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Driving Bicycle Using Using Solar Power- Electric Vehicle

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Abstract: The fuel prices are increasing day by day hence there must be an alternative to reserve these natural resources. Thus this solar e bicycle uses an alternative by harnessing solar energy and thus providing energy to motor to propel the vehicle. Further the emission of harmful gases from different types of vehicles are hazardous to human health. Hence for this reason it is good time to look for more economic friendly fuel sources. Here solar energy which is free of cost is utilized to charge the batteries. Here the dc motor is fitted to front or rear wheel this in turn drive the hub motor which is fitted to the carrier. Here the motor used of 250w which travels at speed of 25-30 kmph

Index Terms **– solar energy, battery, charge, motor, bicycle.**

I. INTRODUCTION

Energy is one of the most basic needs for human survival on earth. We are dependent on one form of energy and the other for fulfilling our needs. One such form of energy are fossil fuels. We use these energy sources for generating electricity, running automobiles etc. The main disadvantage of fossil fuel is they are not environmentally friendly, an also they are exhaustible. To overcome with the problems of fossil fuels, non-conventional sources of energy are used. The increasing mobility has led to extra fuel consumption, increasing automobile exhaust emissions, air pollution and lowering quality of life. In spite of being clean, cheap, and equitable mode of transport for short-distance journeys, E bikes can offer solutions to the problem of urban mobility. Many cities had tried to promote cycling through the implementation of bike-sharing. Electric bikes use batteries as a source of energy, they require a battery charger system which uses the power of solar cells. Main reason to find and modify the need of E Bike is to overcome the problem of the pollution because, vehicles in metro towns, urban zones is swelling uninterruptedly.

Considering all class of society, it is not reasonable to purchase scooters, mopeds, or motorcycles by everyone. So, combining both the issues i.e., environmental progress supporting, and economical affordable alternative would be the best solution. Typical parts of E-bike are Brushless DC Motor (Hub Motor), Throttle (Accelerator), Battery Storage, Frame and other common bicycle parts. There are two parts of electric bicycle according to their functions and working: Power on Demand and Pedal Assist. The motor is activated by a throttle with power-on-demand, as same as on general scooters or motorcycles. By pedaling, electric cycle can be controlled with a pedal-assist. The pedal assist augments the efforts of the rider when they are pedaling.

The e-bikes are known as peddles which have a sensor to identify the pedaling force and the pedaling speed, or both. Disabling the motor is the brake sensing action. The potential for modal shift from fossil fuel-powered transport modes would be increased. Furthermore, E-bike station that could serve as combined weather protection and provider of electric energy by installing solar panels on the roof. The increasing mobility has directly led to deteriorating traffic conditions, extra fuel consumption, increasing automobile exhaust

emissions, air pollution and lowering quality of life. In spite of being clean, cheap and equitable mode of transportation for short distance, cycling can offer solutions to the problem of urban mobility.

Urban mobility is a serious problem in many cities around the world. Issues on the urban mobility affects the quality of life and environmental sustainability in the world. The world population has been progressively concentrating in the cities. All Cities around the world undergo rapid urbanization. Mobility in urban areas is a foremost challenge that must be improved to get a better quality of life for the society. The increasing mobility has strong correlation to the traffic conditions, extra fuel consumption, automobile exhaust emissions, air pollution, and quality of life. Urban mobility is a prevalent problem in many cities around the world. Issues on the urban mobility affects the quality of life and environmental sustainability are gaining Importance in the world. Cycling can be considered as one of the solutions for urban mobility problems especially for short solar energy is used to charge the battery. Battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle

II. LITERATURE SURVEY

In 2015, Ivan Evtimov had constructed an experiment on electric bicycle for evaluation of the energy efficiency. In this experiment, they studied 3 typical city routes of the city Ruse of Bulgaria. It was indicated that depending on the conditions of moving & the slopes of the streets, the regeneration of energy varies from 6 - 14 %. During their experiment, they covered 215 km with the average regeneration of 5.5%. When there is less braking & acceleration the regeneration is more. They also found that the use of electrical bicycle by each person can reduce pollution up to 15 times compared to the cars.

In 2016, Mohammad Reza Maghami, had experimented the amount of power loss because of soiling on solar panel. They found that dust reduces output of power from PV between 2% to 50%. Based on daily, monthly, seasonal & annual basic. Thus, they proposed to clean the PV module for accumulation of dust on daily basis to reduce the power loss.

