:

The maximum speed of a bicycle is 25 kmph. It is required to vary the speed depending upon the road conditions & traffic. Therefore an accelerator or a throttle is necessary.

Throttle allows us to drive the motor from zero speed to full speed. The throttle is fitted on right side of the handle bar and is connected to controller. The throttle converts DC voltage from battery to an alternating voltage with variable amplitude and frequency that drives the hub motor at different speeds. It consists of MOSFET transistors and a small microprocessor.

This throttle is technically referred to as a Hall Effect type. The throttle has three wires contains a black, red, and green. The supply voltage is via red and black wires and is usually around 4 volts. Green wire voltage increases as the throttle is turned.

IV. RESEARCH PAPERS

The following papers are being studied and are referred for the project. These papers belong to various authors, having various papers related to the solar powered tricycle.

A. DANIEL DOURTE, DAVID SANDBERG, TOLU OGUNDIPE, present a paper on "ELECTRIC TRICYCLE: APPROPRIATE MOBILITY":

The aim of this project is to add an electric power train and control system to the current hand-powered tricycle to provide tricycle users with improved levels of mobility. The design objectives required a simple and affordable design for the power train and controls, a design that needed to be reliable, sustainable, and functional The design of the Electric Tricycle is adaptable to the current hand-powered tricycles with little modification. The design consists of an electric motor, a drive system, motor and steering controls, and a power supply.

B. M. REDDI SANKAR, T. PUSHPAVENI, V. BHANU PRAKASH REDDY, present a paper on "DESIGN AND DEVELOPMENT OF SOLAR ASSISTED BICYCLE" Process.

The solar assisted bicycle developed is driven by DC motor fitted in front or rear axle housing & operated by solar energy. The solar panels mounted on the carriage will charge the battery & which in turn drive the hub motor. When the bicycle is idle, the solar panel will charge the battery. This arrangement will replace the petrol engine, the gear box & the fuel tank in case of a two wheeler or a chain sprocket, chain & gear shifting arrangement of a conventional bicycle being used by most common man. As a part of dissertation work, the solar assisted bicycle is fitted with a dc hub motor on front axle of a bicycle with power rating of 250W and with a travelling speed of around 25-30 kmph. It is provided with a pair of lead acid batteries of 35 Ah each, a photovoltaic solar panel with capacity of 20 watt, a voltage regulator of 24v 10 Amp, accelerator and motor controller of 24v 25Amp. There is also a provision for charging of the battery with 220-240V, AC wall outlet supply, in case of poor solar supply due to cloudy weather.

C. N.SASIKUMAR, DR.P.JAYASUBRAMANIAM, present a paper on "SOLAR ENERGY SYSTEM IN INDIA".

Conventional energy sources like coal, oil, natural gas, etc., are limited in quantity, and if these continue to be depleted at the present rate, these will be exhausted in the coming decades. Energy demand is resulting in the creation of fossil fuel based power plants leading to substantial greenhouse gas emissions having an adverse impact on global warming and climate change Solar energy offers a clean, climate-friendly, abundant and inexhaustible energy resource to mankind. The costs of solar energy have been falling rapidly and are entering new areas of competitiveness. Solar Thermal Electricity (STE) and Solar Photo Voltaic Electricity (SPV) are becoming competitive against conventional electricity generation in tropical countries Solar photovoltaic (SPV) cells convert solar radiation (sunlight) into electricity. A solar cell is a semiconducting device made of Silicon materials, which, when exposed to sunlight, generates electricity. Solar cells are connected in series and parallel combinations to form modules that provide the required power.

D. ABDULKADIR BABA HASSAN, present a paper on ''DESIGN AND FABRICATION OF A MOTORIZED PROTOTYPE TRICYCLE FOR THE DISABLE PERSONS'':

This project design is embodied on a motorized tricycle for disabled Persons. The tricycle was specifically designed to suit wheelchair occupants of healthy Upper torso with pelvic to foot restraint. It is also designed to suit a commonly available Wheel chair. The level of relationship between the disabled people in the society has highly being jeopardized; therefore this project was designed to correct the difficulties in mobility of the wheelchair users. The main aim of the project design is to ease mobility for the physically challenged and also provide adequate comfort they desire. Existing tricycles for the disables requires the disabled person to dismount from the wheelchair onto the tricycle. The motorized tricycle in this project is designed to overcome this problem by allowing the disabled person to wheel up or down his wheelchair onto or down the tricycle. This is achieved using a specially designed platform that allows the wheel chair to be wheeled up or down. The prototype of this tricycle has been fabricated. The anthropometrics data that need to be considered in the design of the platform and frame of the tricycle have been taken into consideration at the design stage of the tricycle.

E. T1LAKISWARAN A/L SAMURGAM, Present a paper on "DEVELOPMENT OF BATTERY POWERED TRICYCLE".

The main purpose of this project is to develop a battery powered electric motor tricycle which can be used as a simple transportation and for economy reasons, to develop a battery powered electric motor tricycle which can be used as a simple transportation and for economy reasons. A motorized tricycle is a three wheeled bicycle with an attached motor used to assist with pedaling. Generally considered as a vehicle, tricycles are usually powered by electric motors or small internal combustion engines and have function as electric bicycles. Some can be propelled by the motor alone if the rider chooses not to pedal; while in others the motor will only run if the rider pedals. Electric bicycles are generally powered by rechargeable batteries. These are

normally charged from the utility supply (mains), with perhaps the option of using the motor to effect regenerative braking or charging while being pedaled or rolling downhill. Electric motorized bicycles are either power-on-demand, where the motor is activated by a handlebar mounted throttle, or pedelec (from pedal electric), where the electric motor is regulated by pedaling.

