

# SOLAR POWER BICYCLE

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**Abstract - As we all know the fuel prices especially the petrol is rising steadily day by day. Again the pollution due to vehicles in metro cities & urban areas is increasing continuously. 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 is in progress. The solar assisted bicycle develop is driven by DC motor fitted in rear axle housing & operate 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. As a part of dissertation work, the solar assisted bicycle is fit with a dc b motor on rear axle with the help of chain and sprocket of a bicycle.**

## I INTRODUCTION

Nowadays, the price of oil keeps on increasing. People want to use electricity instead of oil to operate transport. In China, the industry of electric bikes has grown rapidly in these 10 years. The design of electric bikes trends to more environmentally friendly. Solar energy is one of a new ways to replace electricity. The energy from the sun can be used to run electronic devices. In this project, a solar powered bicycle was designed. The materials used are more environmentally friendly and the cost is much lower than the existing solar powered bike. The maximum speed of the bike is 20km/hr. The charging time by using electricity is 2-3 hours and 4-6 hours by using solar energy. The design fulfills the requirements of China's government. Also, our target market is China. We have analyzed the market for of electric bikes to understand the needs of its citizens. The target customers want to have an electric bike with a light weight and don't need to recharge frequently. They also care about the safety of the bike. The depleting reserves of fossil fuels made the engineers and scientists to look for renewable energy sources. In addition, the environmental decay due to the combustion of fuel is alarming and justifies the design of eco-friendly system. India is spending large amount of foreign exchange to import crude oil even though we have abundant

resource of solar energy. If we utilise solar power for local conveyance, a large amount of currency can be saved and we can also ensure pollution free environment and contribute to nation's economy. The general mode of transportation for local trip (within a range of 5 km) is a bicycle, motor cycle or electrical bicycle. Bicycles are the cheapest, healthiest and eco-friendly but poses problem in climbing slopes. Motor cycles are not affordable to poor people and with the rising fuel prices.

All vehicles that are in the market cause pollution and the fuel cost is also increasing day by day. In order to compensate the fluctuating fuel cost and reducing the pollution a good remedy is needed i.e. our transporting system. Due to ignition of the hydrocarbon fuels, in the vehicle, some time difficulties such as wear and tear may be high and more attention is needed for proper maintenance. Our vehicle is easy to handle and no fuel cost to the other existing vehicles. Hence a need for a change in the existing alternative system which can produce higher efficiency at minimum cost was thought about an attempt has been made to design and fabricate such an alternative system. So this project "SOLAR CYCLE" is very much useful, since it is provided with good quality of power sources and simple operating mechanism. Hence "EACH AND EVERY DROP OF FUEL SAVES OUR ECONOMY AND MEET THE NEEDS" is the saturation point that is to be attained as soon as possible. In order to achieve this saturation point we have to save and seek for some other source of power. This power, the alternate power must be much more convenient in availability and usage. The next important reason for the search of effective, unadulterated power are to save the surrounding environments including men, machine and material of both the existing and the next forth generation from pollution, the cause for many harmful happenings and to reach the saturation point.

The aim of the project is to design a scooter with renewable solar energy. Solar Bike aims to be a small research and development business that develops renewable technology and helps everyone start riding electric bicycles around rather than using their cars. We firmly believe that using solar powered bicycles is one of the best methods of reducing our dependence on fossil fuels

and minimizing environmental damage caused by carbon dioxide emissions.

#### *1.1 Solar Energy*

Solar energy has the greatest potential of all the sources of renewable energy and if only a small amount of this form of energy could be used it will be one of the most important supplies of energy especially when other sources in the country have depleted. Energy comes to the earth from the sun this energy keeps the temperature of the above that in colder space causes the water cycle and generates photosynthesis in plants. The solar power where sun hits atmosphere is 1017 watts, where as the solar power on the earth surface is 1016 watts. The total worldwide power demand of all needs of civilization is 1013 watts. Therefore, the sun gives us 1000 times more power than we need. If we can use 5% of this energy, it will be 50 times what the world will require.

