Solar Foldable Electric Cycle

Doshi Harsh[1] Patel Dhananjay[2] Patel Mohit[3] Savaliya Pinak[4] Mr.Jignesh K. Soni[5]
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Department of Automobile Engineering
[1,2,3,4,5]Bhagwan Mahavir College of Engineering & Technology, Surat, Gujarat, India

Abstract— we all know that the fuel price and pollution due to general vehicles in metro cities and urban areas is increasing day by day. To overcome these problems, alternatives methods are being developed. The solar assisted bicycle developed is driven by BLDC motor fitted in front axle and is operated by solar energy. The solar panels placed on the bicycle will charge the battery which further drives the BLDC hub motor. When the bicycle is not in use, the batteries get charged using the solar power; also, batteries can also be charged using a wall charger. This model is being designed in order to overcome few problems associated with previous models. Few problems from previous models are rectified in this prototype and required tests are carried out.

Keywords: Save Non-Renewable Energy, Reduce in Pollution, Easy to Transport, Foldable

I. INTRODUCTION

A folding bicycle is a bicycle designed to fold into a compact form, facilitating transport and storage. When folded, the bikes can be more easily carried into buildings and workplaces or on public transportation (facilitating mixed-mode commuting and bicycle commuting), and more easily stored in compact living quarters or aboard a car, boat or plane. Folding mechanisms vary, with each offering a distinct combination of folding speed, folding ease, compactness, ride, weight, durability and price. Distinguished by the complexities of their folding mechanism, more demanding structural requirements, greater number of parts, and more specialized market appeal, folding bikes may be more expensive than comparable non-folding models. The choice of model, apart from cost considerations, is a matter of resolving the various practical requirements: a quick easy fold, compact folded size, or a faster but less compact model. There are also bicycles that provide similar advantages by separating into pieces rather than folding.

A. Electric Bicycle

An electric bicycle, also known as an e-bike, is a bicycle with an integrated electric motor which can be used for propulsion. There are a great variety of different types of e-bikes available worldwide, from e-bikes that only have a small motor to assist the rider's pedal-power (i.e. peddles) to somewhat more powerful e-bikes which tend closer to moped-style functionality: all however retain the ability to be pedaled by the rider and are therefore not electric motorcycles.

E-bikes use rechargeable batteries and the lighter varieties can travel up to 25 to 32 km/h (16 to 20 mph), depending on the laws of the country in which they are sold, while the more high-powered varieties can often do in excess of 45 km/h (28 mph). In some markets, such as Germany, they are gaining in popularity and taking some market share away from conventional bicycles while in others, such as China, they are replacing fossil fuel-powered mopeds and small motorcycles.

B. Function of Solar foldable Bicycle

Depending on local laws, many e-bikes (e.g. peddles) are legally classified as bicycles rather than mopeds or motorcycles, so they are not subject to the more stringent laws regarding their certification and operation, unlike the more powerful two-wheelers which are often classed as electric motorcycles.

E-bikes can also be defined separately and treated as a specific vehicle type in many areas of legal jurisdiction. A peddles (from pedal electric cycle) is a bicycle where the rider's pedaling is assisted by a small electric motor; thus they are a type of low-powered e-bike.

However, unlike some other types of e-bikes, peddles are classified as conventional bicycles in many countries by road authorities rather than classified as a type of electric moped. Peddles include an electronic controller which stops the motor producing power when the rider is not pedaling or when a certain speed – usually 25 km/h – has been reached. Peddles are very useful for people who have to ride in hilly areas or where there are often strong headwinds.

A peddles can be any type of bicycle, but a peddles city bike is very common. Ordinary conventional bicycles can be converted to peddles with the addition of the necessary parts, i.e. motor, battery etc.

The most influential definition which defines which e-bikes are peddles and which are not, comes from the EU and as such is valid across the whole of Europe. From the EU directive (EN15194 standard) for motor vehicles, a bicycle is considered a peddles.

In a parallel hybrid motorized bicycle, such as the aforementioned 1897 invention by Hosea W. Libber, human and motor inputs are mechanically coupled either in the bottom bracket, the rear wheel, or the front wheel, whereas in a (mechanical) series hybrid cycle, the human and motor inputs are coupled through differential gearing.

II. LITERATURE REVIEW

Solar foldable E-cycle is multifunctional, efficient and economical material handling system widely used in industry.

G.Srinivisa Rao[1] says that This is literature on design of solar bicycle. In this there are many components are used for design like, solar panels, HUB motor, li-ion battery, accelerator, motor controller. It includes details of that components and factor affecting on efficiency This solar bicycle is also cost effective when compared to conventional bikes. The total cost of this solar bicycle is around Rs 20,000/ $300. The payback period is around six years.

