PORTABLE GREEN ENERGY MOBILE LAPTOP CHARGING STATION

[1]Bodke Avadhuth, [2]Mane Tukaram, [3]Kadam Ritesh, [4]Mr. landge M.S
Department of Electrical Engineering, Gramin Technical & Management Campus, Vishnupuri Nanded Maharashtra, India
ambodke9145@gmail.com[1], tukaramm821@gmail.com[2], riteshkadam911205@gmail.com[3], maheshlandge85@gmail.com[4]

ABSTACT

The Portable Green Energy Mobile Laptop Charging Station is an eco-friendly, on/off-grid power solution designed to provide reliable charging for laptops and mobile. This system integrates renewable energy sources solar and wind power, this are generated electrical energy the energy provided on DC-DC boost converter. Deliver stable output rechargeable battery storage unit. The energy is converted DC to AC through a inverter, converted energy deliver for the mobile and laptop charging. This portable and sustainable system is ideal for outdoor, remote, and emergency use, contributing to a greener future by reducing reliance on conventional electricity sources.

Keywords: Green Energy, Solar Power, Wind Energy, Portable Charging Station, Laptop Charging, Renewable Energy, Boost Converter, Inverter, Battery Storage, Voltage Regulator

INDRODUCTION

Nowdays, During traveling, especially in remote areas or long journeys, access to electrical power becomes limited or unavailable. The Portable Green Energy Mobile Laptop Charging Station is designed to overcome this challenge by providing a sustainable and independent power source using solar and wind energy. Its compact and lightweight design allows easy transportation, making it ideal for outdoor activities, camping, fieldwork, and emergency situations. By using renewable energy, it ensures continuous laptop usage without relying on the conventional power grid, thereby promoting eco-friendly travel and reducing carbon emissions.

WORKING OF PROJECT

The Portable Green Energy Mobile Laptop Charging Station works by utilizing renewable energy sources such as solar and wind power to generate electricity and store it for portable use.

1. Power Generation:

The solar panel and windmill (dynamo) convert solar energy and wind energy into DC electricity. These are the primary sources of power for the system.

2. Reverse Polarity Protection:

Diodes are used at the input side to prevent reverse current flow, protecting the circuit if the connections are made incorrectly.

3. Charging and Regulation:

The generated power is passed through a buck converter with a charging controller to charge the battery safely and efficiently. Overcharge and deep discharge protection is handled here.

4. Power Storage:

The rechargeable battery stores the regulated DC power. It acts as a backup to ensure continuous power supply during low sunlight or wind conditions..

5. Voltage Conversion:

When required, the stored battery power is passed through a boost converter to step up the voltage and through an inverter to convert DC to AC if needed for devices like laptops.

6. Output :

The system delivers the final output to the laptop or device via a standard output port. It will be flexible for such a various types of devices port.

I. BLOCK DIAGRAM COMPLETE PROJECT

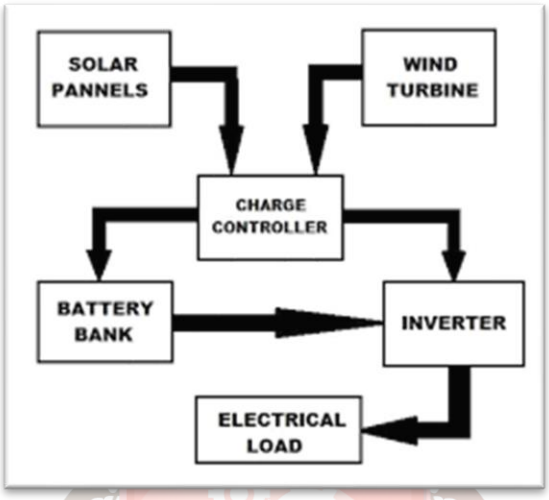

Fig.1 Block diagram

II. COMPONENTS DESCRIPTION

A. SOLAR PANEL

The solar panel is one of the key components of the Portable Green Energy Mobile Laptop Charging Station. It captures sunlight and converts it into electrical energy using photovoltaic (PV) technology. Each panel is made up of multiple solar cells that generate DC (Direct Current) electricity when exposed to sunlight. The efficiency of the panel depends on factors such as sunlight intensity, panel orientation, and temperature.

In this Paper , the solar panel is responsible for continuously generating power during daylight hours, which is then stored in a rechargeable battery. This stored energy is later used to charge laptops and other portable devices. The solar panel is lightweight, durable, and portable, making it ideal for outdoor and traveling conditions. It promotes the use of renewable energy and reduces dependency on grid electricity, contributing to environmental sustainability.

Fig.2 Solar Panel

In the proposed work, the solar panel generates different voltage in different time.

In summer weather

Time	Voltage (v)
Morning	9
Mid-day	11
Evening	8

Table I.

In winter weather

Time	Voltage (v)
Morning	7
Mid-day	10
Evening	8

Table II.