#### *1.2 Need for Non- Conventional Energy*

Fuel deposit in the world will be soon depleting by the end of 2020. Fuel scarcity will be maximum. Country like India may not have the chance to use petroleum products. Keeping this situation in mind we tried to make use of non-pollutants natural resource of solar energy. The creation of new sources of environmentally acceptable, low cost electrical energy as a replacement for energy from rapidly depleting resources of fossil fuels is the fundamental need for the survival of mankind. We have only about 25 years of oil reserves and 75-100 years of coal reserves. Resort to measure beginning of coal in thermal electric stations to service the population would result in global elementary change in leading to worldwide drought and desertification. The hazards of electric stations are only to will.

#### *1.3 Renewable Energy Resources*

A renewable energy resource is a natural source of energy which can be replenished with the passage of time, either through biological process of reproduction or any other natural processes. Renewable resources are a part of Earth's natural environment and the largest components of its ecosphere. 16% of total global energy consumption comes from renewable energy resource. Renewable resources may be the source of power for renewable energy. However, the rate at which the renewable resource is consumed should not exceed its renewal rate to ensure its sustainability . A solar cell (also called a photovoltaic cell) is an electrical device that helps in the conversion of light energy directly into electrical energy by creating voltage when it gets exposed to light. It is a form of photoelectric cell which, when exposed to light,

can produce and support an electric current without being attached to any external source of voltage, but requires an external load for power consumption.

#### *1.4 Objectives*

- In human transportation as a personalized vehicle.
- For inter departmental transportation in huge campuses.
- In industries for different level personnel to move around to inspect the work progress.
- In hospitals, Airports, Shopping malls, IT campuses, Hotels & resorts, Power stations, manufacturing units, etc...
- Light weight & easy to control, makes convenient for use by anyone.
- Controlled speed ensures rider's safety.
- Can be used by old aged demography.
- On site charging facility.
- No need to visit fuel station
- To develop a vehicle that use renewable energy, environmentally friendly and cheap.

## II LITERATURE REVIEW

This chapter will be stressed on the literature review of related system. The main purpose of this chapter is to analyze, identify and make conclusion based on the research. A literature review means a collecting related data, analyzed business process, identify underlying patterns and create the conclusion (Strauss & Corbin 1990). Another description of the literature review is a systematic, explicit and reproducible method to identifying, evaluating and synthesizing the existing body of completed and recorded work produced by researcher, scholars and practitioners (Fink, 2005).

In order to develop a successful project, the current systems are identified. The system of conventional electric powered bicycle, solar system and its connection have been analyzed. Studies of these systems are significant to develop a valid, reliable and efficient upgrade project. The Literature Review part acts as a mean to discover which methodology should be chosen in developing this system.

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 cycle.

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.

### *2.1.2 Domain*

Currently, solar powered bicycle that was studied for this project only uses a battery to get the electric powered supply by recharge it using conventional way. Electric powered bicycle only depends on power that charge in battery to make it functions unless using the manual way to move it. The project is wanted to change the way a battery charge to get the electric power and generate electricity to move the bicycle with optimum energy.

### *2.1.3 Solar Power*

Solar cells (really called “photovoltaic” or “photoelectric” cells) that convert light directly into electricity, bypassing thermodynamic cycles and mechanical generators. PV stands for photo (light) and voltaic (electricity), whereby sunlight photons free electrons from common silicon.

A photovoltaic module is composed of individual PV cells. This crystalline-silicon module has an aluminum frame and glass on the front. In the field of photovoltaic, a photovoltaic module is a packaged interconnected assembly of photovoltaic cells, also known as solar cells. An installation of photovoltaic modules or panels is known as a photovoltaic array or a solar panel. A photovoltaic installation typically includes an array of photovoltaic modules or panels, an inverter, batteries (for off grid) and interconnection wiring.