Deep Prajapati[2] says that We are study this literature for design of fabrication on electric bike, In this literature is show the overview of electric bike design, construction and working. We study this literature for guide to some construction and design related. And also design of different components and calculations of that components. It is very helpful to us for choose the proper component and efficiency of that components.

Mitesh trivedi[3] execution of speedier cyclists (e.g. Speeder rider), the potential mean speed might be even advanced under various situations. Authors also found noteworthy variances in numerous measures between peddles and orthodox bicycles, although less noticeable. This might interpreted as a symptom that, when accelerating from standstill, the assistance provided from motor used by the peddles. riders to reach their preferred speed easier, not earlier. Authors also given the variance in the user population, it is not irrational to admit that at present, e-bikes do not cause any revolution in cycling mean speed at all.

Ambiwade Vishal[4] says that We are study this literature for design of fabrication on electric bike, In this literature is show the overview of portable solar bike design, construction and working. We study this literature for guide to some construction and design related. Designs of bike size of part and weight is importance in design .solar size and weight all so comfort of driver. And also design of different components and calculations of that component. Weight of bike also impact of speed of bike. It is very helpful to us for choose the proper component and efficiency of that components.

Kunjan Shinde[5] says that We are study this literature for design of fabrication on electric bike, In this literature is show the overview of portable solar bike design, construction and working. We study this literature for guide to some construction and design related. design of e bike of part and weight is importance in designs. And also design of different components and calculations of that component. Also a different countries a use of watt (250 -750) and bike weight of different speed is (25-32) a made a different countries. To bike are option pedal, hand or pedal hand in bike type. Use of batteries to a dc to ac form .It is very helpful to us for choose the proper component and efficiency of that components.

Pradeep S[6] says that We are study this literature for design of fabrication on smart bicycle. In this literature is show the overview of portable bicycle design, construction and working. We study this literature for guide to some construction and design related. Foldable bike to overview of deigns of bicycle to note a foldable part a wiring of bicycle battery form and mange a weight form too easy to foldable and easy to one place to other place to transport.

Georgia Apostolou [7] says that One of the largest sources of air pollution in urban areas is transportation . Air pollutants have numerous impacts on human health, the climate, ecosystems, and the built environment. European and worldwide authorities support emission free mobility and consider it necessary for the development of their national sustainable strategies. Since 2000, governments have been promoting bicycles as an alternative mode of transportation to replace private cars, especially in urban areas where the terrain and the road network allow it. Bicycles could contribute to the reduction of air pollution, traffic congestion, noise emission, and energy consumption, allowing at the same time a healthier lifestyle for users.

Dr.Y.sujatha[8] says that the objective to be conduct before continue to proceed on this project, To develop a vehicle that use renewable energy, environmentally friendly and heap. To develop an electrical bicycle that can charge the battery when it is not in used. common rotation axis and two thrust shafts shifting by the action of drive means and acting on the opposite sides of the scissor arms, causing the tabletop to lift or lower.Peddles are classified as conventional bicycles in many countries by road authorities rather than classified as a type of electric moped. Peddles include an electronic controller which stops the motor producing power when the rider is not pedaling or when a certain speed – usually 25 km/h – has been reached. Peddles are very useful for people who have to ride in hilly areas.

Dr.Y.Sujatha[9]says that the first combination of photovoltaic devices and electric vehicles happened in the late 1970's. To generate more publicity and research interest in solar powered Transportation, Due to the unique nature of the solar community and events, these technologies remains an untapped resource. Significant improvements and understanding of electric vehicles has been developed that can be applied to a broader range of automobiles to provide more efficient and cleaner alternatives over combustion engine vehicles.

C.Sivapragash[10] says A number of different aspects thrust the use of electric bicycles in different situations. These include lower energy 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. This paper shows the design of an electrical drive for a motorized bicycle is described, using commercial components available on the market. In this paper , we have proposed electric propulsion system using BLDC motor with sensory speed control along with smooth running operation.

A. Summary of literature Review

The aim of this review paper was to capture the status and experiences with the use of e-bikes, more specifically, with the solar-powered e-bikes. This paper presented research conducted so far on e-bikes and solar-powered e-bikes, as well as the main technical features of solar e-bikes. It also introduced the solar e-bike as a sustainable transportation mode, based on literature data and a field experiment in The Netherlands, which aimed to investigate the target group of solar e-bikes and user beliefs about the specific transportation medians also see the what about the calculation we have use for different feature specifications.