In 2017, S. T. Wankhede, had experiment on the Multi Charging Electric Bicycle. Electric bicycles are addressed by custom designed drives that are more efficient over a given operating cycle. Also, we take PIC16F72 controller which has function of over-current protection. This experiment turned out controller has better dynamic characteristics & run steadily.

In 2017, Kunjan Shinde, worked on electric bike as it is a modification of the existing cycle by using electric energy & Importance in the world. Cycling can be considered as one of the solutions for urban mobility problems especially for short solar energy is used to charge the battery. Battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle.

If solar panels are provided, that would sum up to increase in energy production. With the increasing consumption of petrol, diesel it is necessary to us to shift our way towards electric bike & others because it is necessary to identify new way of transport. The operating cost per/km is very less & with the help of solar panel it can lessen up more.

III. OUTCOME OF LITERATURE SURVEY

The main aim to run bicycle using solar energy that is been obtained from sun and stored in battery to run bicycle.

- BLDC motors are more efficient & powerful among the alternators & dynamos.
- Battery capacity directly affects the range of the e-bike.
- Soiling on solar panel reduces its efficiency.
- BLDC motor can charge the batteries if the polarity is reversed. The efficiency of the system depends on the quality of the material used in the system.

IV. PROBLEM STATEMENT

The above literature survey reveals several problems associated with solar powered electric bicycle which are listed below:

- Use of BLDC motor affects the design and makes the system complicated. It causes the jerky or awkward motor timing during hill climbing and around obstacles.
- The external BLDC motor provide less speed. BLDC motor is connected externally through chain arrangements; losses occur due to friction.
- The solar panel is placed at a fixed point on bicycle. As the sun travels in different direction throughout the day due to which the panel consumes maximum energy when the sun is directly above the panel and consumes less energy when the sun is away from the panel this results in the reduction of power efficiency

V. OBJECTIVES

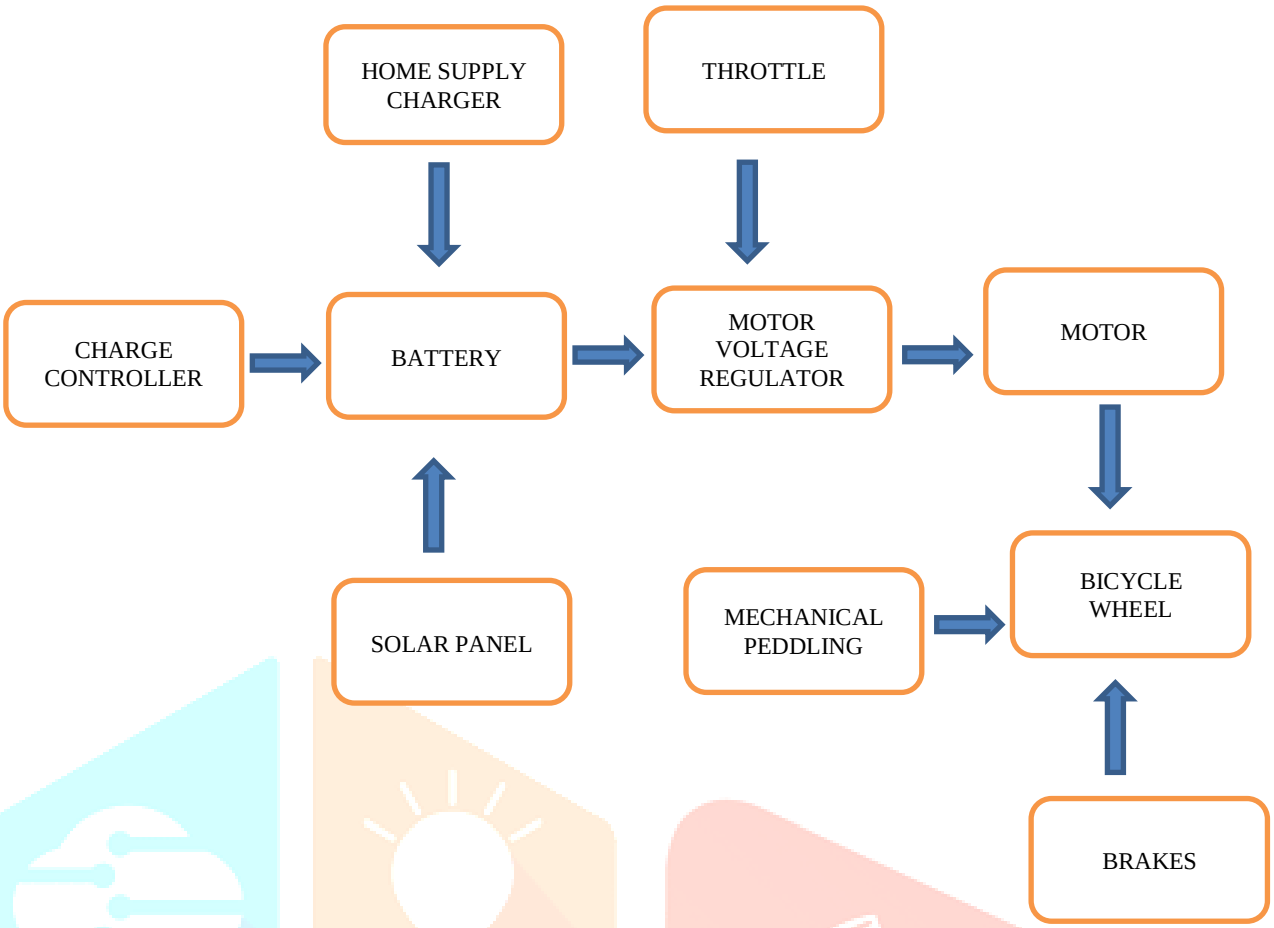
- To use a hub motor to simplify the design.
- Harnessing energy from multiple sources using solar panels.
- Improving the speed of a bicycle.
- Panel should track the direction of sun, consumes and stores the energy.

