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Solar Powered Mobile Charging Station

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Abstract—With the growing popularity of mobile electronics, chargingsolutions that are both affordable and environmental friendly are necessary.
This article explores the development and deployment of solar-powered mobile charging stations as an environmentally friendly and efficient way to meet this growing demand.
The charging station uses solar energy through photovoltaicpanels, providing a clean and renewable energy source.
The model integrates modern technologies such as energy- efficient batteries, intelligent charging controls, and user- friendly interfaces to maximize the efficiency of charging performance and enhance user experience.
The main components of solar powered mobile charging stations include high-efficiency solar panels, energy storagesystems, charging ports compatible with mobiles.
With its modular design, the station can be situated in various locations, including city centers, public squares, andremote areas that have limited access to the traditional power grid.
As discussed, the challenges and opportunities associated with the widespread adoption of solar charging infrastructure, including considerations for technology integration, maintenance, and public awareness.
The further future Scope or steps that can be taken to enhance the project are:-
1. Our main focus -To make our solar panel model rotate in an automatic manner where the intensity of sunlight is more.
2. Technological Advancement -Like increasing the efficiency and energy storage capacity
3. Market Growth -it will help in increasing the adoption of this technology, it will help in development of rural and urban areas, it will help in increasing the business opportunities.
4. It will help in increasing the sustainability whichwill have a positive impact on our environment.

Keywords- *Charge Controller, Charging Station, Mobile Phone,Renewable Energy, Solar Energy , Solar Panel.*

I. INTRODUCTION

In today's generation, we often see people using MobilePhones and constantly complaining about their phone's battery life, mostly while traveling, when there is no power supply or availability of charging ports for charging the devices. So to tackle the problem we haveresearched and are developing a **solar powered mobilecharging station**, which is often talked about but somecountries have taken the initiative to resolve this issue.Only a few foreign countries (America, Japan) have taken the initiative to use renewable energy. As of today, **the MINISTRY of NEW AND RENEWABLE ENERGY of INDIA** is working to expand the use of renewable energy.

Through the research, we got to know that this project has been developed to generate electrical power to compensate for the electric power demand we can also attach a backup storage battery in case of calamities or in case the weather is not clear also solar power is a highly promising and sustainable energy

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source that offers a wide range of benefits for both individuals and society as a whole. Charging stations contribute to the growing field of renewable energy technology and can have a positive impact on communities by providing clean and accessible power sources.

In order to make the solar panel manually movable, wealso added a lever, a rod, and some screws to the model.Twelve screws were inserted at a 30-degree angle.

II. Methodology/Experimental

A. Materials/Components/Flowchart/Block Diagram/Theory

The **main components** in our project are :-

1. *Solar Panel:-*

Figure 2.1 i.e. Photovoltaic panel (Solar Panel), is a device that converts solar energy into electricalenergy. They play a crucial role in solar power systems, which use the sun's abundant and renewable energy. It contains individual solar cells, which are typically made of semiconductor materials like silicon. By using the photovoltaic effect, these cells are in the process of turning sunlight into electrical power.

When sunlight hits a solar cell, photons from the sunlight are absorbed by the semiconductor material. This energy excites electrons, creating an electric current. The electricity produced will be in the form of direct current (DC). It flows out of the solar panel through electrical conductors.

Solar panels can be incorporated into building structures, installed on rooftops, or placed on the ground. Optimizing energy production requires careful evaluation of the mounting angle and direction.

Solar panels can significantly reduce or eliminate electricity bills by generating on-site power. Nowadays, The government is also offering incentives, tax credits, and discounts to encourage the installation of solar panels.

Figure 2.1:Solar Panel

2. *Charge Controller:-*

Figure 2.2 i.e. The solar panels and battery are connected via a charge controller, which is a solar battery charger.

Its task is to control the battery charging process and guarantee that the battery is not excessively—charged.

There are three stages during the charging process mainly known as:-

Bulk Charging -

Until the batteries reach a particular voltage level, the controller at this stage enables the solar panels' maximum current to flow into the batteries.

Absorption Charging -

The controller maintains the voltage steady as long as the batteries reaches the desired level, making sure they are fully charged.

Float or Maintenance Charging -

The controller decreases the voltage so as to avoid overcharging of batteries after they are fully charged.

Figure 2.2:Charge Controller

3. *Rechargeable Battery :-*

Figure 2.3 i.e. rechargeable batteries, also known assecondary cells, are a form of electrical battery madeup of one or more electrochemical cells that may be charged, discharged into a load, and recharged several times. As it stores and accumulates energy through a reversible electrochemical reaction, it is referred to as "accumulator".

Rechargeable batteries come in a wide variety of sizes and forms, from button cells to megawatt systems integrated to maintain the stability of an electrical distribution system. There are several electrode material and electrolyte combinations that are used, such as lead-acid, lithium-ion, and lithium iron phosphate.

A. Advantages of Rechargeable Batteries:

- An integral part of solar power systems are solar rechargeable batteries that they temporarily store the extra energy produced by solar panels throughout theday so that it can be used at night or on overcast days.
- Cost Savings: Rechargeable batteries can end up being more affordable in the long run because of their repeated uses,

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even though they are more expensive initially.

- Reduced Environmental Impact: Rechargeable batteries have a reduced environmental impact than disposable batteries as they produce fewer wastematerials.
- Long-Term Convenience: The user may the recharge batteries for long periods of time rather than having purchase and discard them on a regular basis.