III. PROBLEM DEFINITION

Now the India rapidly becomes most pollutant nation in world, we can test those pollutants in our mouth at urban cities like Delhi, Allahabad, and Gwalior etc. According to report of 2012 there are 37 million motorcycles are holds in

India. China is nearly close to India with a number of 34 million motorcycles. In the major cities 72% pollution created by only vehicles, there are no of bikes and motorcycles are registered every day. Energy to drive vehicles is one of the most vital needs for human survival on earth.

We are dependent on conventional form of energy it's time to work on non-conventional, unexhausted energy sources like solar energy for drive the vehicle for transportation. One such form of energy is the energy from fossil fuels. But the main disadvantages of these fossil fuels are that they are not environmentally friendly and they are exhaustible. To deal with these problems of fossil fuels, India has major share in diesel and petroleum for IC Engine bikes, we need to look at the non-conventional sources of energy. Although the lack portability of IC engine bikes, due to which varies problems are arises like traffic jam in urban areas, where temperature is sensibly raises in current era. The heaviness and bulkiness of IC engine bikes is the main problem, we need to discover better option for it.

IV. WORKING OF CYCLE

– Working procedure of solar foldable electric cycle

The basic working diagram of solar portable bike. By using solar panel sunlight is directly converted into DC current, collect in lead acid batteries through voltage controller. After that power used to rotate the DC motor with speed controlling action by throttle. Motor gives torque to rear wheel at very good speed. When loaded of vehicle near about 35 to 45 km per hr.

1) Used of solar Panel

The title indicates that the bicycle is operated by solar energy. Solar cells convert the energy from the sun directly into electricity based on photovoltaic effect. The photovoltaic effect involves the creation of a voltage based on the electrons ejected by another light effect called photoelectric effect. Solar cell works on two effects namely photoelectric and photovoltaic. In photoelectric effect, electrons are liberated when light rays fall on a metal surface and these electrons are transferred to the valence and conduction band causingvoltage between these electrodes because of the photovoltaic effect.

Fig. 1: Solar Panel

2) Chain Sprocket

A chain and sprocket drive is a type of power transmission in which a roller chain engages with two or more toothed wheels or sprockets, used in engines as a drive from crankshaft to camshaft.

– Specification of solar foldable electric cycle

1. The pedal-assist, i.e. the motorized assistance that only engages when the rider is pedaling, cuts out once 25 km/h is reached.
2. When the motor produces maximum continuous rated power of not more than 250 watts (nab the motor can produce more power for short periods, such as when the rider is struggling to get up a steep hill).
3. An e-bike conforming to these conditions is considered to be a peddle and is legally classed as a bicycle.
4. When the charging is finished, it becomes charge by re pedaling, within a 1 km.
5. In this cycle we are used a battery to rechargeable in home within a 1 hour.
6. Easy to carry since it is portable.

3) Battery

Powers the Air Compressor, and also communicate with solar panel to recharge the battery.it used to recharge in home in some free times. Current supplied from battery it indicates the flow of energy from the battery and is measured in amperes (or Amps). The higher the current rating the slower the battery will discharge. A battery is rated in ampere-hours (abbreviated Ah) and this is called the current rating. This project revolves around charging and discharging energy within a high voltage battery. Thus this project demands for a battery with longer running hours, lighter weight with respect to its high output voltage and higher energy density.