VI. METHODOLOGY

A solar bicycle runs uses the electrical energy of battery to run the hub motor which in turn runs the bicycle. Solar energy is used to charge the battery. Two or more PV cells may be used to harness solar energy to charge the battery. Battery gives the required voltage to the hub motor mounted on the front wheel to run the bicycle. Solar powered electric bicycles use pv cells that convert solar energy into required voltage to charge the battery. There are two types of solar panels that are generally used that is polycrystalline panels and microcrystalline solar panels.

The polycrystalline panels are having less efficiency as compared to microcrystalline panels. Polycrystalline panels have efficiency of approximately 15 – 20% while microcrystalline panels have efficiency of 50 -60%. There are different types of solar panel charge controller motor voltage regulator battery motor home supply charger throttle bicycle wheel mechanical peddling brakes batteries used in electric vehicles like lead acid batteries, lithium ion batteries, Nickel cadmium batteries, etc. Different batteries have their different advantages for different applications.

As far as solar bicycles are concerned lead acid and lithium ion batteries are most commonly used? Lead acid batteries have lower cost, higher current carrying capacity but have smaller life and are heavier. While lithium ion batteries have lower weight but higher cost and there are chances of explosion. The motor used is a permanent magnet Hub motor which will be mounted on the front wheel.

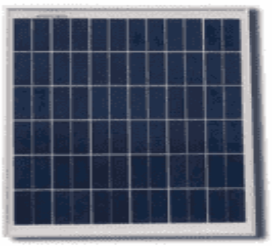


6.1 HARDWARE COMPONENTS USED

Hub Motor

The hub motor is a conventional DC motor. The rotor is outside the stator with the permanent magnets mounted 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 does not need sprockets, brackets, and drive chains. This means they are exceptionally reliable and have a long life. The main characteristic of Brushless DC Machines is that they may be controlled to give wide constant.

Solar Cells/ Panels



As the title suggests the bicycle is operated by solar energy. The lead acid battery is charged with solar energy with the help of a solar cell. Solar cells convert the energy of sunlight directly into electricity using the photovoltaic effect. The photovoltaic effect involves the creation of a voltage into electromagnetic radiation. The photoelectric 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 photo voltaic (Rating-12v dc).

SPV(solar photo voltaic) Charge Controller

SPV Charge Controller It is essential to regulate the voltage output from the solar panel before it is supplied to the battery. A voltage regulator is a power converter with an output DC voltage greater than the input DC voltage. This is used to regulate an input voltage to a higher regulated voltage. The output of the solar panel is not always stable due to fluctuations in the intensity of sunlight, angular changes with respect to the direction of sunlight, as well as other environmental factors. The output of the solar panel is the input of the boost converter, which then outputs into the battery for charging. Because the output of the solar panel will be varying constantly, we need a voltage regulator/boost converter that will take input from a wide range of voltages and output a specific, constant voltage value. A voltage regulator/boost converter is a power converter that will take in a DC voltage and output a higher value DC voltage. (an input range of 9.6V to 13.2V and outputting 24V at a maximum of 2-3 amps).

