SOLAR POWER ASSISTED TWO-WHEELER

Bhosale Shivaji Subhash[1*], Tamboli Madina Shajahan[2], Sharma Kamalkishor Mulchand[3], Deshmukh Narendrarao Pandurang[4], Salunke Shrikant Dadasaheb[5]

Abstract:
The production of solar vehicles has taken on an accelerated pace in a cosmos where environmental conservation and drive figuring are increasing concerns. EVs are increasingly becoming available on the class. This possibility is taken to build and develop solar two-wheelers (E-Bike) solar voltage stored in a battery is used and developed and used for the motor drive. In this article, the so-called solar-powered e-bike focuses primarily on a new form of e-bike, concluding that it has potential as a sustainable mode of transport in urban areas and towns, potentially replacing traditional means of transport. The solar-assisted E-bike and traditional E-bike are contrasted in this article. This system of transport is focused on autorickshaws that function in an environmentally friendly manner. Current cars are to be replaced by a redesigned all-electric equivalent that increases the vehicle's performance. The batteries to be charged use a largely renewable energy source, such as solar power. This paper presents the design of solar assisted E-bike. Solar assisted E-bike system is simulated.

Keywords: -Solar PV System, Electric Bike

[1*,2,3,4,5]Dattakala Shikshan Sanstha "Dattakala Group of Institution" Swami-Chincholi, Daund, Pune, Maharashtra 413130. India.

***Corresponding Author:** Bhosale Shivaji Subhash
*Dattakala Shikshan Sanstha "Dattakala Group of Institution" Swami-Chincholi, Daund, Pune, Maharashtra 413130. India.

DOI: 10.53555/ecb/2022.11.01.66

I.INTRODUCTION

The availability of fossil fuels such as coal, natural gas and oil is restricted in several reports. The effect of fossil fuel energy on global climate change is limited. Energy demand is that as global propulsion and economic growth in many developing countries as well as developed countries are growing. In comparison to fossil fuels, alternative energies or renewable energy should be deliberately pursued sooner rather than later. Renewable energy such as solar will provide a long-term response to climate change and mitigate it. It causes environmental pollution and impacts human life. This type of problem are reduced by using solar assisted E-Bike.Some of the best strategies for reducing environmental harm caused by CO2 emissions are solar E-Bikes.

The benefits of E-Bike helped by solar

- Provide renewable energy to cut CO2 emissions.
- Fuel is not required.
- Low maintenance and noiseless

II. Design of solar assisted E-Bike

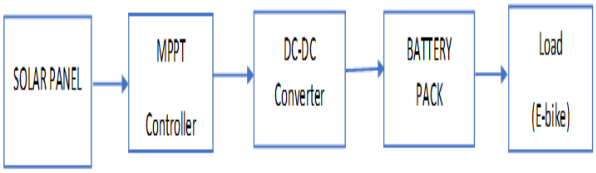

Fig.1: Block Diagram of solar assisted E-Bike

Solar power can be used in electric vehicle. As seen in figure 1, the organizational block diagram is It fit of a solar panel, a DC-DC converter, an MPPT controller, a battery charger and a load converter. Solar panel from voltage and current input to the MPPT controller initially. According to The MPPT algorithm used to track the solar panel's maximum power point, these values can then continue. The MPPT block yield is utilized as a DC-DC converter input, which can be a voltage boundary or an obligation cycle. The DC-DC Converter assists with keeping up the full PowerPoint working voltage. A boost converter is used to increase the overall PowerPoint operating voltage. Between a solar panel and a load, the DC-DC power converter is linked.

PV Module

250 watts module are used. In a series and parallel configuration, modules are connected to form an array of desired high voltage and high current. Using a single diode equivalent circuit, the PV module is mathematically modelled. When designing the PV array, the wallop of solar ray triggers temperature was considered. PV module, to increase voltage. Photocurrent, diode, parallel resistance voicing leakage current and series resistor showing internal resistance to current flow in the circuit are part of this Pv module. PV cell circuit seen in Fig.2.

