JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

FABRICATION OF ECO-FRIENDLY SOLAR POWER ELECTRIC BICYCLE

[1]Premchand Kumar, [2]Alok Gupta, [3]Gaurav Kumar, [4]Ali Nawaz

[1]B.Tech Student, [2]B.Tech Student, [3]Assistant Professor, [4]Assistant Professor
[1,2,3,4]Department of Mechanical Engineering, Meerut Institute of Technology, Meerut, India

Abstract : Pollution due to fuel-based vehicles can be controlled by renewable energy-based vehicles. In this project solar based electrical bicycle was fabricated. Solar based electrical bicycle was designed and fabricated with a motor coupled with the wheels of the bicycle. In the fabricated bicycle motor runs with the help of a 12V battery. A solar panel of 6 Watt was placed onto the handle of bicycle for charging the battery. Initially the passenger cum driver has to run the bicycle by paddling for 5 minutes then the motor is switched on which runs on the battery stored energy. Use of a smart energy management system with solar power charging the battery reduces the pollution. The parameters such as speed, battery level and battery status (Charging/Discharging/low power/full power) was sensed and monitored by ARDUNIO. The bicycle is running at a maximum speed of 30 Km/hr which is better than the existing e-bicycles. The time taken by bicycle to fully charge is 5 hours for 12V lead-acid battery (maximum charging current 2.1A and minimum charging Current 0.7A) connected to the solar panel, which can also be charged using dynamo. The cost of building the bicycle is 12,000 INR. The efforts are made to optimize the performance, accuracy, security, speed, and cost.

Keywords- Solar Energy, Eco-friendly Bicycle, Solar Panel

I. INTRODUCTION

Environment pollution is the foremost issue Indian face today. Pollution is caused by different industries and vehicles. Industries pollutions are restricted by government by laws but pollution due to fuel-based vehicles was growing issue now a days. In our country majority of the vehicles runs on petrol only limited number of vehicles runs on batteries. In this new era, conventional petrol source have to be replaced by different renewable energy sources. Extraction of Solar energy for production of power is now a wide research area. Vehicles also face different issues like Traffic problems, increased fuel costs, investment problems, size, parking problems etc. Considering all the above problems solar powered Bicycle is the best solution for a short distance travel. Usage of solar renewable energy sources in bicycle reduces the pollution. Small size of the bicycle reduces the traffic jams and it also helps elderly people to travel short distance. In this bicycle the smart energy management system with solar charging was utilized. The solar powered vehicles extract energy directly from the sunlight, whereas the hybrid vehicles are restricted to use battery to a specific speed limit and then automatically convert on fuel.

A traditional bicycle is a two-wheel vehicle that is propelled by the rider who delivers muscle power through pedals that rotate one of the two wheels. The rider steers the front wheel to create a force that returns and maintains the vehicle center of gravity into a stable zone whenever necessary, thus keeping the bicycle upright. An electric bicycle carries batteries that deliver electric power to a motor that is coupled to either wheel. In most electric bicycles the rider can chose to use muscle power to deliver all, part, or none of the propulsion power required to maintain an adopted travel speed. Some models even sense pedal pressure and command the motor to deliver more power whenever the rider pedals harder. So no other advanced features in existing system.

Voltage fluctuation due to the rotation and revolution of earth and change in the atmospheric conditions such as clouds, rains etc was managed by the electronic circuits. Voltage comparator compares the voltage of solar panel and the battery and then it provides the higher voltage to the transistor to activate the relay which provides the required and stable voltage. The operation of the system is more efficient than other normal automobiles. Usage of solar renewable energy sources in bicycle reduces the pollution. Small size of the bicycle reduces the traffic jams and it also helps elderly people to travel short distance. Chien-Ching Su and Kaohsiung Hsien have registered a US patent for Solar Skateboard. In which solar panel fixed in skate converts solar energy into electric power to drive the skateboard and to function as a mobile photoelectric charger by supplying power to an electric appliance [1]. Joerg D. Weigl et.al has designed an alternate solution with the bicycle hydrogen system. It is equipped with a proton exchange membrane fuel cell stack. Refilling station was also deigned [2].

The aim of this project is based to reduce pedal force from the human and riding the bicycle by using solar charged battery. It can be self-energized easily. The eco-friendly and cost-efficient solar power electric bicycle was fabricated and tested for its performance. The fabricated solar powered bicycle runs for 20 Km, 15Km , 12Km, 8Km, 5Km for 100%, 80%, 60%, 40%, and 20% battery charging level respectively.