Lead Acid Battery

Batteries are one of the most popular types of batteries in electronics. Although slightly lower in energy density than lithium metal, lead acid is safe, provided certain precautions are met when charging and discharging. This has many advantages over other conventional types of batteries, the lead acid battery is the optimum choice for a solar-assisted bicycle. The current supplied by the battery indicates the flow of energy from the battery and is measured in amperes. The higher the current flow faster the battery will discharge. A battery is rated in ampere-hours, and this is called the battery capacity. This project revolves around supplying and utilizing energy within a high-voltage battery. It demands for a battery with longer running hours, lighter weight with respect to its high output voltage, and higher energy density. Among all the existing rechargeable battery systems, the lead acid cell technology is the most efficient and practical choice for the desired application. The battery chosen for this project was a high-capacity lead acid battery pack designed specifically for vehicles. The plastic casing is provided to house the internal components of the battery.

Accelerator/Throttle

The maximum speed of a bicycle is 30 kmph. It is required to vary the speed depending on the road conditions & traffic. Therefore, an accelerator or a throttle `is necessary. The throttle allows us to drive the motor from zero speed to full speed. The throttle is fitted on the right side of the handlebar and is connected to a controller. The throttle converts DC voltage from the battery to an alternating voltage with variable amplitude and frequency that drives the hub motor at different speeds. It consists of MOSFET transistors and a small microprocessor. This throttle is technically referred to as a Hall Effect type. The throttle has three wires contains black, red, and green. The supply voltage is via red and black wires and is usually around 4 volts. Green wire voltage increases as the throttle is turned.

Motor Voltage Regulator

Voltage regulator controls the voltage level as per requirement. The voltage regulator used in this project acts as a tapping switch. In our project two voltage levels are used.as per required voltage levels regulator can be adjusted The world population has been progressively concentrating in the cities . Cities around the world are undergoing rapid urbanization. Mobility in urban areas is one of the challenge that must be addressed and improved to get a better quality of life for the community . The increasing mobility has strong correlation to the traffic conditions, extra fuel consumption, automobile exhaust emissions, air pollution, and quality of life. Urban mobility is a prevalent problem in many cities around the world. Issues on the urban mobility affects the quality of life and environmental sustainability are gaining importance in the world.

Arduino Uno

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button.

Light Dependent Resistor

An LDR is a component that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. Light Dependent Resistors (LDR) are also called photo resistors. They are made of high resistance semiconductor material. When light hits the device, the photons give electrons energy. This makes them jump into the conductive band and thereby conduct electricity

Light-Emitting Diode (Led)

When exposed to light photodiodes produce a current that is directly proportional to the intensity of the light. This light generated current flows in the opposite direction to current in a normal diode or LED. As more photons hit the photodiode the current increases causing a voltage across the diode. As the voltage across the diode increases the linearity decreases.