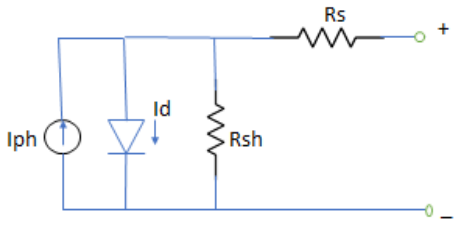

Fig.2: PV Cell Model Noesis Circuit

The mathematical modeling of the PV array can be given as:

$$Ia = Ia - (I_{ph} - Ia - Ir .* (\exp((Vc + Ia .* Rs) ./ Vt\_Ta) -1)) \quad (1)$$

$$I_{sc} = I_{sc}\_TrK * (1 + (a * (TaK - TrK))) \quad (2)$$

$$I_{ph} = G * I_{sc} \quad (3)$$

$$b = Eg * q /(n * k) \quad (4)$$

Solar cell current,

I_{ph}= [I_{sc} +K(T-298)]*Ir/1000

Where,
$I_{ph=}$ Light generated current
q= Electron charge $1.6*10^{-19}$c
k= Boltzmann's constant $1.38*10^{-23}$J/K
$R_{s=}$series Resistance
$R_{sh=}$Shunt Resistance
$I_{sc=}$Short Circuit current
Eg= Bang gap semiconductor energy used in the cell

Table1: PV module specification

PV Module parameter	**Values**
PV Module	250 watts
OC voltage	37.51
SC current	8.63
No. of parallel PV cell	6
No. of series PV cell	10
Temperature Coefficient	25^0c

DC-DC Boost converter

The boost converter is a tool for the absorption and injection of energy from the solar panel to the DC link. The circuit component of the boost converter consists of inductor, IGBT, diode, and capacitor which acts as a load.

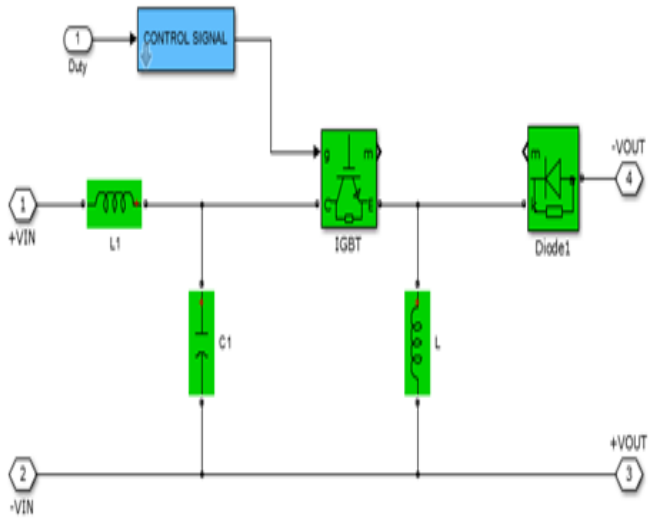

Fig.3: DC-DC Boost Converter Simulink model

Table2: DC-DC converter parameter specification

Parameter	**Rating**
Inductor	$1000*10^{-6}$
Capacitor	$2000*10^{-6}$
(IGBT) Forward voltage	2.5
Resistance	0.00001
Current fall time	$1*10^{-6}$
Current tail time	$1*10^{4}$
Diode Resistance	0.00001
Forward voltage	0.8

MPPT

MPPT is victimized to achieve the solar wear full power point and gives the gate signal to raise the converter as well. The Boost converter helps to preserve the full PowerPoint operating voltage. For maximal power point monitoring, there are some methods used. Methods are used to interrupt and observe.

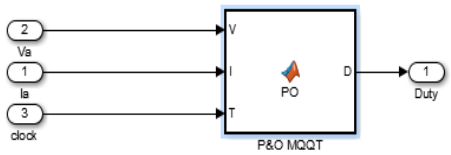

Fig.4: MPPT Simulink model

Battery

Electric vehicle uses rechargeable batteries. battery system uses lithium-ion type battery. Depending on the kind of use the life of a battery pack varies.

