PORTABLE GREEN ENERGY MOBILE LAPTOP CHARGING STATION

A Thesis
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DECLARATION

We hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of Hasan Tareq Mahin, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thereof has been or is being submitted elsewhere for the award of any degree.

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Abstract

People usually run out of phone and laptop charging while travelling. At such times there is literally no way of charging your phone laptop in an outdoor environment. Well we hereby solve this problem with a green energy system using a dual power generator solar plus wind energy charging system for mobile phones and laptop. Windmill is an essential product in non-renewable energy sources. When we are going with a windmill, it should produce an optimum output, when we get optimum output it will be cheaper than the conventional sources. So here we have done an efficient wind mill controller which turns to maximum air velocity position. And another two setups where rain water power generation and solar power generation process. Nowadays power demand is more. So this project has developed to generate the electrical power in order to compensate the electric power demand. This project is designed with fan arrangement, solar panel, dynamo, and gear arrangement, turbine, funnel and control unit.

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LIST OF ABBREVIATIONS

AC	Alternating Current
DC	Direct Current
RPM	Revolutions Per Minute
PWM	Pulse Width Modulation
Amp	Ampere
VAWT	Vertical-Axis Wind Turbine
PV	Photovoltaic
RAC	Receiving Average Current
RV	Receiving Voltage

Chapter 1

INTRODUCTION

1.1 General

People usually run out of phone and laptop charging while travelling. At such times there is literally no way of charging your phone laptop in an outdoor environment. Well we hereby solve this problem with a green energy system using a dual power generator solar plus wind energy charging system for mobile phones and laptop.

The charging station is a portable charging station so that it can be easily moved with an anti-theft feature to prevent any theft or mischief with the charging station. The green energy charging station offers a wide variety of features including:

- Dual Power generation Solar plus Wind Energy
- Vertical Windmill for all direction wind generation
- 5V DC USB charging ports for Mobile phones
- 230V AC socket for all Laptop charging
- Inbuilt Inverter and charge controlling circuitry
- Select the type of device and charging duration to activate port for charging
- Automatic Charge Cutoff on Charging Completion
- Anti-Theft Feature – Alert Buzzer Alarm in case of Station Robbery/Damage Attempt

The system makes use of a battery to store the energy generated by both the power generators. This battery supply is now connected through the inverter for usage. The system provides 2 types of outputs. 4 USB outputs for 4 x 5V DC mobile charging ports and 1 x 220V AC port with current limitation for charging laptops only.

The system is fitted with 4 wheels for ease of movement making it very portable. It can easily be used near bus stops, garden, historical monuments, zoo, college campus, corporate parks, footpaths, open parking and more. The system is further fitted with anti-theft feature to prevent robbers from robbing or miscreants from damaging it. It instantly senses if it is being moved by unauthorized person or is trying to be damaged using impact sensors.

In such cases the system instantly sounds a loud alarm sound to alert nearby people authorities without stopping. Thus the system provides efficient mobile and laptop charging outdoors with a whole lot of features.
Solar Wattage: 80 Watts
Windmill: 30 Watts

1.2 Objectives

To make the technology environment friendly in case of energy sources. The implementation of both solar energy and wind energy combined in the project.

Chapter 2

LITERATURE REVIEW

Bangladesh is a developing country. Bangladesh has various tourism and tourism potential places. But most of the tourist areas are in remote areas and there is lack of electricity. The three districts of Chittagong Hill Tracts and various coastal areas of the sea and various islands have great tourism potential place. There is potential in tourism in different parts of our country due to lack of infrastructural development we are not able to attract foreign tourists. Due to non-availability of electricity in our remote areas, various tourists cannot charge their mobile laptops which they cannot visit to enjoy the beauty of those particular place. Also we have to face various problems due to lack of electricity or mobile charging laptop charging stations in our various public places. Fossil fuels which are used in the power plants of our country are very harmful to our environment. So we are going to create a system with our thinking that is completely environment friendly and does not harm the environment.

Our system is fully powered by two green energy systems one is solar energy and the other is wind energy. Solar energy can generate electricity as long as the sun shines and we have used wind power as an alternative. Here we have used two solar panels which are 10 watt x2, 20watt. which are able to produce of 12 volt electricity. Used a 20 watt wind generator capable of generating electricity from 12 volts to 24 volts. Also, we have used a solar charging control unit and a battery system that will normally charge the battery. an inverter that can be convert 12volt dc to 220 volt ac. 5 volt DC can be used USB cable for normally mobile and other device charging. We have installed our entire system on a sturdy frame made of stainless steel that looks great. Hopefully the people will benefit greatly by using our system and attract a lot of tourism and is very important to the economy of Bangladesh.

Chapter 3

INSTRUMENTATION

3.1 Solar Panel: A solar panel is a set of solar photovoltaic modules electrically connected and mounted on a supporting structure. A photovoltaic module is a packaged, connected assembly of solar cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 320 watts. The efficiency of a module determines the area of a module given the same rated output - an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, an inverter, and sometimes a battery and solar tracker and interconnection wiring.