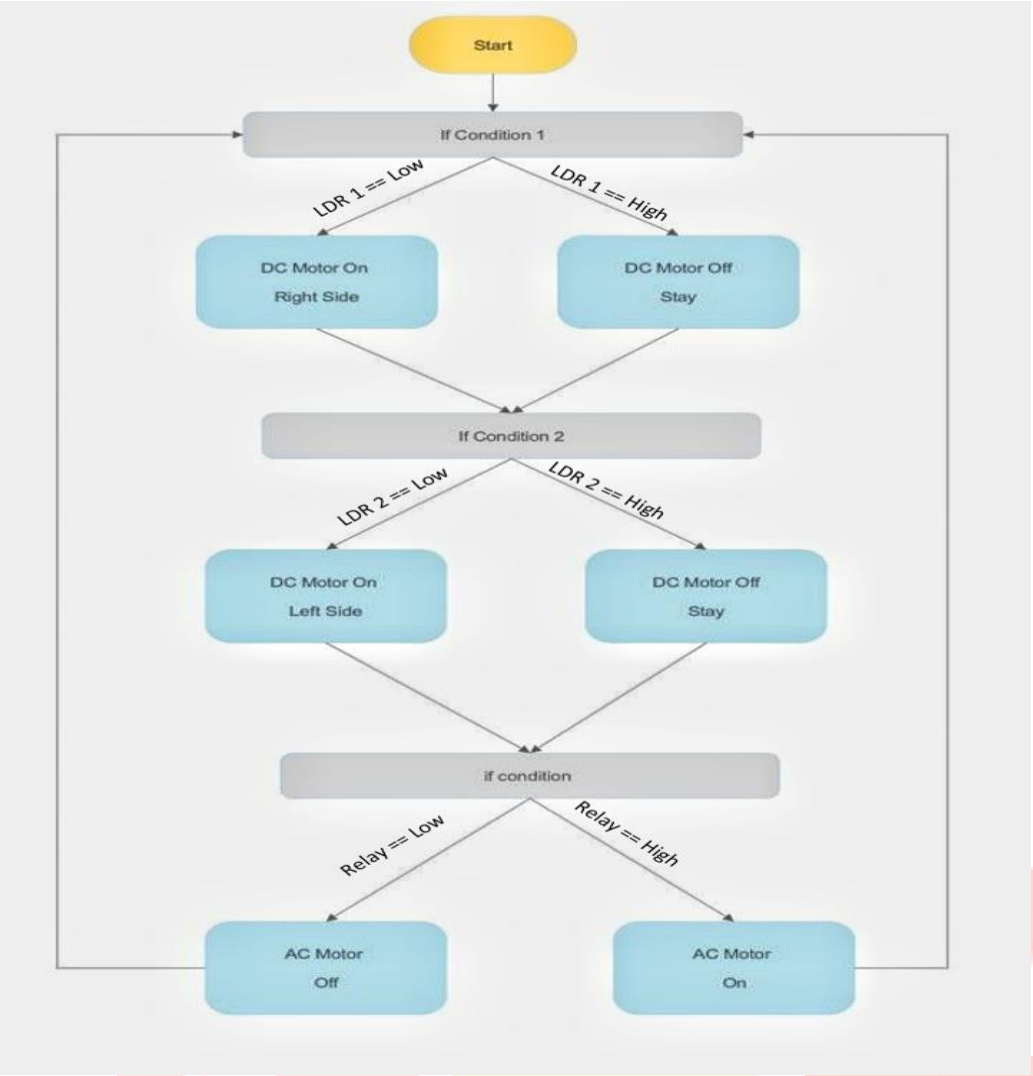
Servo motor

The servo motor is an assemble of four things: a normal DC motor, a gear reduction unit, a position sensing device and a control unit.

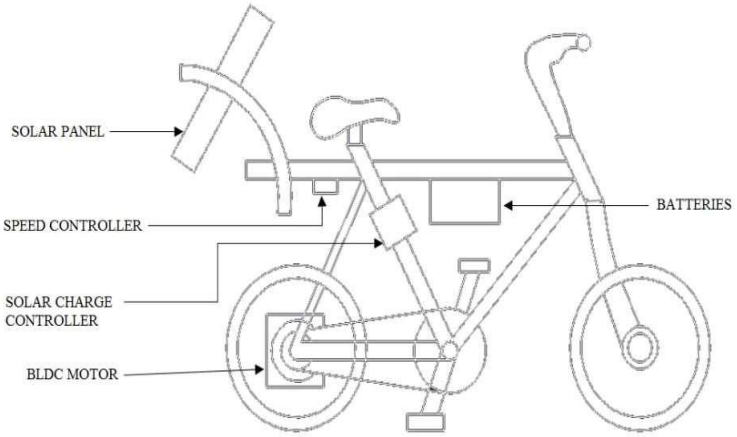
Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage.