F. YOGESH SUNIL WAMBORIKAR, ABHAY SINHA, Presents a paper on "SOLAR POWERED VEHICLE".

The renewable energy is vital for today's world as in near future the nonrenewable sources that we are using are going to get exhausted. The solar vehicle is a step in saving these nonrenewable sources of energy. The basic principle of solar car is to use energy that is stored in a battery during and after charging it from a solar panel. The charged batteries are used to drive the motor which serves here as an engine and moves the vehicle in reverse or forward direction. The electrical tapping rheostat is provided so as to control the motor speed. This avoids excess flow of current when the vehicle is supposed to be stopped suddenly as it is in normal cars with regards to fuel. This idea, in future, may help protect our fuels from getting extinguished.

G. ARUN MANOHAR GURRAM, P.S.V RAMANA RAO, RAGHUVEER DONTIKURTI, presents a paper on "SOLAR POWERED WHEEL CHAIR: MOBILITY FOR PHYSICALLY CHALLENGED".

Personal mobility means freedom for the physically challenged. One of the best inventions in the medical field that helped both the elderly and the handicapped is the mobility vehicle. The fact that they are no longer depending on someone else to perform daily duties is a big step forward. On the journey to mobility and freedom, motorized scooters and wheelchairs are the tools to finish that journey. With scooters and wheelchairs, there is a small inconvenience to mobility independence. The addition of some devices enables persons with physical disabilities a comfortable travel beyond their own homes. The present work involves in design and fabrication of solar powered wheel chair. A motorized wheelchair, power chair, electric wheelchair or electric-powered wheelchair (EPW) is propelled by means of an electric motor rather than manual power.

H. SHUH JING YING, STEPHEN SUNDARRAO, presents a paper on "POWER ASSIST HAND TRICYCLE WITH BATTERY FOR DISABLED PERSONS".

A hand tricycle is originally designed to be used by a disabled person with lower extremity weakness but with power in his or her hands and arms. This tricycle is modified by the addition of an electric motor and battery to help power the vehicle. The functions of the original design are not altered. The battery, motor, speed reducer and clutch are properly arranged. An additional sprocket is attached to the drive wheel. The motor controller can adjust the speed in five different settings and the tricycle can be driven forward or backward. They salvaged a lightweight tricycle weighing about thirty pounds from a storage area. It was not in working condition. The wheels are arranged with one fixed direction drive wheel in front and two pivoting wheels for steering in the rear. Two handles beside the seat are used for hand control of the steering. A large sprocket 25.4 cm in diameter located in front of the driver is connected with two crank handles for the driver's hands to power the vehicle.

I. CHETAN MAHADIK, SUMIT MAHINDRAKAR, PROF. JAYASHREE DEKA, presents a paper on "AN IMPROVED & EFFICIENT ELECTRIC BICYCLE SYSTEM WITH THE POWER OF REAL-TIME INFORMATION SHARING".

This paper presents the development of an associate degree "Electric Bicycle System" with an innovative approach. The aim of this paper is to show that the normal bi-cycle can be upgraded to electric one by some means– that including the development of a regenerative braking system and innovative BLDC motor control. The main components of the electric bicycle are brushless DC motor, motor controller, photo-voltaic, dry cell battery and solar panel. Also throttle and extra features such as horn, speedometer, and LED signal etc. The power source for this system is given by dry cell battery. The output of dry cell battery is 48V. There are multiple forms of charging source is used such as AC voltage through an outlet, solar energy and mechanical pedal charging system. The source of battery charging is photovoltaic solar panel and it is light weight. The solar panel output is 12V and 20 watt. Also they use mechanical pedal charging system, so dynamo is use for this charging system.

J. QINGFENG SU, GENFA ZHANG, JIANMING LAI, SHIJUN FENG, AND WEIMIN SHI, presents a paper on, "GREEN SOLAR ELECTRIC VEHICLE CHANGING THE FUTURE LIFESTYLE OF HUMAN".

Electric vehicle with more advantages of no noise, no pollution, saving energy and reduce carbon dioxide emissions is to power-driven vehicle with a motor drive wheels moving. Solar electric vehicle can make to reduce our greenhouse gas emissions and other pollution. All advantages of solar electric vehicle make research and application of solar electric vehicle as a "hot spot" of automotive industry and the trend of future cars. Solar electric vehicle is made of PV panels, battery, electric motor, vehicle controller and vehicle body. Solar electric vehicle drives using dual-mode of PV and battery hybrid. It can be achieved PV-driven and battery-driven independently. In good sunny conditions, the full charge endurance of solar electric vehicle can be increased about 35% substantially compared with no PV panels. Solar electric vehicle can achieve low-carbon, energy saving, environmental protection and true zero-emissions for the future of human life.

V. CONCLUSION

Hence above explained components are used for the fabrication of the solar powered tricycle. The recharging capacity of the panels is satisfactory.

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