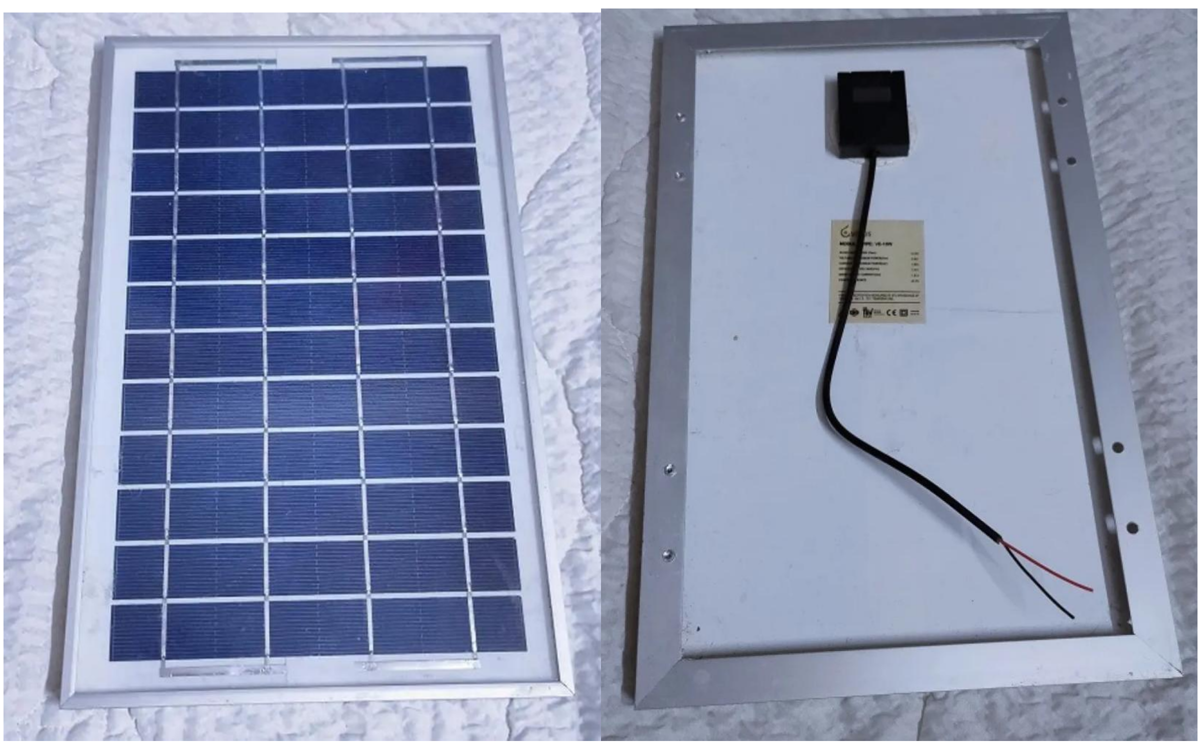


Figure: 3.1 Solar Panel

3.2 Inverter (12V DC to 220V AC): Inverters (sometimes called power inverters) are just a class of electronic devices called power electronics that convert direct current into alternating current. Scientifically speaking, the transformer in an inverter must have a 1:19 turn ratio in order to convert 12V DC to 220V AC. The inverter works by switching back and forth the direction of the DC input very quickly to complete the DC to AC conversion. The result is that the 12V DC input becomes 220V AC output.