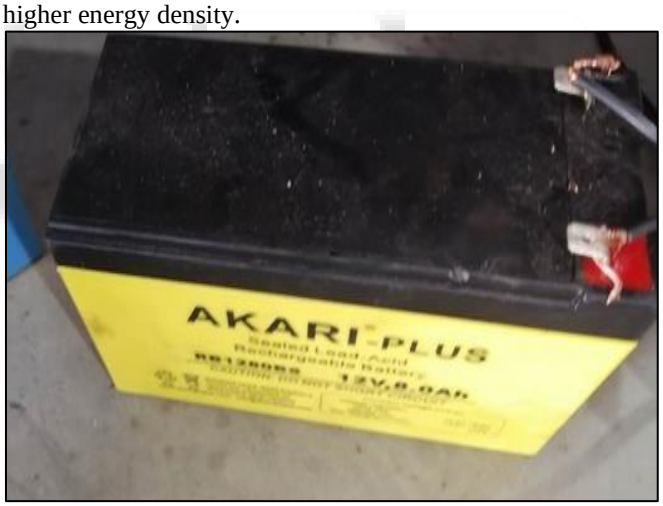

Fig. 2: Lead acid battery

4) Fabrication of designing model frame

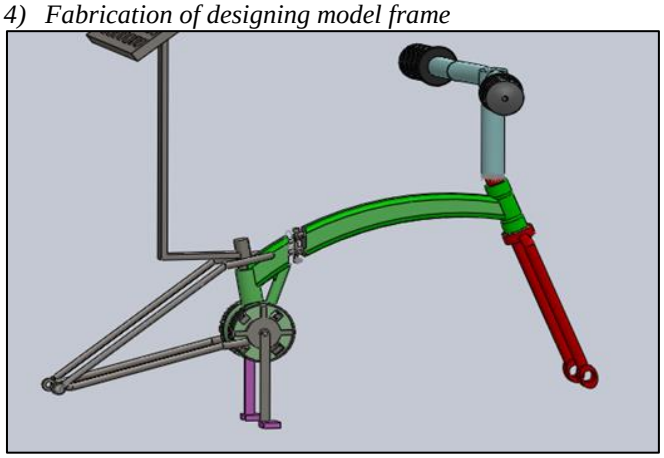

Fig. 3: Frame work of cycle

In this cycle we are making a frame work of model, to containing a load absorb capacity and frame working.to lack of heaviness and bulks of controlling loading.

5) 5. Component Seat:-

To operate with softly seating and handling movement, With soft cushioning effect to provide good and long driving skills.

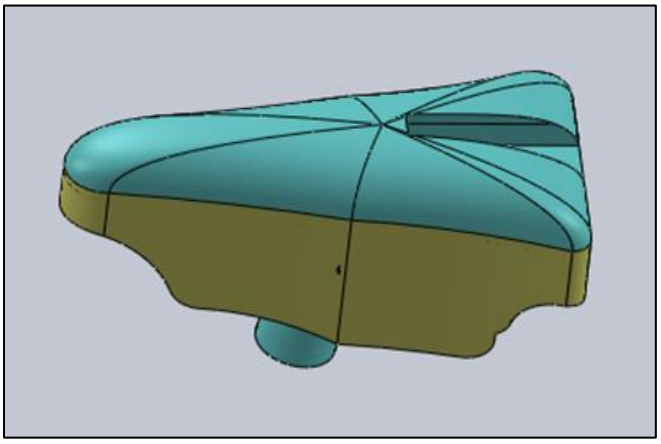

Fig. 4: Seat Design

6) BLDC Motor Hub: -

An electric motor is a device used to convert electrical energy to mechanical energy. Electric motors are extremely important in modern-day life. The basic principle on which motors operate is Ampere's law. This law states that a wire carrying an electric current produces a magnetic field around itself.

Fig. 5: BLDC motor

A. Working and specification cycle

Fig. shows the basic working diagram of solar portable bike. By using solar panel sunlight is directly converted into DC current, collect in lead acid batteries through voltage controller. After that power used to rotate the DC motor with speed controlling action by throttle. Motor gives torque to rear wheel at very good speed. When loaded of vehicle near about 35 to 45 to km per hour.

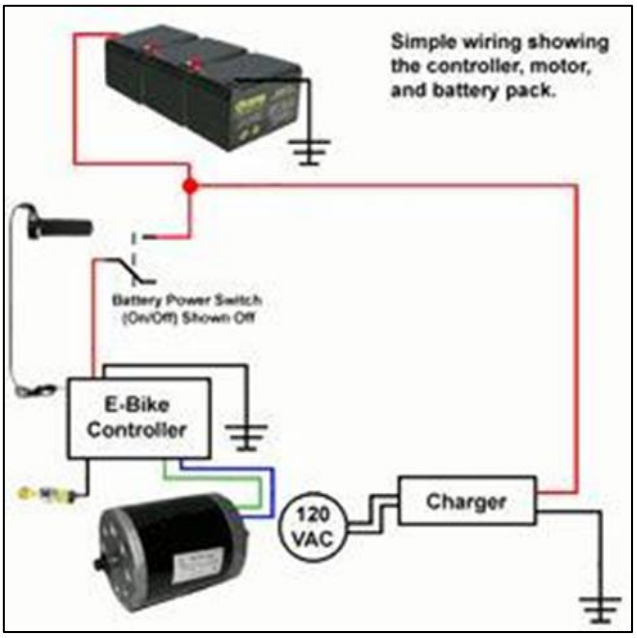

Fig. 6: Basic Wiring Diagram

B. Material Function

Various types of electrical components were used for making the Solar Portable Bike. Some of them with average price are,

Sr. No.	Component	Specification
1	BLDC Motor (MY1016)	24V 250W
2	Speed Controller And Throttle	(XCLUMA) 24V 350W
3	Solar Panel	250W
4	Batteries	(12V 7A)×2
5	Fabricating Material	Metal sheet, Steel pipes, Wood, Bearings, Chain drive and Sprocket, Wheels, etc.
6	Accessories and Attachments	Indicating lights, horn, charging port, etc.