Solar energy is the utilization of the radiation energy from the sun. Solar power is used interchangeably with solar energy but refers more specifically to the conversion of sunlight into electricity by photovoltaic and concentrating solar thermal devices, or by one of several experimental technologies such as thermoelectric converters, solar chimneys and solar ponds.

Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is

absorbed by the material (a semiconductor), electrons are dislodged from the material's atoms. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface.

When the electrons leave their position, holes are formed. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load, electricity flows.

### *2.1.4 Solar Powered Bicycle*

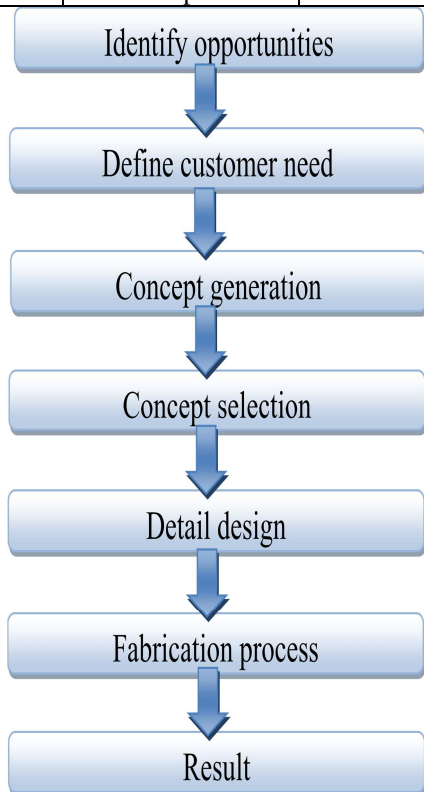
An electric powered bicycle carries batteries or fuel cells that deliver electric power to a motor that is coupled to either wheel. In most electric bicycles the rider can choose to use muscle power to deliver all, part, or none of the propulsion power required to maintain his or her adopted travel speed. Some models even sense your pedal pressure and command the motor to deliver more power whenever you pedal hard.

Many electric powered bicycles are specifically design and build for travel. Average travel speed, when compared to pedaled-only bicycles, can be increased by 8 to 10km/h (5 to 6 mph) above the speed an average person could travel by pedaling.

## III METHODOLOGY

4. Research for the Components required for the Project. Select the suitable material. Light, easy to join and easy to fabrication and working.
5. Cost Estimation of the Components.
6. Selection of the Best Method.
7. Purchasing of the Components.
8. Determining the size of component drawing for fabrication.
9. Fabrication of Mechanical Model. Development assembling all parts of the project
10. Development of Electrical Circuit if need.

Sl. No	Components	Quantity
1	Pedal	1
2	Wheel	2
3	Sprocket	2
4	Chain drive	1
5	Motor	1
6	Battery	1
7	Handle	1
8	Chain drive	1
9	Solar panel	1



**Fig 3.1 Methodology**

General methods for project development,

1. Select the concept for the project
2. Preparation of a statement and objective of the problem indication the purpose of the project
3. Research the literature study make review o other model and focusing on how to make it simple and relevance to the project.

### 3.1.1 Research for Components

Different literatures and technical papers were reviewed to collect the list of the components required to develop an automatic brake failure indicator according to our requirement. Major components that are required to develop an automatic brake failure indicator system are drum brake, motor, and sensor.

### 3.1.3 Selection of Best Method

As the condition for our project is to develop an automatic wiper system which is cheap, reliable and easy to control, conductive method supports all our requirements.

### 3.1.4 Components

The components used in the project are shown in the table below. The detailed explanation of the components is given below.

### 3.1.5 Fabrication of Mechanical Model

The mechanical model of a windshield to demonstrate the working of an automatic wiper system is developed. The detailed explanation of the procedures and processes involved in fabrication is given below chapters.