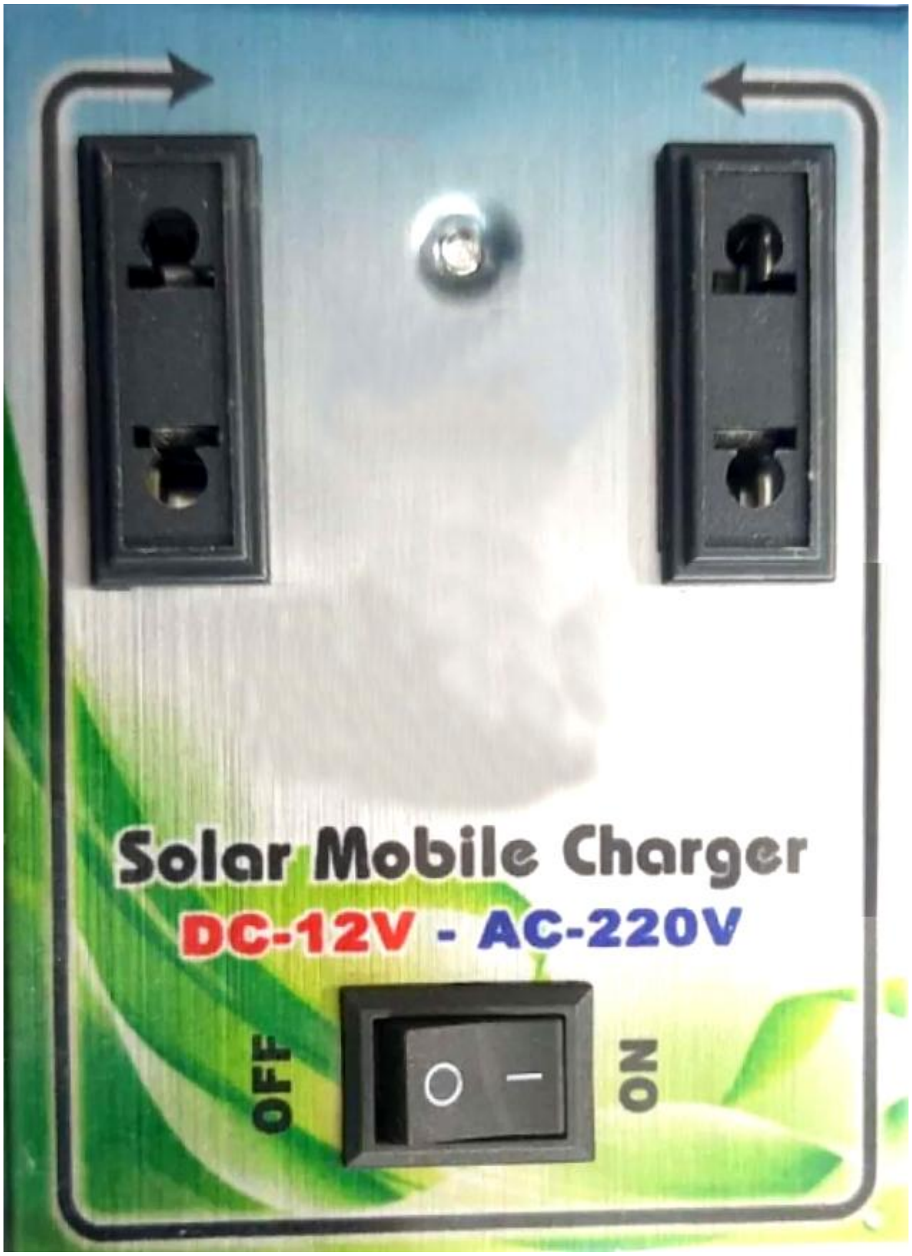


Figure: 3.2 Inverter (12V DC to 220V AC)

3.3 Solar Charge Controller: The most essential charge controller basically controls the device voltage and opens the circuit, halting the charging, when the battery voltage ascents to a certain level. More charge controllers utilized a mechanical relay to open or shut the circuit, halting or beginning power heading off to the electric storage devices.

Generally, solar power systems utilize 12V of batteries. Solar panels can convey much more voltage than is obliged to charge the battery. The charge voltage could be kept at the best level while the time needed to completely charge the electric storage devices is lessened. This permits the solar systems to work optimally constantly. By running higher voltage in the wires from the solar panels to the charge controller, power dissipation in the wires is diminished fundamentally.

The solar charge controllers can also control the reverse power flow. The charge controllers can distinguish when no power is originating from the solar panels and open the circuit separating the solar panels from the battery devices and halting the reverse current flow.

Figure: 3.3 Solar Charge Controller

3.4 System Connection Diagram:

Figure: 3.4 System Connection Diagram

- LCD Display: Solar charge controller comes with a big LCD display that can clearly indicate the status and data, it can be conveniently switched modes and parameter configuration.

- Safety Protection: Short-circuit protection, open-circuit protection, reverse protection, over-load protection, more safety for using, suitable for home, industrial, commercial etc.
- Function: This controller can only use photovoltaic panel as the charging source, do not use DC or other power supply as the charging source.
- Application Scenario: Solar panel suitable for solar power system, solar street lamp, smart home, solar light box, intelligent irrigation, camping lantern etc.

Specifications:

- Battery Voltage: 12V/24V auto
- Charge current: 30A
- Float charge: 13.7V(defaults, adjustable range 13~15V)
- Discharge stop: 10.7V(defaults, adjustable range 9~11.5V)
- Discharge reconnect: 12.6V(defaults, adjustable range 11.5~13V)
- USB output: 5V/3A
- Self-consume: <10mA
- Operating temperature: -35~+60 degree C
- Weight: 132g
- Size:185*92*47mm
- Maximum Loaded Solar : 360W (12V) and 720W(24V)
- Max Current Rating : 30A
- Dual MOSFET Supported
- Over Load Protected
- Over Charge Protected
- PWM Technology used for Charging Batteries

3.5 Wind Turbine Generator with Gearbox: When the wind strikes the rotor blades, blades start rotating. The turbine rotor is connected to a high-speed gearbox. Gearbox transforms the rotor rotation from low speed to high speed. The high-speed shaft from the gearbox is coupled with the rotor of the generator and hence the electrical generator runs at a higher speed. An exciter is needed to give the required excitation to the magnetic coil of the generator field system so that it can generate the required electricity. The generated voltage at output terminals of the alternator is proportional to both the speed and field flux of the alternator. The speed is governed by wind power which is out of control. Hence to maintain uniformity of the output power from the alternator, excitation must be controlled according to the availability of natural wind power. The exciter current is controlled by a turbine controller which senses the wind speed. Then output voltage of electrical generator(alternator) is given to a rectifier where the alternator output gets rectified to DC. Then this rectified DC output is given to line converter unit to convert it into stabilized AC output which is ultimately fed to either electrical transmission network or transmission grid with the help of step up transformer. An extra units is used to give

The power to internal auxiliaries of wind turbine (like motor, batteryetc.), this called Internal Supply Unit.

There are other two control mechanisms attached to a modern big wind turbine.

- Controlling the orientation of the turbine blade.
- Controlling the orientation of the turbine face.

The orientation of turbine blades is governed from the base hub of the blades. The blades are attached to the central hub with the help of a rotating arrangement through gears and small electric motor or hydraulic rotary system. The system can be electrically or mechanically controlled depending on its design. The blades are swiveled depending upon the speed of the wind. The technique is called pitch control. It provides the best possible orientation of the turbine blades along the direction of the wind to obtain optimized wind power. The orientation of the nacelle or the entire body of the turbine can follow the direction of changing wind direction to maximize mechanical energy harvesting from the wind. The direction of the wind along with its speed is sensed by an anemometer (automatic speed measuring devices) with wind vanes attached to the back top of the nacelle. The signal is fed back to an electronic microprocessor-based controlling system which governs the yaw motor which rotates the entire nacelle with gearing arrangement to face the air turbine along the direction of the wind.

