IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.67

Volume 5, Issue 5, March 2025

Solar Power Bank -Portable Solar Charger for Rural Areas

Vedant Bedade, Prathamesh Waykole, Prof S. D. Sayyase, Prof. S. A. Shastri
Department of Electrical Engineering
Guru Gobind Singh Polytechnic, Nashik, India

Abstract: *The Results Of This Study Suggest That Solar Battery Chargers Can Be A Viable Alternative To Traditional Chargers. Particularly In Outdoor And Off-grid Settings Where Access To Electricity May Be Limited. The Solar Battery Charger Developed In This Study Was Capable To Provide Electricity In Rural Area Where Electricity Is Minimum.*

Keywords: Solar Battery

I. INTRODUCTION

Energy Access Crisis: 1.2 billion people worldwide lack access to electricity (WHO).
2. Rural Energy Poverty: 95% of energy-poor populations live in rural areas (IEA).
3. Limitations of Traditional Energy: High costs, environmental impact, and unreliable supply.
4. Solar Energy Potential: Abundant, renewable, and sustainable energy source.
5. Project Objective: Develop a solar-based power bank for rural areas, providing reliable and efficient electricity

II. HARDWARE REQUIREMENTS

a) Solar panels (8)

Solar panels convert sunlight into electricity using photovoltaic (PV) cells. These cells absorb sunlight, exciting electrons to generate direct current (DC) electricity. An inverter then converts DC into alternating current (AC) for home or business use. Excess energy can be stored in batteries or sent to the power grid.

Figure1 Solar panels

b) Rechargeable battery

A rechargeable battery stores energy through a reversible chemical reaction. During charging, electrical energy converts into chemical energy. During discharging, the stored chemical energy is converted back into electricity to power devices.

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.67

Volume 5, Issue 5, March 2025

Figure2 Rechargeable battery

c) Charge controller

A charge controller regulates power from solar panels to batteries, preventing overcharging and over-discharging. It ensures efficient charging and protects battery lifespan.

Figure3 Charge controller

d) Power bank circuitry

A power bank stores energy in rechargeable batteries and supplies power to devices via USB output. It includes a charging circuit to regulate input power, a boost converter to provide stable output voltage, and a protection circuit to prevent overcharging, over-discharging, and short circuits

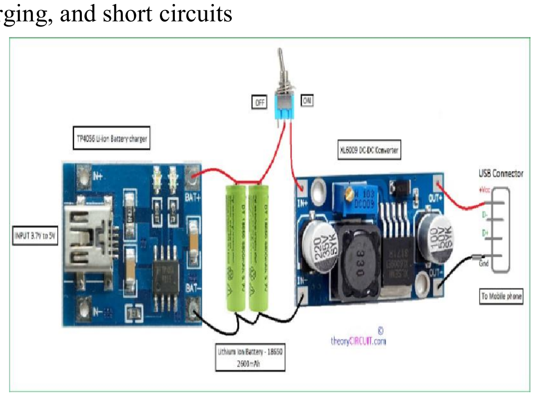

Figure4 Power bank circuitry

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.67

Volume 5, Issue 5, March 2025

e) USB ports and LCD display

A USB port transfers power and data by connecting devices through standardized electrical contacts. The LCD display in a device shows information like battery percentage or status using a controller that processes input signals. Both work together in gadgets like power banks to indicate charging status and power levels.

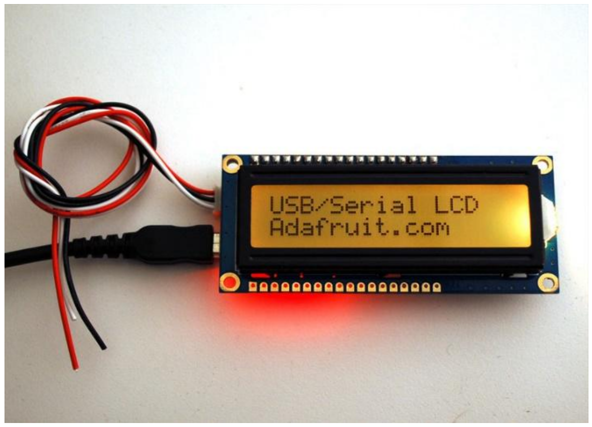

Figure 5 USB ports and LCD display

f) Enclosure and miscellaneous

An enclosure protects internal components from physical damage, dust, and moisture while providing structural support. Miscellaneous components, like connectors, LEDs, and cooling vents, enhance functionality and usability. Together, they ensure durability, safety, and efficient operation of electronic devices.

III. SOFTWARE SPECIFICATION

1.Monitoring and control using Arduinoor Raspberry Pi

2. Optional: Mobile app for remote monitoring and control.

IV. APPLICATION

Emergency power

- Outdoor lighting
- Charging station
- Water pumps
- Street light

V. TECHNICAL SPECIFICATIONS

*Performance Metrics:

- Efficiency: 85%
- Weight: 5 kg
- Dimensions: 20 x 15 x 10 cm
- Operating Temperature: -20°C to 40°C

VI. FUTURE SCOPE

- Short-Term (2-3 years)-
- Pilot project expansion to 100+ villages-
- Technology upgrades (IoT, AI, energy storage)
- Mid-Term (5-7 years)
- Large-scale deployment across 5+ states or countries
- Integration with other renewable energy sources (wind, hydro, bioenergy)

• Long-Term (10-15 years)-
• Smart grid integration for efficient energy distribution

VII. KEY OPPORTUNITIES

Government incentives and subsidies-Private sector investment
International collaborations-Growing demand for renewable energy solutions.

VIII. CONCLUSION

This basic circuit diagram for a solar-based power bank involves a simple yet efficient system to store solar energy and make it available for rural applications. It is scalable based on the energy requirements and can be modified to handle larger batteries or additional devices as needed.

REFERENCES

1."Design and Development of Solar-Powered Power Bank for Rural Electrification"* by A. K. Singh et al. (2018) Journal:_ International Journal of Renewable Energy Research
2."Solar-Based Portable Power Generation System for Rural Areas"* by R. K. Sharma et al. (2020) Journal: Journal of Solar Energy Engineering This study develops a portable solar power generation system for rural areas, emphasizing efficiency, cost-effectiveness, and userfriendliness.
3. "Optimization of Solar Power Systems for Rural Electrification"* by J. Liu et al. (2020) Journal:_ IEEE Transactions on Sustainable Energy This research optimizes solar power systems for rural electrification, focusing on maximum power point tracking, battery management, and system sizing.
4."Energy Access in Rural Areas: Challenges and Opportunities"* by S. K. Singh et al. (2020) Journal:_ Energy for Sustainable Development This review highlights challenges and opportunities in providing energy access to rural areas, emphasizing the role of solar based power banks.