Chart 1.Material Specification

C. Solar Modular Rating

PARAMETER	VALUE
MAXIMUM POWER (Watt)	100
OPTIMUM OPERATING VOLTAGE (Voo)	18.9 V
OPEN CIRCUIT VOLTAGE (Voc)	22.5 V
OPTIMUM OPERATING CURRENT (amp)	5.29 A
SHORT CIRCUITING CURRENT Isc (amp)	5.75 A

Chart 2. Solar Value Rating

D. Advantage

- Easy to communicate with low fatigue.
- Less maintenance cost.
- Normal Drag/Pedal is possible when power is not use.
- Deployable batteries can be taken inside house.

- Cost of the unit is very low.
- High efficiency can be obtained if inverter is used.
- Easy to carry since it is portable.
- Less energy consumed.
- High efficiency can be obtained if inverter is used.
- We are folding a bicycle in two parts to carry easily in transport.

E. Scope in Future

- 3D Design of electric folding bicycle.
- Market survey.
- Prepare a manufacturing drawing.
- Fabricate a model.
- Testing a electric folding bicycle.
- Maybe power generate by wheel rotation

F. Application

- Use as a portable bike.
- Use at tropical areas where normal vehicles can't go.
- We can carry it easily.
- It is use on a short distance.
- Easy handling in travelling.

G. Specification of E-bicycle

1. The pedal-assist, i.e. the motorized assistance that only engages when the rider is pedaling, cuts out once 25 km/h is reached.
2. When the motor produces maximum continuous rated power of not more than 250 watt.
3. An e-bike conforming to these conditions is considered to be a peddle and is legally classed as a bicycle.

V. Conclusion

A solar powered bicycle is practically designed and developed with an electrical efficiency greater than 80%. And the maximum speed of this solar assisted bicycle is 30 km/h, can be travelled up to 35 to 40 km with full charge of battery. It can be used by any age group people up to the weight of 120 Kg. By using this type of solar bicycles, pollution can be reduced and mainly fossil fuels can be protected and also good weight of loads can be pulled using this design. This solar bicycle is also cost effective when compared to conventional bikes. This paper compromises with 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.

References

[1] Ambilwade vishal,pathak vaibhav j,zhilwant supriya "dual purpose portable solar bike with optimized design" international research journal of engineering and technology, volume:05,issue:05,may-2018.
[2] Kunjan b.shinde" review on electric bike" international research journal of mechanical engineering and technology volume:7 ,issue:1 ,Nov 2016-april-2017.
[3] Dr.vatarajus,prem singh ,ragharedra prasad"national conference on advance in techanical engineering science" international research journal of engineering and technology, project reference no:-37S1127.
[4] Dr.Y.Sujatha, R.Jeelan, B.Ramakrishna review on "Solar Bicycle Performance and Analysis' in Andhra Pradesh. IJRMET Vol. 7, Issue 1, Nov 2016 -April 2017.
[5] Angèle Reinders and Karst Geurs Review An "Overview of Existing Experiences" with Solar-Powered E-Bikes. Received: 1 July 2018; Accepted: 2 August 2018; Published: 15 August 2018.
[6] M. W. Daniels and P. R. Kumar, "The optimal use of the solar power Automobile Selected from International Conference on Recent Trends in Applied Sciences with Engineering Applications. Control Systems Aditya Pratap Singh, "Speed Control of DC Motor using Pi Controller Based on Mat lab" Innovative Systems Design and Engineering, Vol.4, No.6, 2013.
[7] G.Srinivasa Rao,K.Harinadha Reddy,Raghu Thumu and Ch Amarendra"review on design of solar bicycle's L University volume:9 ,issue: trends and future in engineering, sep-6/2017.
[8] Sweta matey"review on-design and fabrication of electric bike", Department of mechanical engineering, university of mumbai, volume: 8,issue 3, March 2017.
[9] Tina gehlet,matthias kuehn,katja schleinitz,tibor petzolt, review on "The German Naturalistic Cycling Study Comparing cycling speed of riders of different bike's and conventional bicycles, November 2012.
[10] An innovative solar powered electric bicycle, by C.SivapragashC.ShankarM.Nageena.Reetha.Devi,K.Kiruthiga 10 JULY,2015,ISSN:-0974-2017