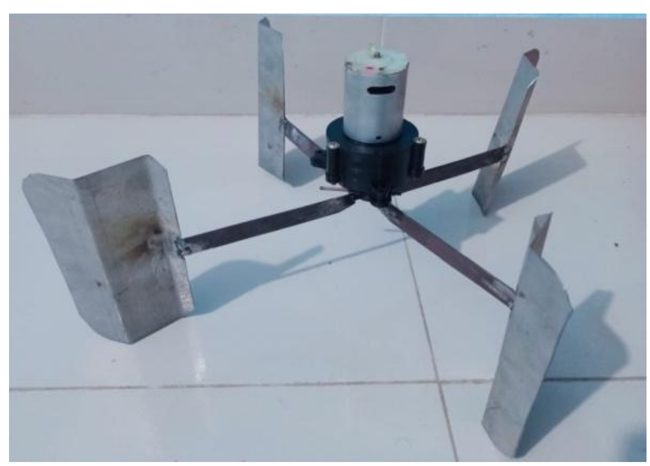


Figure: 3.5Wind Turbin**e** Generator with Gearbox

3.6 Base Frame: The base frame is the base to fix pantograph frames. It supports the fixed part of the frame and is mounted on supporting insulators of pantographs.

Base frames are usually made of profile steel, plates through extrusion, or steel tubes through splicing or castings and profile steel through splicing. Base frames should have strong rigidity to avoid distortion of frames during handling and installation, which may impair pantograph performance. Base frame mass occupies a large part of the total mass of pantographs, so a lighter structure is still expected.

Figure: 3.6 Base Frame

Chapter 4

METHODOLOGY

4.1 Working Process:

In this model we are generating electrical source of energy by utilizing wind energy.
By using this renewable energy sources we can generate electrical source of energy free from pollution.
Here vertical axis wind turbine is capable of generating 6v.The output of vertical axis wind turbine is fed to voltage regulator to maintain stable voltage. Solar panels are Capable of generating 12v each mounted on both sides to generate 24v.The output of vertical axis wind turbine and solar panel is fed to charge controller to control the flow of charge.
At final Stage Dc to Ac converter is placed in order to operate different types of Ac loads. The output values can be monitored by using Liquid crystal display operated with the help of micro-controller which is placed internally present in the kit.

4.2 Proposed system specifications:

Solar panel rating: 12V, 20W, 1.13A--2 panels need.
A 12V solar cell is a solid state electric device that converts the energy of light directly into electricity by photo voltaic effect. Assemblies of cells used to make solar modules which are used to capture energy from sunlight are known as solar panels.
Vertical wind mill: 12V, 1.5A DC Generator, blades 10inchs, side arms.

A 12V vertical-axis wind turbine (VAWT) is a type of wind turbine where the main rotor shaft is set transverse to the wind while the main components are located at the base of the turbine. This arrangement allows the generator and gearbox to be located close to the ground, facilitating service and repair.
Battery: 12V, 7.5MAh.

An electric battery is a device consisting of one or more electro chemical cells that convert stored chemical energy into electrical energy. Each battery consists of a negative electrode terminal and a positive electrode terminal.
DC to AC converter: 12V to 220V AC.

DC to AC converters is mainly designed for changing a DC power supply to an AC power supply. Here, DC power supply is comparatively stable as well as positive voltage source whereas AC oscillates approximately a 0V base stage, typically in a sinusoidal or square or mode.
2 USB ports: 5V.

3 Pin Sockets: 5A

LCD display.

Buzzer:
A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (peizzo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.

Micro controller: A microcontroller is an integrated circuit (IC) device used for controlling other portions of an electronic system, usually via a microprocessor unit (MPU), memory, and some peripherals.

Steel pipe: 4 feet.

Iron box: 1sq feet.

Wood base tray: 1 ½sq feet.

Voltage regulator: 6V.

A voltage regulator is a system designed to automatically maintain a constant voltage. A voltage regulator may use a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

Solar charge controller: 12V.

A solar charge controller is used to charge the battery from power generated by solar panels and prevent the battery from overcharging. It is also known as a voltage or current controller as it directs the voltage and current from the solar panels to the battery and also stops the reverse flow at night.

Touch Sensor: Touch Sensors are the electronic sensors that can detect touch. They operate as a switch when touched. These sensors are used in lamps, touch screens of the mobile, etc… Touch sensors offer an intuitive user interface.

