Solar Electric Bicycle Research Methodology

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Abstract

The rapidly increasing prices of petroleum and diesel have made the role of alternative energy sources for vehicles more significant. It is becoming essential to increase the use of renewable energy sources namely solar energy as compared to conventional sources of energy generation [7]. Furthermore, the emission of poisonous gases from different types of vehicles has become highly detrimental to the health of the beings. For this reason, it is the right time to look for more economic friendly fuel sources. In this paper attempt has been made to design and prepare a self-charging electric bicycle consisting solar panel. Solar energy can be utilized which is available free of cost to charge the batteries. Brushless DC Motors (BLDCs) use generators to convert electrical energy into wheel rotation and store the same rotational energy into electrical energy.

Keywords— Solar Bicycle, Solar Charging, Dynamo Charging, Self- Charging.

Introduction

Nowadays in India, frequent power cuts are very commonly observed. Hence consumer tend to adopt alternative measures to generate power [6]. An e-bike/e-bike/boost bike is a bicycle with a built-in electric motor that can be used for propulsion. Electric bikes use rechargeable batteries and lighter models can reach speeds of 25-32 km/h, while more powerful models can often reach speeds of 45 km/h or more. Solar energy is used to charge the battery. Two or more photovoltaic cells can use solar energy to generate a voltage that can be used to charge a battery. The battery supplies the necessary voltage to the hub motor mounted on the front wheel to start the bike. Solar bikes are not commonly sold in everyday life, but production can be increased to prevent pollution. It is primarily used as a hands-on project and is sometimes sponsored by government agencies.

A solar bicycle is a bicycle which runs using the electrical energy of battery to run the hub motor which ultimately runs the bicycle. Solar energy is used to charge the battery. Two or more Photovoltaic cells may be used to harness solar energy to generate voltage to charge the battery. Battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle.

To overcome these problems, an effort is being made to search some other alternative sources of energy for the vehicles. Again, it is also not affordable to purchase vehicles (mopeds, scooters or motorcycles) for all the class of society. Keeping this in mind, a search for some way to cater these economically poor people as well as to provide a solution for the environmental pollution was in progress. 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.

LITERATURE REVIEW

In this paper, during these researches ebike literature survey is conducted by reviewing various research papers. In that number of research papers & patents are collected then analyzed by which we have get the information are: In 2007, Annette Muetze at all[1], work on changing electric bicycle System as a platform to improve electric bicycle performance by using new drive systems i.e. key parameters that will result in improvement of the system performance. It also provides brief idea about power requirement, speed & load (Weight of rider & bicycle). In 2012, Ian Vince Mcloughlin at all[9], were inventing the electric bicycle for the campus mobility in which they inculpated brushless DC motor which is mounted on either front or rear wheels for producing electricity. They also come with a modern technology that they provided navigation facilities for each system for the campus they invented for with android touchscreen. This is because bikes require 200-250 watts of sustained pedaling force. So most people don't accept it. In 2013, Swapnil Shringarpure generally experimented with automated bicycles [17]. Development of electric bicycles that can be implemented as an alternative to two-wheeled bicycles that consume a lot of fuel and pollute the environment. In order to cope with the lightning speed of today's life, fast transportation has been one of the key factors, and fast transportation has provided the demands of modern people's lives and, on the other hand, has led to population growth. fuel and energy consumption. It has played a decisive role in increasing pollution. research done in this paper is limited to making a prototype of electric bicycle the same can concept can be applied to a bigger cycle with taking many factors into consideration & keeping the basic logic same. In 2013, Minas Roukas[13], work on Development of the control system for an electric vehicle as a platform to construct EDV as a demonstration Vehicle & for testing modern technologies. It also provides control allocation for control system by providing desired speed & reduce oscillation. They also performed various simulation test for required trajectory for movement of vehicle. In 2014, Vivek V Kumar at all[21], have worked on design & implementation of electric assisted bicycle with selfrecharging mechanism. For this, a PMDC motor, flywheel, housing, multi-crank freewheel, sprocket, battery and control system were used. The motor uses an effective discharge of 12V and 14A from the battery. However, it was found that the current drops to 1 as the effective speed increases.077 A. In 2014, Rahul Sindhwani [15] theorized the basic requirements for improving the efficiency of e-bikes in general. International Journal of Science and Engineering Research, Vol. 10, No. 5, May 2019, reports that electric bikes with hub motors integrated into the rear wheels to generate the initial torque needed to bring the vehicle up to 50% more efficient do. From rest to movement. Motor integrated with chain drive for additional power transmission. In 2015, Ivan Evtimov designed an experimental electric bike to evaluate energy efficiency in general[10]. In this experiment, they studied three typical urban routes in the Bulgarian city of Rousse. Depending on traffic conditions and road slope, energy recovery rates range from 6 to 14%. During the experiment, we drove 215 km with an average refresh rate of 5.5%. The less braking and acceleration, the more regeneration. They also found that using these electric bikes by one person can reduce pollution by up to 15 times compared to conventional cars.