B. Dynamo

A dynamo is an electrical generator that produces direct current with the use of a commutator. The word dynamo (from the Greek word dynamics; meaning power) was originally another replacement for the word generator. A small electrical generator built into the hub of a bicycle wheel to power lights is called a hub dynamo, although these are invariably AC devices and are actually magnetos.

Fig.3 Dynamo

In the proposed work, dynamo generates different voltage in different rotation as shown in Table III.

RPM	Voltage (v)
380	11
340	10
280	8.5

Table III.

C. BOOST CONVERTER

The Step-Up Boost Converter is an essential electronic circuit used in the Portable Green Energy Mobile Laptop Charging Station. Its main function is to increase (or “boost”) the input DC voltage from a lower level to a higher, stable output voltage suitable for charging a laptop.

In this project, the energy generated from the solar panel or windmill may vary depending on environmental conditions. Often, the voltage produced is lower than the required charging voltage of a laptop. The boost converter steps up this lower voltage to a fixed, higher DC voltage level, ensuring a consistent and efficient power supply.

The converter works using switching devices like MOSFETs and inductors to temporarily store and release energy at a higher potential. It is compact, efficient, and reliable—making it ideal for portable, renewable energy-based systems. This component plays a critical role in maintaining voltage stability and protecting the connected devices from power fluctuations.

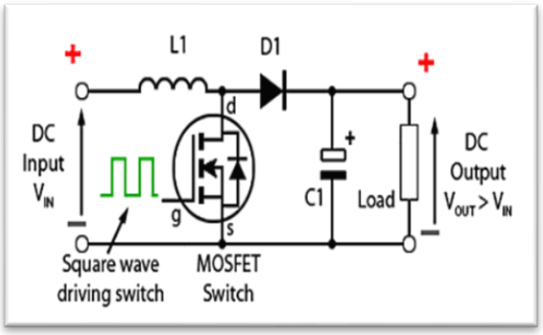

Fig.4 Boost converter

D.BUCK CONVRTER

A buck converter is a DC-DC step-down converter used to reduce a higher input voltage to a lower, stable output voltage. In this project, the buck converter is used in charging controller to safely charge the battery from the solar panel or windmill output.

The charging controller regulates the voltage and current going into the battery, ensuring it charges efficiently without overcharging or overheating. The buck converter steps down the input voltage to the optimal level required by the battery. This combination protects the battery and extends its lifespan.

The system automatically adjusts according to the input voltage and battery status. This makes the charging process safe, efficient, and suitable for renewable energy systems where input voltage may fluctuate.

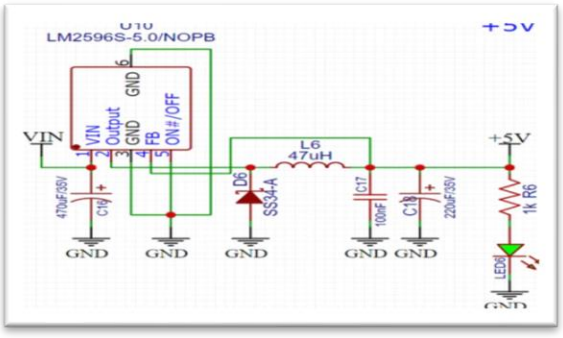

Fig.5 Buck converter

E. VOLTAGE REGULATOR

The LM317 is a popular adjustable voltage regulator used to maintain a stable output voltage. It can provide an output voltage in the range of 1.25V to 37V and a current up to 1.5A, depending on the external components.

In the Portable Green Energy Mobile Laptop Charging Station, the LM317 is used to regulate the output voltage to a safe level. It helps in providing a constant voltage for buck converter. By adjusting the external resistors, the desired voltage level can be set easily.

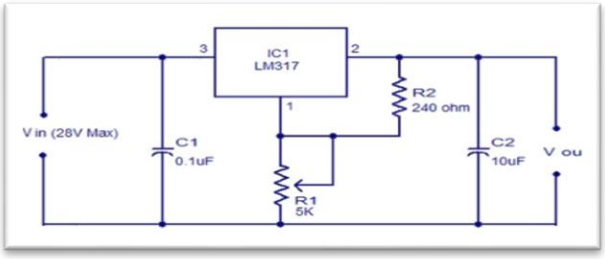

Fig.6 voltage regulator

F. REVERSE POLARITY PORTECTION CIRCUIT

In this paper, reverse polarity protection is implemented using diodes for both the solar panel and the dynamo (windmill) inputs. A diode is placed in series with the positive terminal of each power source to prevent damage in case of incorrect wiring.

If the solar panel or dynamo is connected in reverse by mistake, the diode blocks the reverse current flow, ensuring no voltage reaches the rest of the circuit. This simple method provides effective protection against accidental reverse polarity, especially in outdoor and mobile conditions.

Using diodes for reverse polarity protection is a cost-effective and reliable solution to safeguard sensitive components such as batteries, charging controllers, and voltage regulators in the system.