4.3 Block diagram:

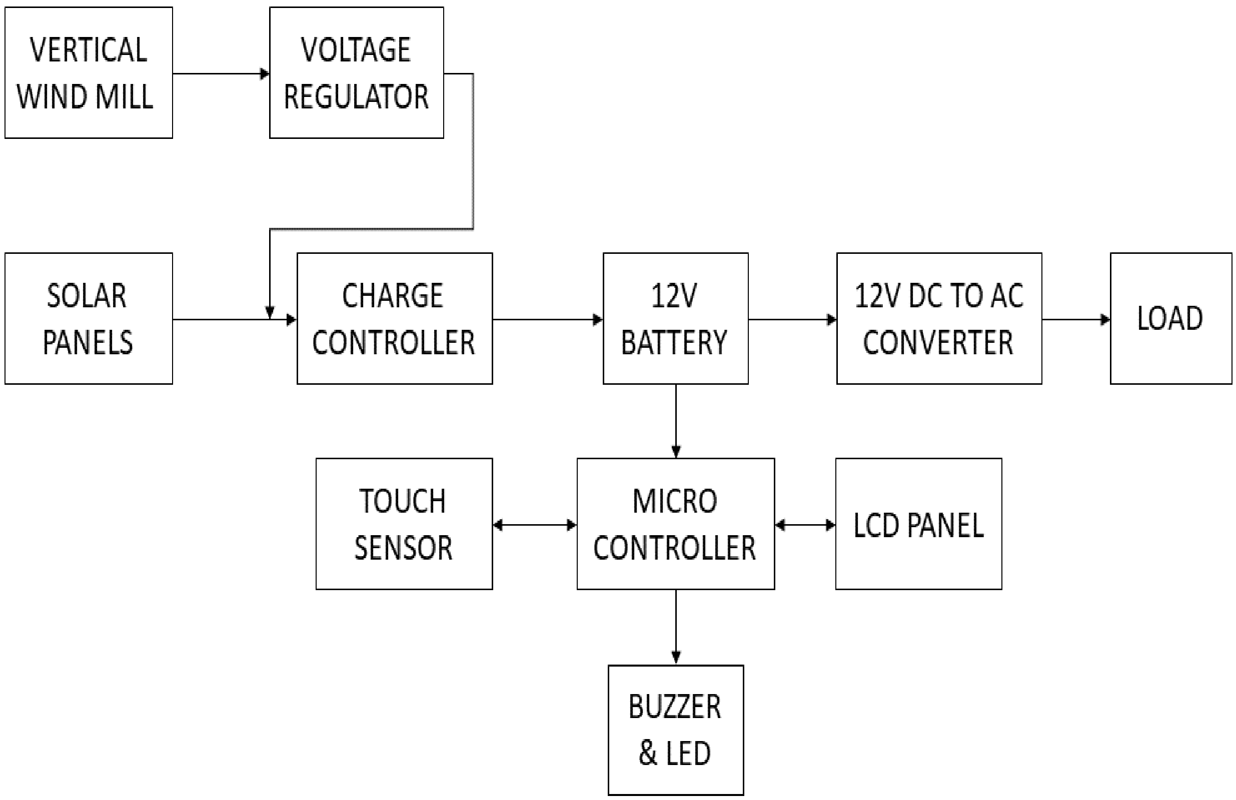


Figure: 4.3 Block diagram

4.4 Flow chart

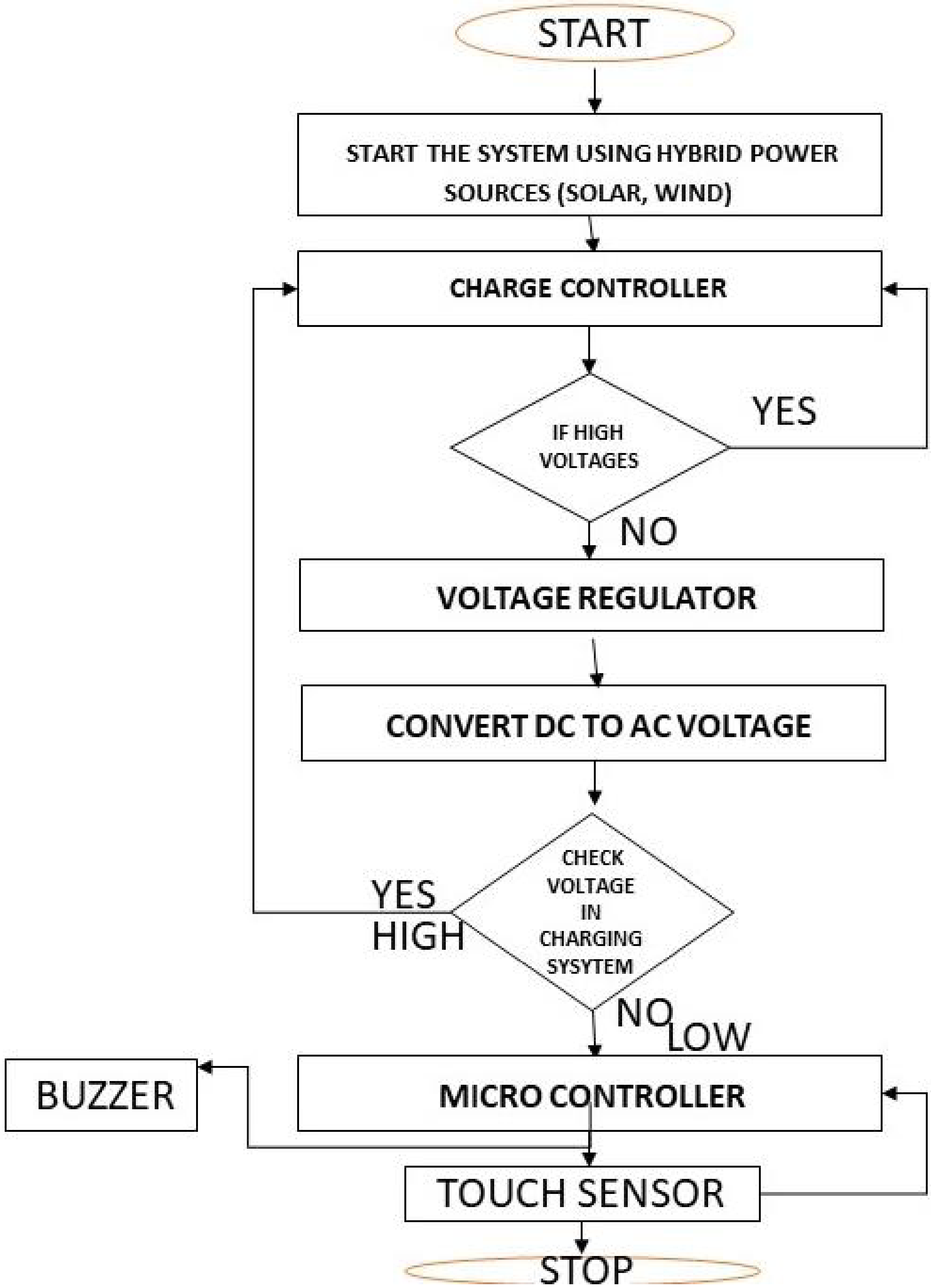


Figure: 4.4 Flow chart

4.5 Algorithm

Step-1: start the system using hybrid power sources (solar and wind energy).
Step-2: Connect hybrid power source to the solar charge controller.
Step-3: Check if any high voltages occurs repeat step-2.
Step-4: Maintain stable voltage by voltage regulator. Then convert DC to AC by invertor circuit.
Step-5: Check if any interruption occurs repeat step-2.
Step-6: The gearbox increases the rotational speed of the shaft, up to 1200-1800 rpm. This is the required rotational speed of most generators to produce acceptable levels of power.
Step-7:Both the solar panel and the turbine have the same charge flow rate.
Step-8: This battery have a typical cycle life of 300 – 500 (charge, discharge cycles).
Step-9: Finally stop the system using switch.

4.6 Working Principle of Solar Energy:

1. Power generation principle