In 2016, Mohammad Reza Magami [14] experimented with the amount of power dissipation due to pollution in solar panels in general. They found that dust reduced the power output of solar systems by 2% to 50% in other areas. Based on daily, monthly, seasonal and annual baselines. Therefore, they suggested cleaning the PV modules from dust on a daily basis to reduce power loss. In 2017 S. T. Wankhede generally [16] experimented with multi-charge electric bicycles. Electric bikes can be equipped with specially designed drives that are most efficient for a given duty cycle. Also with the PIC16F72 controller, this controller has overcurrent protection. Experiments have shown that the controller has the best dynamic characteristics and works reliably. In 2017, Kunjan Shinde [11] was working on an electric bike that would increase energy production by modifying an existing cycle using electricity and solar power, provided solar panels were provided. As the consumption of natural resources, such as gasoline and diesel fuel, increases, new modes of transportation must be defined, so a shift to alternative resources such as electric bicycles is required. Operating costs per km are very low and even more savings can be achieved with the help of solar panels.

RESEARCH METHODOLOGY

Block Diagram

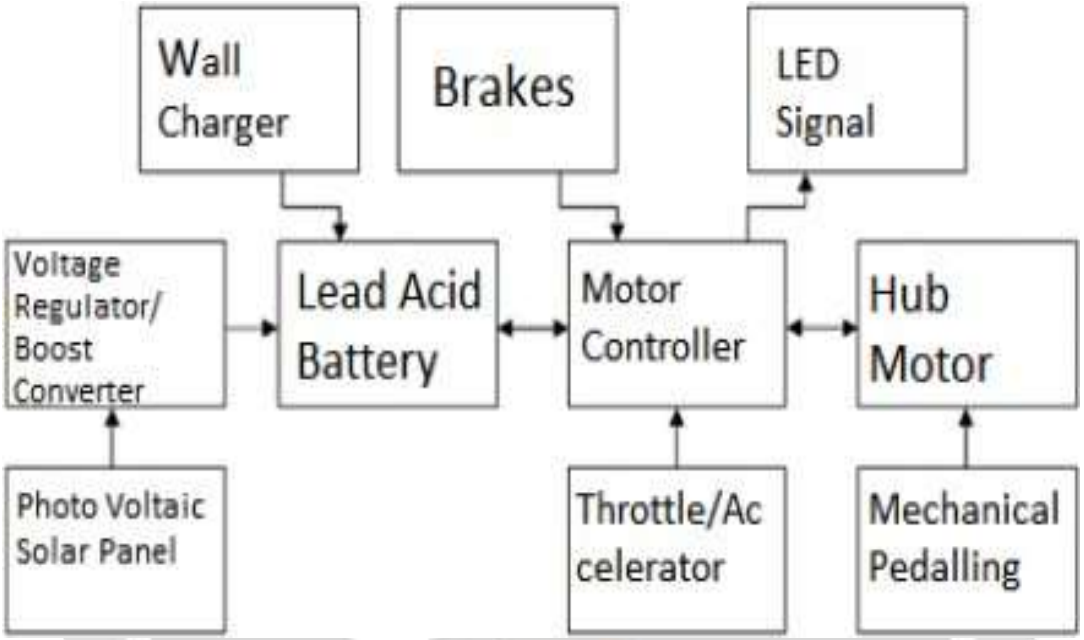

Fig 1-Block diagram of solar assisted bicycle

Working

The rider first pedals the bike to provide the initial torque needed to start the cycle. As soon as the cycle enters the dynamics, the throttle turns on the motor. This is the most attractive feature of our cycle. Because our bikes have this feature, we almost face the possibility of engine damage. So the bike works efficiently the first time you pedal and use engine power. A block diagram of a DC motor-powered and battery-powered hybrid bike mounted on the mid-axle of a bike is shown in Figure 1. Solar panels are mounted on a carriage. Solar Panel generates 12 volts of power when exposed to sunlight and when the terminals are connected to the charge controller. The generator is mounted on the side axle of the bicycle to support the generator axle against the tires on the rear wheel. As the wheels rotate, the generator's shaft rotates, generating 12V of power. The terminal is also connected to the charge controller. A solar panel charges the battery when the bike is idle during the day. Because of uneven sunlight and different wheel speeds, the output voltages of solar panels and generators are inherently different. The charge controller regulates a constant voltage of 12 volts and charges the battery. Power flow works in parallel with the power delivered by the rider through the pedals. The rider on a solar bike can either select the engine all the way out or pedal (as on a regular bike). The