#### IV BLOCK DIAGRAM AND COMPONENTS DESCRIPTION

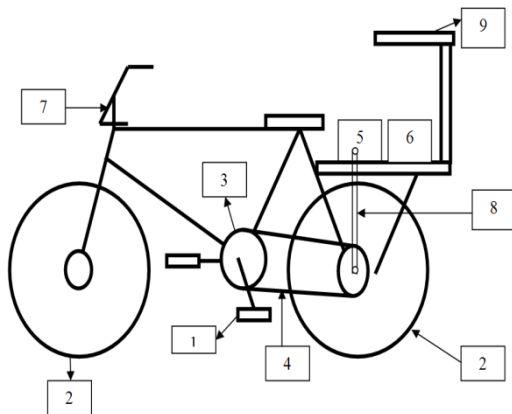


Fig 4.1 Block Diagram

##### 4.2.1 Pedal



Fig 4.2 Pedal

A bicycle have pedal, wheel, handle and chain drive. The bicycle pedal is the part of a bicycle that the rider pushes with their foot to propel the bicycle. It provides the connection between the cyclist's foot or shoe and the crank allowing the leg to turn the bottom bracket spindle and propel the bicycle's wheels. Pedals usually consist of a spindle that threads into the end of the crank and a body, on which the foot rests or is attached, that is free to rotate on bearings with respect to the spindle.

Pedals were initially attached to cranks connecting directly to the driven (usually front) wheel. The safety bicycle, as it is known today, came into being when the pedals were attached to a crank driving a sprocket that transmitted power to the driven wheel by means of a roller chain.

##### 4.2.2 Wheel



Fig 4.3 Wheel

Wheel is the important part of the cycle. A bicycle wheel is a wheel, most commonly a wire wheel, designed for a bicycle. A pair is often called a wheel set, especially in the context of ready built "off the shelf" performance-oriented wheels.

Bicycle wheels are typically designed to fit into the frame and fork via dropouts, and hold bicycle tires.

##### 4.2.3 Sprocket



Fig 4.4 Sprocket

A sprocket or sprocket-wheel is a profiled wheel with teeth, or cogs, that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

#### 4.2.4 Chain Drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.



Fig 4.5 Chain Drive

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attaching shafts or hubs to this gear. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally known as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ration can be altered. For example, when the bicycle pedals' gear rotate once, it causes the gear that drives the wheels to rotate more than one revolution.

#### 4.2.5 Motor

Hub motor electromagnetic fields are supplied to the stationary windings of a motor. The outer part of the motor follows those fields that turn the wheel that is attached. In a brushed motor, energy is transferred by brushes which are in direct contact with the rotating shaft of the motor. In a brushless motor, the Energy is transferred electronically, with no physical contact between stationary and moving parts. Although the brushless motor technology is more expensive, most of them are more efficient and longer-lasting than brushed motor systems. Electric motors have

greater torques at startup, making them more suitable for vehicles as they need the most torque at startup too.

The idea of "revving up" so common with internal combustion engines is unnecessary with electric motors. Their greatest torques occurs as the rotor first starts turning and this is why electric motors do not require a mode. A gear-down arrangement might be needed, but unlike in a transmission type combustion engine, shifting is not needed for electric motors. Wheel hub motors are common on electric bikes and electric scooters in some parts of the globe, especially Asia.

The hub motor is a conventional Dc motor. The rotor is outside the stator with the permanent magnets mounted on inside. The stator is mounted and fixed onto the axle and the hub will be made to rotate by alternating currents supplied through batteries. Hub motor generates high torque at low speed, which is highly efficient and which doesn't need sprockets, brackets and drive chains. This means they are very reliable and have a long life.



Fig 4.6 Hub Motor

#### 4.2.6 Battery

Battery is a primary storage of the electric power and whenever power required that time battery provides the power of the motor and vehicle is drive. We used four numbers of 12 V 7 amps batteries in series. All batteries are in series connection that's why the output of the all battery is 48V. A VRLA battery (valve-regulated lead-acid battery), more commonly known as a sealed battery (SLA) or maintenance free battery, is a type of lead-acid rechargeable battery. Due to their construction, the Gel and AGM types of VRLA can be mounted in any orientation, and do not require constant maintenance.

