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Design And Development of Solar Power Bank with Wireless Charging /Review

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Abstract – This project revolves around the development of a solar-powered portable charger equipped with wireless charging functionality. Harnessing solar energy through embedded photovoltaic cells, the power bank offers a sustainable and on-the-go power solution. The inclusion of wireless charging technology adds convenience to device charging, catering to the growing demand for cable-free experiences. This abstract summarizes the project's focus on combining solar efficiency with wireless convenience, aligning with the pursuit of eco-friendly and user-friendly energy solutions.

1. INTRODUCTION

Wireless charging is emerging technology now days. Wireless charging is also known as a wireless power transfer; here the power is transferring to the load without interconnecting cords. The solar power bank integrates solar charging with efficient battery support and wireless charging to provide a unique power bank product. The device is able to self-charge anywhere during day time so that the user never runs out of power. Wireless charging is also called as inductive charging. Wireless charging eliminates the cable required for charging. It reduces the wear and tear of hardware ports.. Solar energy is radiant light and heat from the Sun which harnessed using range of technologies such as solar heating, solar thermal energy, solar architecture and photosynthesis. It is an important source of renewable energy and the technologies are broadly characterized as passive solar and active solar depending on way they capture and distribute solar energy. Active solar include use of photo-voltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar include orienting building to Sun, selecting materials with favorable thermal mass, and designing spaces that naturally circulate air. Solar technology is broadly characterized as passive or active depends on way they capture, convert & distribute sunlight and enable solar energy to be harnessed at different levels. Although the solar energy refers primarily to use of solar radiation for practical ends, all renewable energies, other than geothermal and tidal, derive their energy from the Sun in direct and indirect ways. Solar power is the conversion of sunlight into electricity or directly using photovoltaic, indirectly using concentrated solar power. PV converts the light into electric current using the photoelectric effect.

2. WIRELESS CHARGING: ENHANCING USER CONVENIENCE

Wireless charging, based on inductive charging principles, allows for the transfer of energy between two coils—one in the charging station and the other in the device—without the need for physical connectors. This technology, standardized by the Wireless Power Consortium under the Qi standard, offers several benefits:

- **Elimination of Physical Connectors**: Reduces wear and tear on charging ports.
- **User-Friendly Experience**: Simplifies the charging process, especially in challenging environments.
- **Safety**: Minimizes the risk of electrical short circuits and corrosion

3. OBJECTIVE

The primary goal of this project is to create a sustainable and user-friendly portable power solution by integrating solar energy harvesting with wireless charging technology. The specific objectives are as follows:

1. **Design and Construct a Solar-Powered Charging System:**
   Develop a system that utilizes solar panels to convert sunlight into electrical energy, which is then stored in a rechargeable battery. This system aims to provide an eco-friendly alternative to traditional power

sources, especially in areas with limited access to electricity.

2. **Integrate Wireless Charging Capabilities:** Incorporate a wireless charging module based on inductive coupling to allow for cable-free charging of compatible devices. This feature enhances user convenience by eliminating the need for physical connectors.
3. **Develop a Compact and Portable Design:** Create a lightweight and durable enclosure that houses the solar panel, battery, and wireless charging components, ensuring the device is suitable for outdoor activities and emergency situations.
4. **Implement Efficient Power Management:** Design a charge controller and voltage regulation system to manage the distribution of power between the solar panel, battery, and wireless charging module, ensuring optimal performance and safety.
5. **Conduct Performance Testing and Evaluation:** Assess the efficiency, charging speed, and durability of the solar power bank under various environmental conditions to ensure reliability and user satisfaction.

4. COMPONENTS USED-

1. Solar Panel

- **Function:** Converts sunlight into electrical energy.
- **Specifications:** Typically, a 5V or 6V panel with a power output ranging from 1W to 5W, depending on the desired charging speed and battery capacity.
- **Example:** A 5V, 2W solar panel can provide approximately 400mA of current under optimal sunlight conditions.