Table3: Battery Pack specificatio

Parameter	Rating
Battery type	Lithium Ion
Nominal voltage	48
Rated capacity(Ah)	7.2
Initial state of charge	50
Max capacity(Ah)	100
Fully charged Voltage(v)	58.4
Internal Resistance	0.0048
Charging Time	49 Min.
Maximum distance per recharge(km)	90km

III. Design of Electric Bike

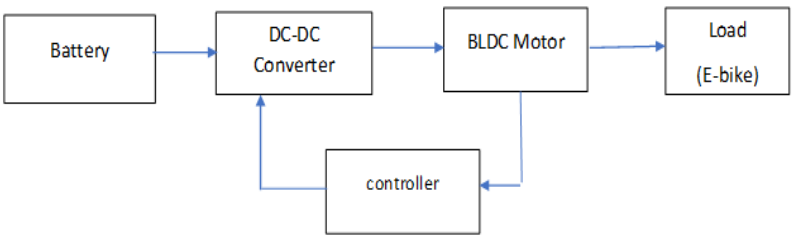

Fig.5: Block diagram E-bike

Electric bike that is powered with the aid of a battery that is attached to an electric motor.The main principle of EMF of on AC motor which incur electrical energy fund in D.C battery is connected with help of DC to AC device. The E-bike consist of DC motor battery frame, breaking system, chain set and sprocket. With a maximum of 500 rpm per minute, the DC motor has a rated power capacity of 750w. The rated voltage is dc 48v and 13.5amp is the rated current.

IV. Perturb and observe algorithm (P&O)

For tracking the MPPT, the P&O process is used. In this technique, the energy variation of the PV module is caused by a minor disturbance. Intermittently, the PV yield power is estimated and contrasted and the past force. A similar cycle proceeds if the yield power increments, in any case, the unsettling influence is turned around. In this calculation, the PV module voltage is upset. The voltage of the PV module is extended or reduced to check whether the force is increased or decreased. This implies the working purpose of the PV module is on the left of the MPPT when an expansion in voltage prompts an increment in force. Further interruption against the option to hit MPPT is thus important. On the other hand, if an expansion in voltage prompts a lessening in force, this implies that the PV module's working point is on the privilege of the MPPT, and along these lines, more aggravation to one side is needed to arrive at the MPPT. The flow chart of the adopted P&O algorithm for the charge controller is given in Fig.8. Checks PV and battery voltages while the MPPT charging regulator is attached between the PV module and the battery. Choose whether or not the battery is completely energized after the battery voltage is determined. At a time where the battery is completely energized (12.6 V at the battery terminal), charging avoids trying not to trick the battery. At that point, the microcontroller can measure the current force Pnew at the output by estimating the voltage and current and contrast this calculated force with the previous measured power Pold.On the off chance that Pnew is more noteworthy than Pold, the PWM obligation cycle is expanded to remove most extreme force from the PV board. The duty cycle is reduced if Pnew is lower than Pold to ensure that the system returns to its previous full power. This MPPT algorithm is fast and simple to apply, with high accuracy and low cost.

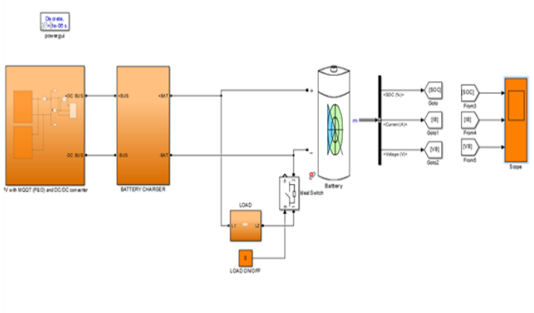

Fig 7: Simulation Diagram(a) E-bike

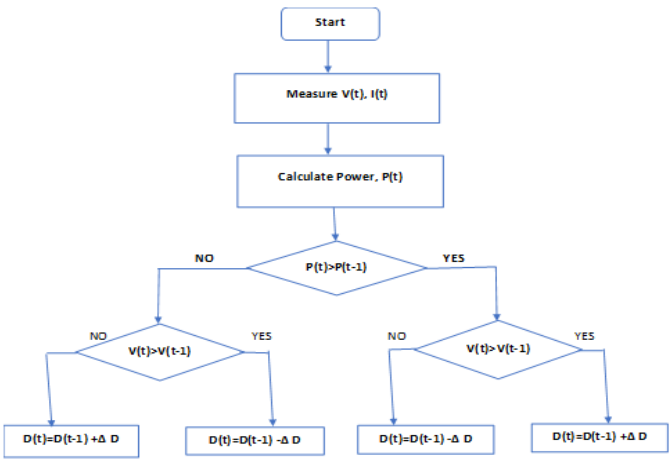

Fig.6: Perturb and observe (P&O) Algorithm flowchart

V.SIMULATION DIAGRAM

PV cells are the source of power the battery is charged genuinely from the PV cells during the time when
the.power is adequate and gets feed among DC-to-DC converter and this uploads the battery charge evidently. The E-bike and E-rickhaw model is designed and simulated using matlab/Simulink. Simulink model shown in Fig.9 and obtained the corresponding voltage, current, SOC waveform