#### 4.2.7 Handle

A bicycle handlebar or bicycle handlebars is the steering control for bicycles; It is

the equivalent of a steering wheel for vehicles and vessels. Besides steering, handlebars also often support a portion of the rider's weight, depending on their riding position, and provide a convenient mounting place for brake levers, shift levers, cyclo computers, bells, etc. Handlebars are attached to a bike's stem which in turn attaches to the fork.

*4.2.8 Solar Panel*

As the title suggests, the bicycle is operated by solar energy. The batteries are charged with solar energy with the help of a solar cell. Solar cells convert the energy of sunlight directly into electricity through the use of the photovoltaic effect. The photovoltaic effect involves the creation

Sl. No	Specifications	Values
1	Solar panel size	
	(i) Length	300 mm
	(ii) Width	300 mm
	(iii) Thickness	30 cm
2	Current	5 amps
3	Voltage	12V
4	Power	60 watts

of a voltage into an electromagnetic radiation. The photo

electric and photovoltaic effects are related to sunlight, but are different in that electrons are ejected from a material's surface upon exposure to radiation of sufficient energy in photoelectric, and generated electrons are transferred to different bands of valence to conduction within the material, resulting in the build-up of voltage between two electrodes in photovoltaic.

Solar cells are electrically connected and fabricated as a module with a sheet of glass on top to allow light to pass and protect the semiconductor from the weather. To obtain a desired peak DC voltage we will add solar cells in series, and to obtain a desired peak current, the solar cells are put in parallel position.



Fig 4.8 Solar Pane

*4.3 Components Specifications*

Sl. No	Parameters	Values
<b>a) Motor</b>		
1	Voltage	12 volt
2	Current	5 amps
3	Speed	70 rpm
<b>b) Battery</b>		
1	Voltage	12 volt
2	Current	7 amps
Sl. No	Parameters	Values
<b>a) Solar panel</b>		
1	Length	12 volt
2	Weight	5 amps
3	Thickness	70 rpm
<b>b) Battery</b>		
1	Voltage	12 volt
2	Current	7 amps

Table 4.2 Components Parameter Values

**V. WORKING PRINCIPLE**

The solar bicycle is driven by hub motor fitted in front axle housing & operated by solar energy. The solar panel mounted on the carriage is charge the battery & which in turn drive the hub motor. When the bicycle is idle during the day, the solar panel will charge the battery. The system will make bicycle operate more efficiently The basic configuration of an solar bicycle drive consists of a controller that controls the power flow from the battery to the electric motor. This power flow acts in parallel with the power delivered by the rider via the pedal of the bike. The rider of an solar bicycle can choose to rely on the motor completely, pedal and use the motor at the same time or pedal only (use as a conventional bicycle).

*Advantages*

- Noise free
- Pollution free
- Affordable price



- Fewer mechanical components & less maintenance.
- Its runs on rechargeable batteries.

#### *VI. CONCLUSION*

Solar assisted bicycle is modification of existing bicycle and driven by solar energy. It is suitable for both city and country roads, that are made of cement, asphalt, or mud. This bicycle is cheaper, simpler in construction & can be widely used for short distance travelling especially by school children, college students, office goers, villagers, postmen etc. It is very much suitable for young, aged, handicap people and caters the need of economically poor class of society. It can be operated throughout the year free of cost. The most important feature of this bicycle is that it does not consume valuable fossil fuels thereby saving crores of foreign currencies. It is ecofriendly & pollution free, as it does not have any emissions. Moreover it is noiseless and can be recharged with the AC adapter in case of emergency and cloudy weather. The operating cost per kilometer is minimal, around Rs.0.70/km. It can be driven by manual pedalling in case of any problem with the solar system. It has fewer components, can be easily mounted or dismounted, thus needs less maintenance.

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