II. BICYCLE FABRICATION METHODOLOGY

The conception of the electric bicycle became possible and sensible. Because the years progress, additional electrical bicycles were made with varied driving mechanisms. The solar powered electrical bicycle offers a cleaner travel for short-to-moderate distances instead of driving a petrol/diesel-powered automotive. It'll run on clean power with the flexibility to recharge the battery three separate ways: through AC wall supply, by generating power through the pedals of bicycle dynamo and by solar-cell generative power. Fashionable electrical bicycles integrate many inventions from technology and style, significantly within past year.

In this research work the solar powered bicycle with IoT was fabricated with solar panel, battery, BLDC motor, and Arduino. The bicycle itself had no gear and therefore the motor may draw up to 7Ah with a 12V lead-acid battery (maximum charging current 2.1 A and minimum Charging Current 0.7A). The Fig.1 represents the block diagram for motor control and charging indicator. The solar panel receives the sunlight and produces the DC power. DC power from solar panel was altered by the solar panel charge controller. Solar panel charge controller steps up the voltage into the required battery rating and the energy is stored in the battery. The battery can also be charged directly with AC supply with charger. The motor speed controller controls the speed of the BLDC motor with the help of moving the accelerator, when the accelerator moves on increasing the motor speed is increased and the accelerator is reduced the motor speed will be reduced.

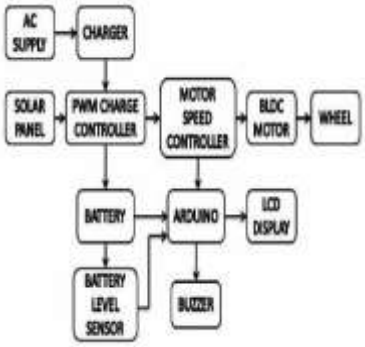


Fig.1 Motor Controller and Voltage Level Indicator

The motor speed and the level of the battery have been sensed by ARDUINO. ARDUNIO send the motor speed and the battery level to LCD display, buzzer and mobile phone with IOT. The Arduino consists of a physical programmable circuit board used to write and upload computer code to the physical board, it is easy user interface. The vehicle speed, and battery level can be calculated by using the Arduino with the help of the Arduino IDE with using the formulas. The solar panel receives the solar light and stores energy in the battery with the help of the solar PWM converter or battery can be charged by using the ac mains supply. The solar panel which is used to receive the energy from the solar and the produced energy will be stored in the battery; the battery will store the 12V DC. But the BLDC motor speed controller requires 48V DC, so the PWM solar charge convert 12V DC to 48V DC. Fig. 2 and Fig. 3 shows the fabricated solar powered bicycle and vehicle setup respectively.

The energy can be converted to 48v because the motor speed controller requires 48v to operate the motor. The motor was interconnected with wheel which is the BLDC hub motor. The voltage level sensor is used to measure the voltage level in the battery and displays the battery level in the display and estimates the remaining kilometres to be operated with the battery level also displays. When the battery level is low the buzzer will alarm the low indication of the battery.



Fig. 2 Fabricated solar powered bicycle



Fig. 3 Vehicle Setup

The throttle is used to control the speed of the BLDC hub motor with the control in motor speed controller which was shown in the Figure 3. The voltage in the battery can be measured by using the voltage level sensor where the sensor is connected to the Arduino with the calculations the voltage can be measured and the estimated kilometres displayed in the display was shown in the Figure 4. The battery is below 20% the buzzer will indicates the sound for each 5 sec to ensure the battery is low level we want to the charge the battery.

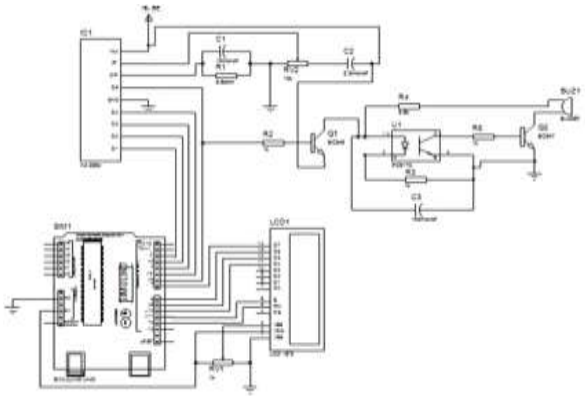


Fig. 4 Battery Level Indicator

III. RESULTS AND DISCUSSION

In this research work the authors tried to optimize the performance, accuracy, security, speed, and cost incurred in the fabrication of solar powered bicycle. The aim of this project was to reduce pedal force by the driver while riding the bicycle through the utilization of solar charged battery. The eco-friendly and cost-efficient solar power electric bicycle was fabricated and tested for its performance.