VI.SIMULATION RESULT

Simulation Result of E-bike

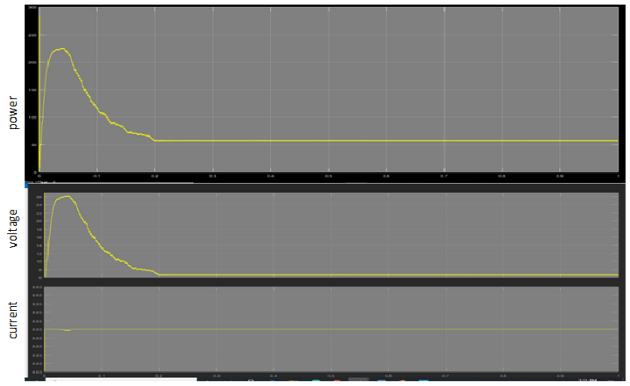

Fig.8. PV Module output waveform

Fig.9 DC-DC Converter output waveform

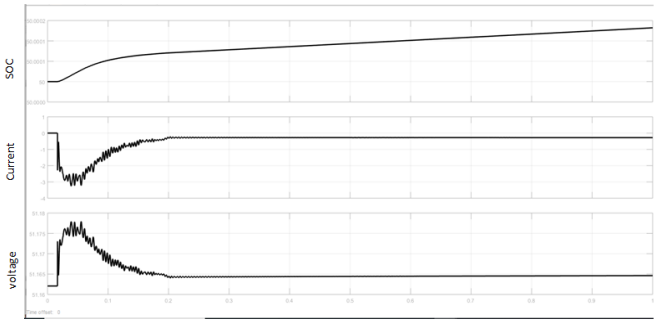

Fig.10 Battery output waveform

Conclusion

The E-Bike is designed by optimizing body weight of bike and powered by Stand-alone Photo Voltaic systems. This paper shows the best method of utilizing the solar energy for passenger and good transportation purpose, also explores different ways for reduction of emissions from commercial vehicles by developing a user friendly ecologically and economically viable e-bike as a sustainable transport for rural urban areas with an increase in utilization of natural power like solar energy having solar radiations. The purpose of the paper i.e. the development of an effective and optimised system, has been achieved.

REFRENCES

1. Priscilla Mulhall1, Srdjan M. Lukic2, Sanjaka G. Wirasingha1, Young-Joo Lee1, and Ali Emad Solar/Battery Electric Auto Rickshaw Three-Wheeler (2009)
2. C.D. Ajudiya, M. M. trivedi, "Design and Development of EBike –A Review" Iconic Research and Engineering journalsVol.1 Issue 5- Nov 2017
3. Kumari, J. S., Babu, D. C. S., & Babu, A. K. (2012). Design and analysis of P&O and IP&O MPPT techniques for photovoltaic system.
4. Suwannatrai, P., Liutanakul, P., & Wipasuramonton, P. (2011). Maximum power point tracking by incremental conductance method for photovoltaic systems with phase shifted full-bridge dc-dc converter. In Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON), 2011 8th International Conference on (pp. 637-640). IEEE.
5. Fred Chiou, "Solar Energy for Electric Vehicles"2015 IEEE Conference on technology for sustainability.
6. Yogesh Sunil Wamborikar, Abhay Sinha" Solar Powered Vehicle" Proceedings of the World Congress on Engineering and Computer Science 2010 Vol II WCECS 2010, October 20-22, 2010, San Francisco, USA
7. Mulhall, P.; Emadi, A. Comprehensive simulations and comparative analysis of the electric propulsion motor for a solar/battery electric auto rickshaw three-wheeler. In Proceedings of the 2009 35th Annual Conference of IEEE Industrial Electronics, Porto, Portugal, 3–5 November 2009; pp. 3785–3790