2. Rechargeable Battery

- **Function:** Stores the energy harvested by the solar panel for later use.
- **Specifications:** Lithium-ion or lithium-polymer batteries with capacities ranging from 10,000mAh to 20,000mAh are commonly used.
- **Example:** A 20,000mAh lithium-ion battery can provide multiple full charges for smartphones.

3. Wireless Charging Module

- **Function:** Transfers power wirelessly to compatible devices using inductive coupling.
- **Specifications:** Modules based on the Qi wireless charging standard are widely used. These modules typically operate at 5V and can deliver power ranging from 5W to 15W.
- **Example:** A Qi-certified wireless charging module can charge devices like smartphones and earbuds without the need for physical connectors.

4. LED Indicators

- **Function:** Displays the charging status and battery level.
- **Specifications:** Typically, multi-color LEDs (red, green, blue) are used to indicate charging, full charge, and standby modes.

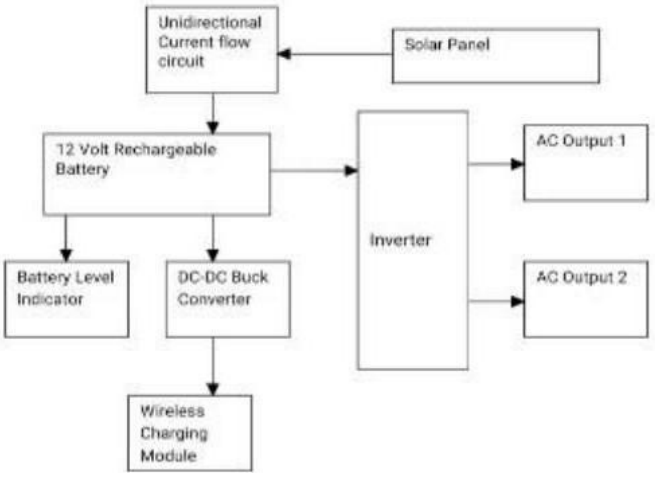
5. Enclosure

- **Function:** Houses all the components, providing protection and portability.
- **Specifications:** Durable materials like ABS plastic or aluminum are used. The enclosure should have cutouts for the solar panel, USB ports, and wireless charging pad.

6. Miscellaneous Components

- **Function:** Facilitate the assembly and operation of the power bank.
- **Examples:**
  - **Switches:** Power on/off switches to control the device.
  - **Connectors:** USB Type-A, Type-C, or micro-USB connectors for wired charging.
  - **Wires and Cables:** For internal connections.

5. BLOCK DIAGRAM



5. WORKING PRINCIPLE

Solar panels convert solar energy into electricity. They use the concept of photoelectric effect, emission of electrons when light falls on solar panel. Solar panels are made up of silicon cells, silicon has an atomic number 14. When light falls on silicon cell, the outer most electrons of silicon i.e. two electrons are set into motion. This initiates the flow of electricity. Silicon has two different cell structures: mono crystalline and polycrystalline Mono crystalline solar panels are manufactured from one large silicon block and are made in silicon wafer formats. Polycrystalline solar cells are also silicon cells, which are produced by melting multiple silicon crystals together. Mono-crystalline silicon cells are more efficient but expensive when compared to polycrystalline cells. Solar energy converted into electrical form and saved to the lead acid battery. This battery power supplied to the wireless charging module and inverter circuit. Wireless Battery Charger Circuit Principle: This circuit mainly works on the principle of mutual inductance. Power is transferred from transmitter to the receiver wirelessly based on the principle of "inductive coupling".

6. CONCLUSION

Therefore in this project we have successfully developed a solar power bank with inverter successfully. To charge the battery the power from solar panel is fed to the battery. Then the battery power given to buck converter and wireless module and inverter circuit. inverter converts dc 12 v to ac 230v AC. A 5watt bulb is lit at the output as a load. Wireless charging technology gradually eliminates the use of wired cords. It is more convenient and easy method. This technique eliminates the wear and tear of the hardware ports. This technology mainly provides portability to the user. Wireless charging seems a good idea and has been introduced to many mobiles iPhone 7(Apple), galaxy S5 (Samsung), Lumia 930(Microsoft), and xperia z3 (sony).These mobiles are built on the concept of inductive charging.

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