Initially, the passenger cum driver of the bicycle drove the bicycle by paddling for 5 minutes then the motor was switched on which runs on the solar energy which was stored in the battery. The parameters such as speed, battery level and battery status (charging/discharging/low power/full power) was sensed and monitored by ARDUNIO. The bicycle can run at a maximum speed of 30 Km/hr which is better than the existing e-bicycles. The time taken by bicycle to fully charge is 5 hours for 12V lead-acid battery (maximum charging current 2.1A and minimum charging Current 0.7A) connected to the solar panel, which can also be charged using dynamo. The cost incurred in the fabrication of solar powered bicycle was 12,000 INR as shown in Table 1. It can also be duduced that the smart energy management system with solar power charging the battery will definitely reduce the air pollution.

Table.1: Cost incurred in fabrication of solar powered bicycle

Component Name	Cost (Rs.)
Bicycle	3000
Motor	700
Battery	900
Gear system	400
Solar Panel	1500
Arduino	1200
Braking System	1000
Painting cost	1000
Lights	1000
Dynamo	800
Switches	500
Total Cost	**12000/-**

The performannce analysis of the solar powered bicycle with the battery percentage, voltage level, estimated kilometres driven from the current location, and charging time are shown in the Table 2. The fabricated solar powered bicycle runs for 20 Km, 15Km , 12Km, 8Km, 5Km for 100%, 80%, 60%, 40%, and 20% battery charging level respectively.

Table.2: Overall performance analysis of solar powered bicycle

S.No.	Battery Percentage	Voltage Level	Distance Driven (Km)	Charging Time
1	100	11.92	20	5 Hours
2	80	10.4	15	4 Hours
3	60	7.8	12	3 Hours
4	40	5.3	08	2 Hours
5	20	2.6	05	1 Hours

IV. CONCLUSIONS

The use of bicycle is good for maintaining, hygiene, and it is also environment friendly. In some localities there is a problem of jams and parking spaces. A number of different aspects thrust the use of solar powered electric bicycles in different situations. These include low cost per distance travelled for a single rider, savings in other costs such as insurances, licenses, registration, and parking, improvement of the traffic flow, environmental friendliness, and the health benefit for the rider. The world is quickly moving towards energy sustainability. With an unhealthy hike in the prices of petrol and diesel, an automobile running on solar power can create a trend thus solar bicycle is very essential.

In this research work a solar powered electric bicycle was fabricated by using commercial components available in the market. In this bicycle we have used electric propulsion system using BLDC motor with sensory speed control along with smooth running operation. When compared to the normal electric vehicle the fabricated solar powered bicycle is cost-efficient. The cost incurred in the fabrication of solar powered electric bicycle is aapproximately 12000 Indian Rupees. Solar charging of the proposed system makes it energy efficient. The fabricated solar powered electric bicycle is running successfully as per the desired objectives.

REFERENCES

1. Chien-Ching Su and Kaohsiung Hsien " Solar Skateboard" U.S Patent US20070272465A1, Nov. 29, 2007

2. Joerg D. Weigl , Low Wen Bin , Ayush Kumar Pacheriwala and Luo Yi1 "Multifunctional Solar Charging Station for Electric Vehicles" EVS28 KINTEX, Korea, May 3-6, 2015

3. Ankicakovač and Matejparanos "Design of a solar hydrogen refuelling station following the development of the first croatian fuel cell powered bicycle to boost hydrogen urban mobility" International Journal of Hydrogen Energy,Vol.44, No.20, 19 April 2019, PP. 10014-10022

4. Abdulkadir Baba Hassan,"Design And Fabrication Of A Motorized Prototype Tricycle For The Disable Persons" IOSR Journal of Engineering,Vol.2,No.5, Pp.1071-1074,2012.

5. Arun Manohar Gurram, P.S.V Ramana Rao, Raghuveer Dontikurti, "Solar Powered Wheel Chair: Mobility For Physically Challenged" International Journal of Current Engineering and Technology ,ISSN2277–4106,Volume 2, No.1, Pp .211-214,2012.

6. 6. Pooja Iyer M, G Ravi Teja, V Sitaram Prasad, "Design And Fabrication of Solar Electric Scooter International Journal of Research in Engineering and Science (IJRES) Vol 2,No.5, Pp .21-28,2014

7. Satish Kumar Dwivedi , Deepak Kumar Yadav, Ashutosh Mishra, Madhusudan Jaiswal , Challenged Shrikant Singh, Sujeet Kumar,"Design And Fabrication of A Motorized Tricycle For Physically Persons" International Journal of Engineering Science Invention,Vol.3,Pp.29-32,2014. Meerut Institute of Technology, Meerut

8. 8. Reddi Sankar.M, T. Pushpaveni, V. Bhanu Prakash Reddy, "Design And Development Of Solar Assisted Bicycle", International Journal of Scientific and Research Publications, Vol 3,No. 3,Pp .781-786,2013.