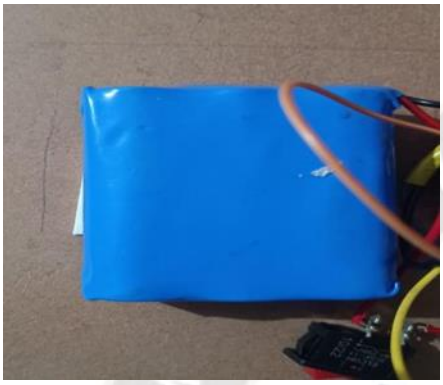

Figure 2.3:Rechargeable Battery

II. FLOWCHART

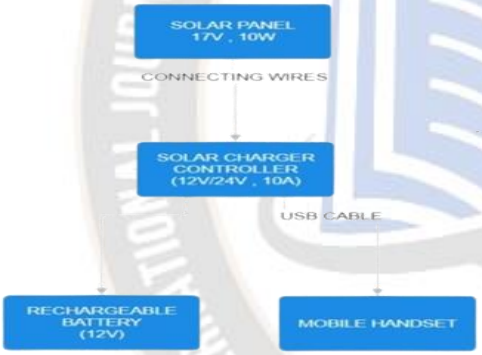

Figure 2.4:Flowchart

A. BLOCK DIAGRAM

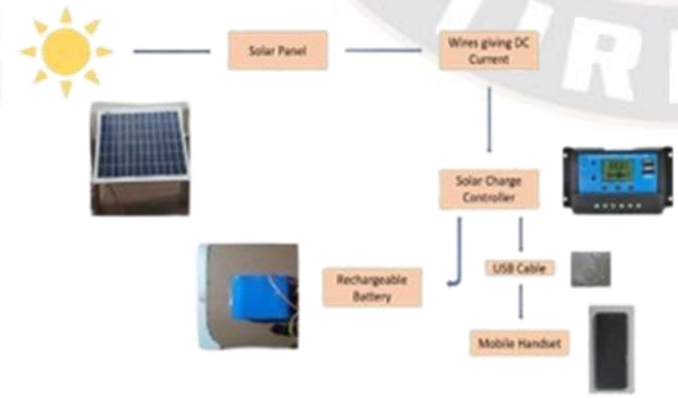

Figure 2.5:Block diagram

B. THEORY

Typically, a solar panel, a charge controller, and a rechargeable battery are used to make a solar-powered mobilecharging station.

Working :- Sunlight is captured by the solar panel and transformed into electrical energy, which is eventually storedin the rechargeable battery. The voltage regulator stabilizes and controls the solar panel's voltage output to make sure it stays within a safe range for battery charging. To maintain optimal charging conditions, the charge controller regulates the power flow from the solar panel to the battery.

Our main objective is to utilize solar energy to its maximum potential and help in creating a convenient, sustainable and easy-to-usemobile device charging solution. A solar-powered mobile charging station serves the growing demand for environmentally clean and sustainable solutions, which help in promoting the use of renewable energy sourceswhile meeting the growing need for mobile device charging. Based on the specific requirements of the target location and user population, the structure and features can be modified.

III. RESULTS AND DISCUSSIONS

When we completed building the circuit, we observed thatthe Solar Panel is in working condition and Due to Manual Movement of Solar Panel towards the sunlight, we found that there was a slight increase of about 30 to 33% in Power Output.

In the end when we connected the Mobile phone it was charging successfully.

The following table shows the overall voltage across the solar panel at a particular time of a day. The following readings were taken in Jan 2024. The day was mostly sunny.

Table 1

Time	MAX VOLTAGE
7am	2V
8am	3.5V
9am	6V
10am	8V
11am	9V
12pm	10.5V
1pm	12V
2pm	12V
3pm	10V
4pm	6V
5pm	3V

As per the timings we have marked the exact reading of how much time the mobile handset took for the full charging of battery inside it.

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Table 2

Around 8am	2hours
Around 10am	1 hour 30 minutes
Around 1pm	1 hour
Around 3pm	1 hour

Figure 3.1 shows the model of our project.

VIII. FUTURE SCOPE

Technological Advancements :

- Enhanced Efficiency.
- Energy Storage.Market Growth :
- Increased Adoption.
- Urban and Rural Deployment.Business Opportunities:
- Sustainability and Environmental Impact .
- Government Support as well as Corporate Sustainability.

To make Solar Panel Rotating on dual axis automaticallythrough sun rays which will rotate with the help of DC Motor.

VIII. Conclusion

To put it all together, a solar powered mobile charging station combines the generation of solar energy with the readily available requirement for charging mobile devices, making it an inventive and environmentally friendly solution. This idea supports eco-friendly behaviours while meeting the growing need for convenient charging stations. There are various significant benefits to mobile charging stations that use solar power:

Renewable Energy: These charging stations reduces the carbon footprint associated with generating electricity byusing solar power to provide a clean, renewable energy source. This reduces dependency on conventional systems.

Accessibility: By placing solar powered mobile charging stations properly in parks, public spaces, and community areas, users on the go can have a quick and readily available way to charge their devices.

Environmental Effect: By utilising solar energy in charging stations, the environmental impact of conventional electricity producing methods is decreased overall, as well asair pollution and greenhouse gas emissions.

Energy Isolation: By generating electricity locally, solar charging stations enhance energy independence. This is especially helpful in isolated or off-grid locations where there may not be much or any traditional power infrastructure.

Community Engagement and Awareness: By executing as noticeable indications of the use of renewable energy, these stations promote community involvement and increase knowledge of the advantages of sustainable energy ways.

VIII. ACKNOWLEDGMENT

We want to express our gratitude to our project guide who helped make our solar panel mobile charging station project possible. This project promoted renewable energy sources while providing environmentally responsible ways to fulfill the rising need for mobile device charging.

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