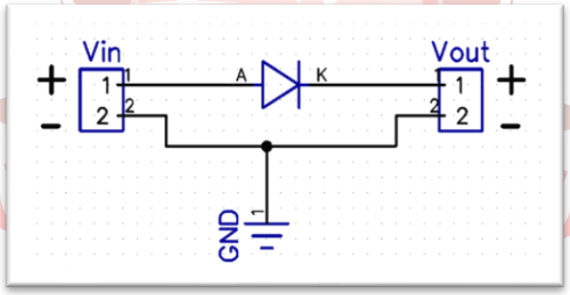

Fig.7 Reverse polarity protection circuit

G. BATTERY

The rechargeable battery is a vital component in the Portable Green Energy Mobile Laptop Charging Station. It stores the electrical energy generated by the solar panel and windmill and supplies it when sunlight or wind is not available.

In this paper, a sealed lead-acid battery is commonly used due to its high energy density, portability, and long cycle life. The battery stores DC power and supplies it to the inverter depending on the requirement. Use two batteries are connected in series, the one battery rating 6 volt, current 4.5 Ah total voltage 12 volt 4.5Ah.

Fig.8 battery

H. INVERTER

An inverter is an essential component that converts Direct Current (DC) into Alternating Current (AC). In this project, the inverter is used to convert the DC voltage stored in the battery into AC voltage, which can be used to power or charge laptops and other devices that require an AC supply.

Since most renewable sources like solar panels and windmills generate DC power, and laptops often use AC adapters, the inverter bridges this gap. The inverter used in this project is compact, efficient, and capable of delivering the required output voltage (usually 230V AC) to ensure compatibility with standard laptop chargers.

I.VOLTAGE REGULATOR IC

Member of 78xx series of fixed linear voltage regulator ICs are used to maintain the output voltage at a constant value. The xx in 78xx indicates the fixed output voltage. 7805 provides +5V regulated power supply. Capacitor of suitable values can be connected at input and output pins depending upon the respective voltage levels

Pin description is shown in Table IV

PIN NO.	NAME	FUNCTION
1	Input voltage (5-18V)	Input
2	Ground (0V)	Ground
3	Regulated output; 5V	Output

Table IV

J. WIND TURBINE

A wind turbine is device that converts kinetic energy from the wind into electrical power. In this project use vertical wind turbine

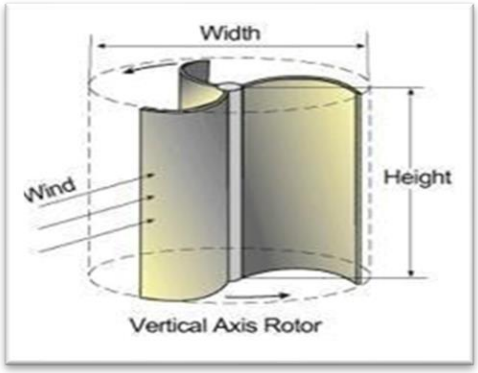

Fig.9 wind turbine

K. LEDs

In the Portable Green Energy Mobile Laptop Charging Station, LEDs are used as indicators to show the system's operating status. They help users easily understand conditions like power ON/OFF, charging status, battery level, or fault alerts.

L. WIRE

Wires are used for the connection of element.

ADVANTAGES & DISADVANTAGES

Advantages :

1. Easy to use
2. Uses clean and green energy
3. Efficient working
4. Clean and pure energy
5. Long term warranty

Disadvantages :

1. It depend on sunlight and wind, so it may not work well in bad weathe.
2. initial cost is high due to solar panels and winmill.

CONCLUSION

The Portable Green Energy Mobile Laptop Charging Station project successfully demonstrates the integration of renewable energy sources such as solar and wind power to provide an eco-friendly and sustainable solution for mobile device charging. Through the use of solar panels, a mini windmill, battery storage, and power conditioning units like boost converters and inverters, the system ensures a reliable and portable power supply. This project not only promotes the use of clean energy but also highlights the importance of reducing dependence on conventional power sources. Overall, the system offers a practical and scalable solution for remote areas, travel, emergency situations, and green energy enthusiasts.

REFERENCES

[1] Rai, G. D. Non-Conventional Energy Sources, Khanna Publishers, New Delhi.

[2] B.H. Khan, Non-Conventional Energy Resources, McGraw-Hill Education, 2nd Edition.

[3] Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning.

[4] Kothari, D.P., and Nagrath, I.J., Power System Engineering, Tata McGraw Hill.

[5] James Larminie and John Lowry, Electric Vehicle Technology Explained, Wiley.

[6] Rashid, M.H., Power Electronics: Circuits, Devices & Applications, Pearson Education.

[7] https://www.sciencedirect.com/ (for journal articles on solar and wind energy systems)

[8] https://www.ieee.org/ (IEEE papers on renewable energy systems and mobile charging stations)

[9] https://www.researchgate.net/ (for research-based studies on green energy solutions)

[10] Government of India - Ministry of New and Renewable Energy (MNRE), https://mnre.gov.in/