electric bike speed controller signals the bike motors with different voltages. This signal determines the orientation of the rotor with respect to the starter coil. The proper functioning of the speed controller depends on the use of various mechanisms. On custom electric bikes, Hall sensors help determines the position of the rotor. If your speed controller does not include such sensors and the speed controller on an adaptive bike may not the electromotive

force of the un driven coil is calculated to get the rotor orientation. The mechanism of an electric speed controller differs depending on whether you own an adaptive or purpose build electric bike. An adaptive bike includes an electric drive system installed on an normal bicycle. A purpose built bike, more expensive than an adaptive bike, provides easier acceleration and affords extra features.

Why do we waste time drilling for oil and shoveling coal when there's a gigantic power station in the sky up above us, sending out clean, nonstop energy for free? The simmering nuclear energy, the sun, has enough fuel to power the solar system for the next 5 billion years, and solar panels can turn that energy into an endless and convenient source of electricity.

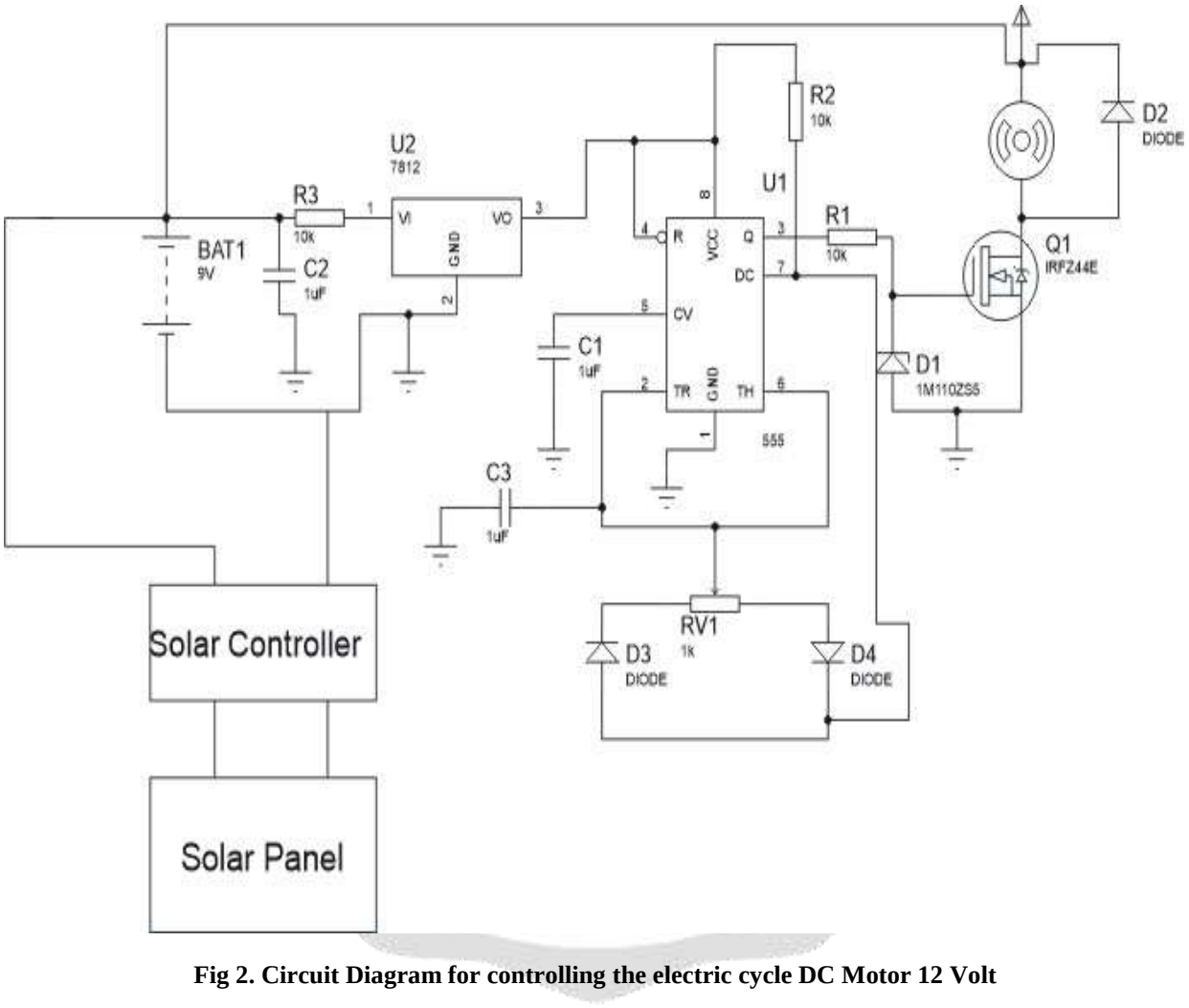

Fig 2. Circuit Diagram for controlling the electric cycle DC Motor 12 Volt

Solar energy may seem strange or futuristic, but it is already common place. You may be wearing a solar powered quartz watch or a solar powered pocket calculator on your wrist. Many people in the garden have solar lanterns. Spacecraft and satellites usually also have solar panels. NASA has also developed a solar powered airplane! As global warming continues to threaten our environment, there is no doubt that solar energy will become an even more important form of renewable energy in the future.

Pins 8 and 4 of the NE555 timer chip are connected to the positive terminal (VCC) of the power supply and pin 1 is connected to the negative terminal (GND) of the power supply. Connect the cathode () terminal of diode 1, the anode (+) terminal of diode 2, and one terminal of a 1 kΩ resistor together to form a connection point. This connection point is connected to pin 7 of the chip. The positive (+) terminal of diode 1 is connected to terminal 3 of

potentiometer (VR1), the negative () terminal of diode 2 is connected to terminal 1 of potentiometer (VR1) and the other terminal of resistor 1k is connected to VCC. The signal terminal (2) of the potentiometer is connected to pins 6 and 2 of the microcircuit. One end of the capacitor 1 is connected to pins 6 and 2 of the chip and the other end is connected to GND. One end of capacitor 2 is connected to pin 5 of the IC and the other end is connected to GND. The output pin (3) of the IC is connected to the gate terminal of the IRF540 MOSFET through a 33 ohm resistor (R2). A 10 kΩ resistor is connected between pin 3 and VCC. The source terminal of the MOSFET is connected to GND and the drain terminal is connected to one terminal of the DC motor. The other terminal of the DC motor is connected to VCC. Diode 3 is connected between the two terminals of the DC motor.