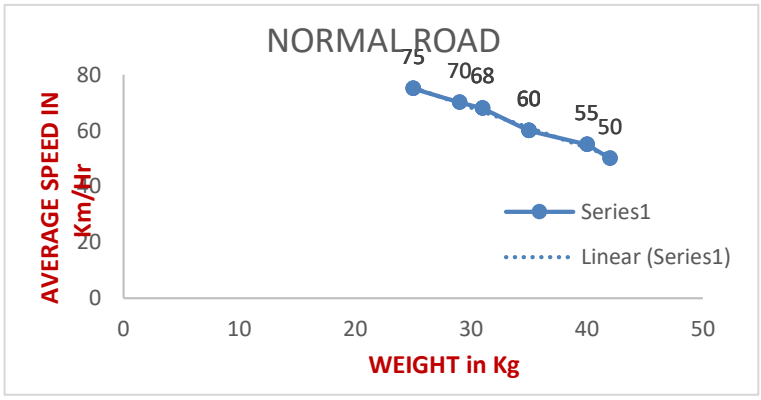
6.2 Software Implementation



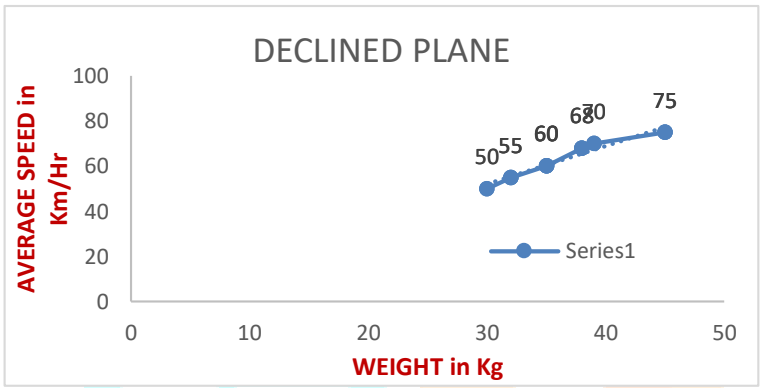
VII. DESIGN



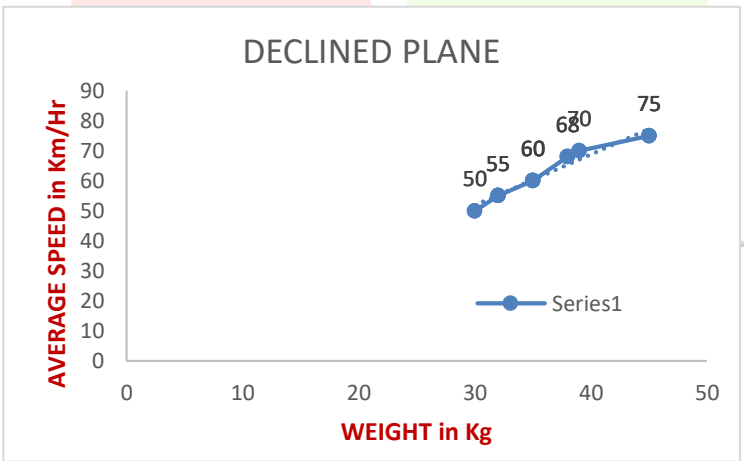
VIII. EXPERIMENTATION



The average speed decreases with increase in weight. The load 75kg has maximum speed 19km/hr.



The average speed increases with increase in load therefore, the load of 75kg has speed of 45km/hr



The average speed increases with increase in load therefore, the load of 75kg has speed of 45km/hr

IX. ADVANTAGES

- Helps preserve the environment
- Reduces air contamination
- Easier to ride
- More economical than fuel bike

X. APPLICATION

It can be widely used for short-distance traveling especially by school children, college students, office goers, villagers, postmen etc.

XI. FUTURE SCOPE

- Use PIC Microcontroller for charging system
- Use high torque motor to drive the bicycle.
- GPS tracker can be used to track the cycle
- PV cell can be cleaned by implementing cleaner mechanism
- 24V battery can be use to enhance the power of bicycle.

XII. CONCLUSION

Solar-assisted bicycle modification of existing bicycles 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 traveling especially by school children, college students, office goers, villagers, postmen, etc. It is very much suitable for young, aged, and handicapped people and caters to the need of the 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. 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 pedaling in case of any problem with the solar system. It has fewer components, can be easily mounted or dismounted, thus needs less maintenance. From a future energy system perspective, it is important to identify new ways of transport and generation of electricity and solar powered E-bike pools may just be such a case. E-bikes are an order of magnitude more energy efficient than car, bus or other heavy transport mode.

Using a solar panel at 0.2-0.8 m2 per E-bike has been shown to be enough to supply the early energy demand by the E-bike pool depending on simulated system usage (3-10.8 trips/(bike & day)). The computed area is smaller than the assumed maximum area at 3-3.8 m2/E-bike meaning that energy self-sufficiency on a yearly scale can be accomplished without running out of space. Using larger panel area than 0.2-0.8 m2 per E-bike will for a grid-connected system lead to net electric energy production.

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