A solar cell is essential a PN junction with a large surface area. The N-type material is kept thin to allow light to pass through to the PN junction.
The sunlight shines on the pn junction of the semiconductor to form a new hole-electron pair.
The holes flow from the p region to the n region under the action of the PN junction electric field, and the electrons flow from the n region to the p region. After the circuit is turned on, a current flows . This is the working principle of photoelectric effect solar cells.

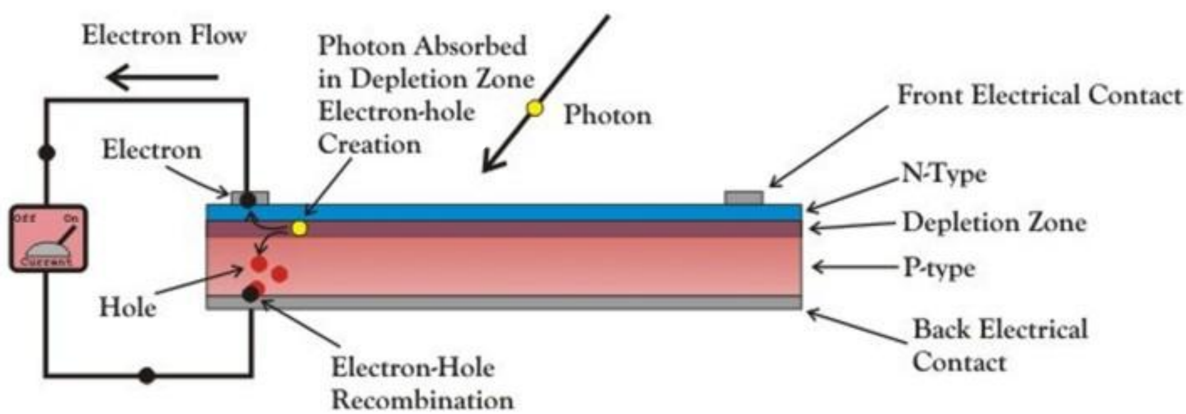


Figure: 4.6 Power generation principle

2. Solar power generation Solar power generation in two ways, one is the light - heat - electricity conversion, the other is the light - electricity direct conversion.

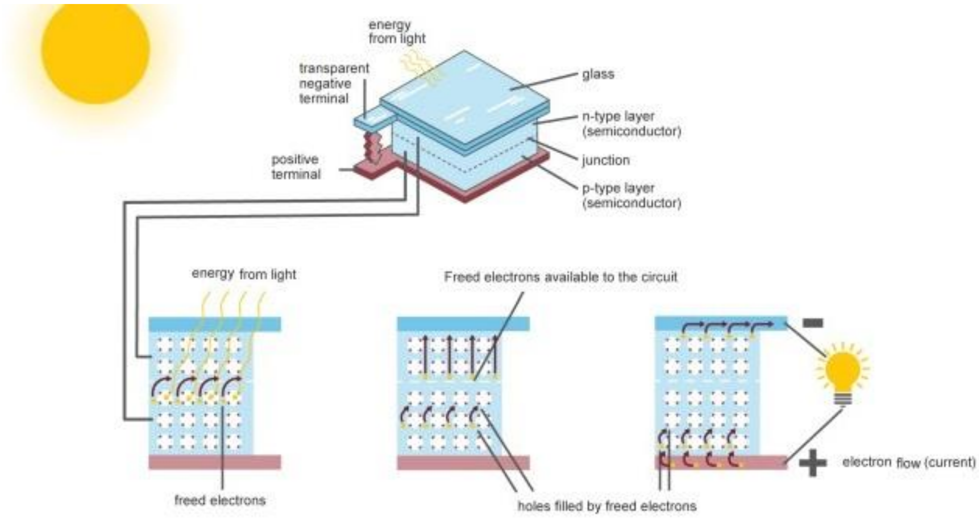


Figure: 4.6 Inside of Photovoltaic Cell

1). Light-Heat-Electric Conversion Method By utilizing the heat generated by solar radiation to generate electricity, it is common for solar collectors to convert all absorbed heat energy into vapor of working fluid to drive the steam turbine to generate electricity.