• DC Motor Speed Control Using Ne555 and IRF540 Principles

In this project, the NE555 timer IC acts as a reliable multivibrator. In this mode, the chip outputs continuous HIGH and LOW PWM (Pulse Width Modulation) signals on the output pin (pin 3). This output pulse can be adjusted by changing the values of the resistor and capacitor (C1) connected to the chip. Since we used a potentiometer (VR1) here, you can change the resistance value by turning the knob on the potentiometer (VR1). The output of the microcircuit is fed to the gate pin of the IRF540 MOSFET. Turning the potentiometer knob also changes the output value of the microcircuit. Here the IFR540 MOSFET acts as an amplifier. MOSFET voltage gain change with gate voltage changes.

Advantages of

1. It is more economical than fuel-powered cars or motorcycles and cheaper than urban electric vehicles.
2. Pollution-free, forget about CO2 emission!
3. Depending on the terrain or type of distance, electric bikes may be more comfortable because the rider can cover more distance or climb hills when more moderate exercise is needed.

Conclusion

Solar bikes are modifications of conventional bikes powered by solar energy. Suitable for both urban and country roads made of cement, asphalt or earth. This bike is inexpensive, simple in construction, and widely used for short-distance riding, especially for students, college students, office workers, villagers, postmen, etc. It is very suitable and satisfying for young, old and disabled people. The necessity of an economically poor society can use it for free all year round. The most important feature of this bike is that it does not consume valuable fossil fuels, saving billions of dollars in foreign currency. It is environmentally friendly and does not pollute the environment as there are no exhaust gases. It is also silent and can be charged with an AC adapter for emergencies and cloudy weather. The operating cost per km is at least Rs 0.70/km. If anything goes wrong with the solar system, it can be operated by manual pedaling. Requires less maintenance with fewer parts and easy assembly and disassembly. From the perspective of future energy systems, it is important to identify new ways to transport and generate electricity, and the pool of solar electric bikes could be one such case. E-bikes are much more energy efficient than cars, buses, or other large vehicles. Using solar panels per ebike was found to be sufficient to meet the initial energy demand of the ebike pool, based on simulated system usage.

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