2). The direct conversion between light and electricity uses the photoelectric effect to directly convert solar radiation into electric energy, and the basic device for photoelectric conversion is a solar cell. A solar cell is a device that directly converts sunlight energy into electricity due to the photovoltaic effect. It is a semiconductor photodiode.

When the sunlight shines on the photodiode, the photodiode turns the light energy of the sun into electricity and generates Current. When many batteries in series or in parallel can become a relatively large output power of the solar square.

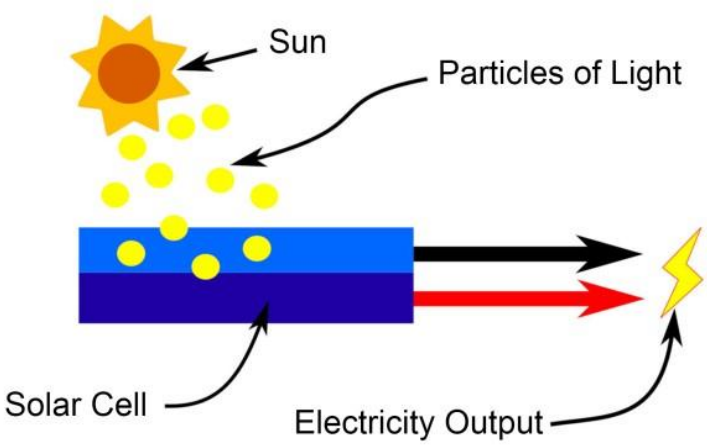
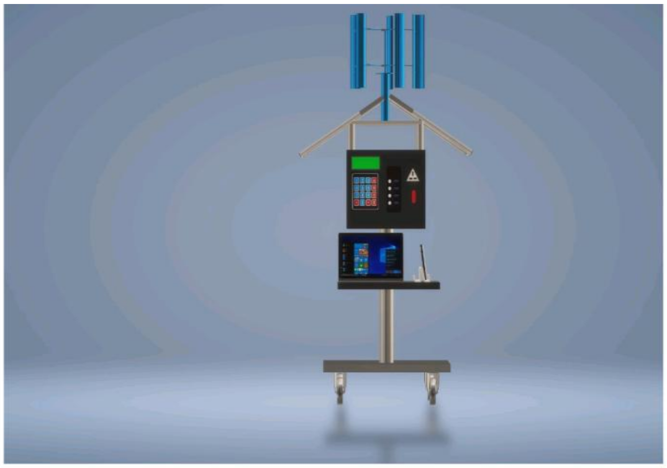


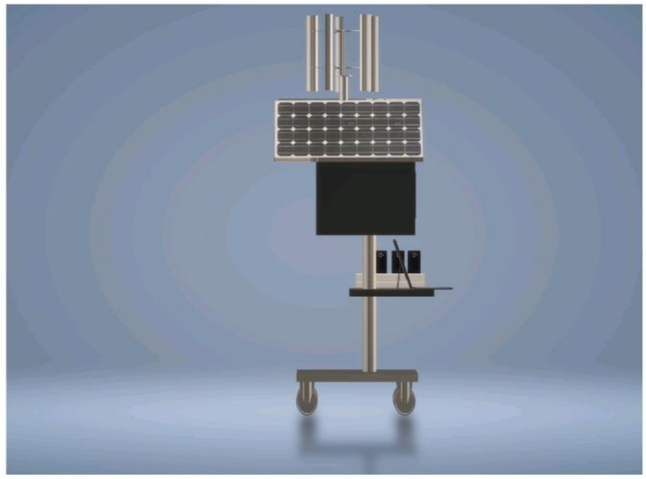
Figure: 4.6 The direct conversion between light and electricity of Solar Panel

4.7 Project View

Front View



Side View



3D View

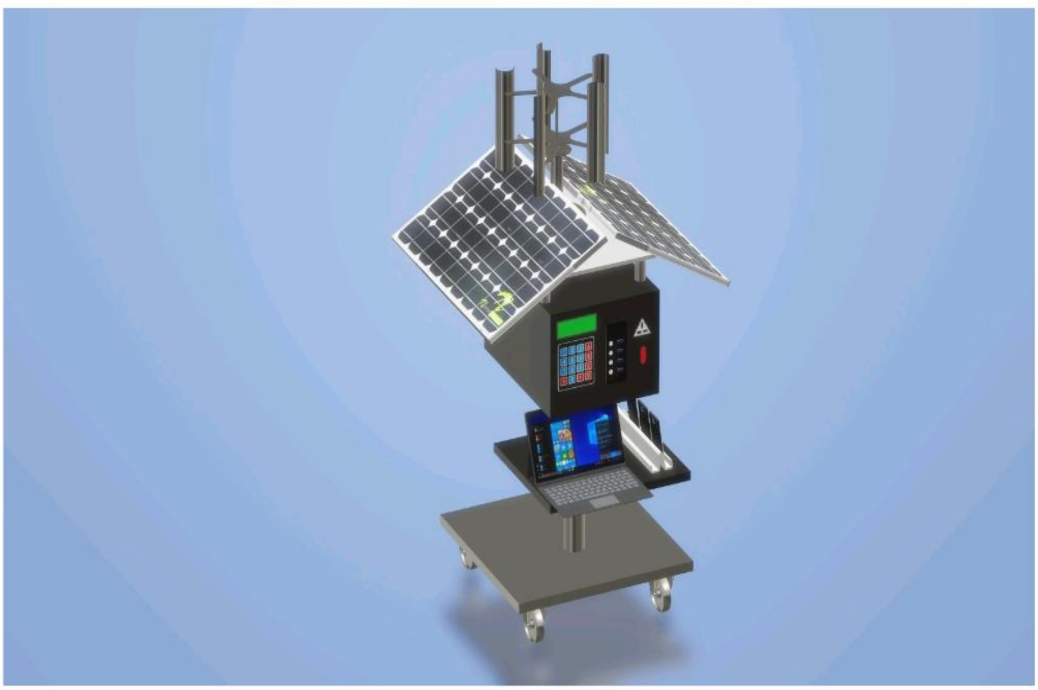


Figure 4.7: Project View

Chapter 5

FUTURE RECOMMENDATION

5.1 Future Recommendation of this project

- Anti-theft Alarm system
- Locker system for storing valuables of tourists
- Water Purification RO System (Low power consumable)
- Intercom system for emergency communication.
- Use of street light.
- There will be emergency power port through which small medical devices and electric vehicles can be charged.

Chapter 6

RESULT & DISCUSSION

6.1 Output Result

Table 6.1 Timely Solar System Current and voltage output data

SL NO	∆t	Receiving Voltage	Receiving Current	Average Voltage	Increase	Average Current	Descries
1	11:00-12:00	12.00V	2.56Amp	100%	0.00%	91.00%	-1.25%
2	12:00-12:30	12.50V	1.58Amp	110%	4.00%	96.00%	-1.26%
3	12:30-13:00	12.70V	1.46Amp	112%	5.50%	88.00%	-9.58%
4	13:00-13:30	13.00V	1.40Amp	115%	7.60%	85.00%	-14.28%
5	13:30-14:00	12.00V	1.20Amp	100%	0.00%	77.00%	-33.33%
6	14:00-14:30	12.03V	1.10Amp	110%	2.43%	75.00%	-45.45%
7	14:30-15:00	12.50V	1.30Amp	100%	0.00%	80.00%	-23.07%
8	15:00-16:00	11.50V	1.30Amp	110%	-4.16%	80.00%	-23.07%
Total Result=5Hr		T=5Hr	RAC =108%	RV25.00%Dise		λ=83.00%	

Table 6.2 Timely Wind System Current and voltage output data

SL NO	Δt	Wind Speed	Receiving Voltage	Receiving Current	Average Voltage	Increase	Average Current	Descries
1	11:00-12:00	11.80	12.00V	2.56 Ah	100%	0.00%	66.67%	-33.33%
2	12:00-12:30	12.30	12.50V	1.58 Ah	104%	4.00%	98.70%	-1.26%
3	12:30-13:00	13.90	12.70V	1.46Ah	105.5%	5.5%	90.42%	-9.58%
4	13:00-13:30	13.20	13.00V	1.46Ah	107.9%	7.9%	90.42%	-9.58%
5	13:30-14:00	12.30	12.00V	1.47Ah	100%	0.00%	91.16%	-8.84%
6	14:00-14:30	12.26	12.03V	1.48Ah	101%	1.00%	92.00%	-8.10%
7	14:30-15:00	9.96	12.00V	1.48Ah	100%	0.00%	92.00%	-8.18%
8	15:00-16:00	8.79	12.00V	1.46Ah	105.5%	5.50%	90.02%	-9.98%
Total Result=5Hr		Avg=11.81	T=5Hr	RC=103%	RV=12.108%Dise		λ=90.9%	

Figure: 6.2 Output result

The above mentioned images are from the output of the proposed system. The proposed system is used to charge the mobile phone with the help of USB cable. In this charging system we have used solar panels connected in series to generate output voltage. While charging the system the liquid crystal display is used to show how much the device is charging and it also produces a buzzer sound while the charging of the device is full.

6.2 Discussion

Portable laptop and mobile charging station is a system that utilizes two sources or more of renewable energy. As an advantage, it will assist in producing continuous sources of energy and utilizing one source in the absence of other source(s). The aim of this research is to enhance the energy output of renewable energy system which is the wind turbine by incorporating solar panels. Other objective is to investigate the effect of solar panels distribution on the total power output of the new created hybrid system by investigating two cases. First, by using one large solar panel that is connected to the hybrid controller with the wind turbine. Second, by using smaller size solar panels that have an equivalent area to the panel used in the first case. Results showed that the power output of the wind turbine is improved when connected to the solar panel, and a continuous power output is achieved. One big solar panel has better effect in improving the power output than using smaller size solar panels.

Chapter 7

CONCLUSION

7.1 Conclusion

Developing Hybrid system in renewable energy resources is the most convenient and effective for the production of electricity as compared to non-renewable energy sources. It is not only less costly but also does not affect the environment i.e. Non-polluting. It is also placed in some hilly area for producing electricity in place of non- conventional methods. In future the world is full of electricity by non-conventional energy resources. The hybrid system have less maintenance and longer life span. It just only has high initial investment for the production of electricity. In future, most of the companies implemented hybrid renewable systems for power supply.

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