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FBM-SEREMBAN INTERNATIONAL INNOVATION COMPETITION (FBM-SIIC)

INNOVATION IN ACTION: TURNING IDEAS INTO REALITY

Chapter 61
The Solar Charging Backpack

Nurul Aliya Binti HafizulAzwa, Umar Uzair Bin Saiful Nizam, Mohamad Syazwan Hakim Bin Mohd Rusna, Muhammad Danial Aiman Bin Abdullah Sani & Noorita Mohammad

Faculty of Business and Management,Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, 42300, Bandar Puncak Alam, Selangor.

2024220882@student.uitm.edu.my

ABSTRACT

All undergraduate business students in the Marketing program (BA270) at Universiti Teknologi MARA (UiTM) must undertake the subject *Innovation and New Product Planning (MKT523)*. Students, trekkers, and people in off-grid locations increasingly require renewable energy sources as they rely more on portable electronic gadgets such as smartphones and tablets. Traditional charging methods are ineffective in such areas due to the lack of reliable electricity sources. We recommend the Solar Backpack as a revolutionary, multicomponent solution that offers clean, portable energy while promoting sustainable living practices. The Solar Backpack features thin, foldable solar panels that harvest solar power and convert it into electric energy, which is stored in an onboard rechargeable battery. Built-in USB ports allow users to recharge their electronic devices, while LED indicators display power status during charging. The backpack is made from recycled, durable materials to create a waterproof product suitable for outdoor activities and environments. The Solar Backpack includes all the necessary features to serve as an outstanding choice for individuals who care about the environment and require mobile power and portable storage. The Solar Backpack represents modern green technology advancement through its ability to replace traditional energy sources with renewable power. Both functionally and environmentally beneficial, it is a product well worth investing in to promote sustainable innovation.

Key Words: Solar backpack, renewable energy, portable charging solution, green technology, sustainable innovation

1. INTRODUCTION

The rapid growth of mobile technology has created a higher demand for dependable portable power sources, as these technologies have become essential for everyday activities, including communication, education, navigation, and entertainment. Electronic devices such

as smartphones, tablets, and other digital tools are now indispensable, while the need for continuous power remains a practical issue—especially for mobile individuals who rely on their devices to always remain functional. This power challenge is most critical for people living in rural or remote areas where electricity infrastructure is lacking. In such settings, traditional charging methods are ineffective, creating a gap between device utility and energy availability. The solar backpack addresses this issue by utilizing renewable energy through the integration of solar panels within a backpack. It allows users to store solar power via built-in, foldable, lightweight solar panels, and includes an internal rechargeable battery that enables device charging at any time and in any location. This innovation offers valuable features such as mobility, convenience, and accessibility. The use of eco-friendly technology within a practical design enables the solar backpack to support responsible energy usage and provide effective solutions for individuals who prioritize both functionality and environmental awareness. As a result, it is particularly suitable for students, off-grid users, and those who enjoy outdoor and adventurous activities.

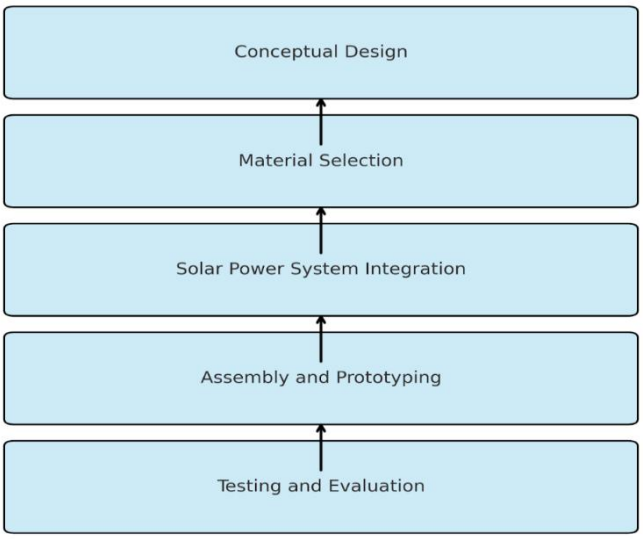
2. LITERATURE REVIEW

Recent advancements in renewable energy technology have significantly improved the design and functionality of solar-powered portable devices. Mohd Faizal et al. (2024) developed a user-oriented solar-powered portable charger that incorporates IoT elements, specifically designed for outdoor and off-grid applications. According to their study, the device emphasizes usability while ensuring sustainable power capabilities that allow it to function independently of traditional energy sources. Verma (2024) explores the evolution of solar technology, detailing the progression from first-generation silicon cells to more advanced multi-junction and perovskite-based technologies. He highlights that scalability and cost-effectiveness are crucial factors for the sustainable global development of solar-powered products. Further contributing to this field, Ramesh and Suresh (2023) examine how consumer perceptions influence the adoption of green technologies. Their research suggests that environmentally friendly materials, paired with transparent marketing strategies, play a vital role in shaping consumer behavior, aligning with the values and expectations of environmentally conscious buyers.

3. METHODOLOGY

3.1 Conceptual Design

The first stage concentrated on recognizing the requirements of intended users like students, hikers, and commuters. A design brief was developed detailing the preferred characteristics: lightweight framework, ergonomic support, ample storage, and built-in solar energy production. Drawings and three-dimensional models were made utilizing CAD applications such as AutoCAD or SolidWorks.



3.2 Material Selection

Sustainable and long-lasting materials were selected. The exterior material utilized is water-repellent, recycled polyester. For the energy system, efficient and adaptable monocrystalline solar panels with outputs ranging from 5W to 10W were chosen due to their light weight and flexibility for use on curved surfaces.

3.3 Integration of Solar Power Systems

A small solar panel system was set up on the upper flap of the backpack, linked to a charge controller and an integrated 10,000mAh lithium-ion battery pack. The charge controller managed current flow and stopped overcharging. USB ports were incorporated for charging devices.

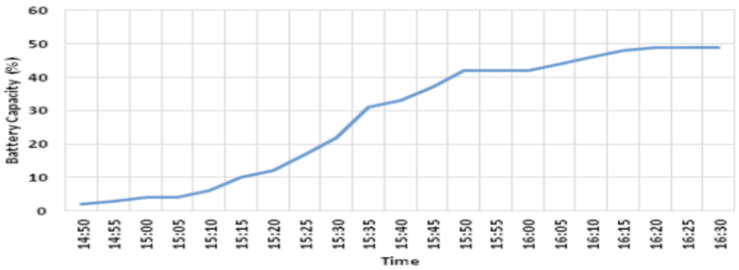
3.4 Assembly and Prototyping

Components were added to the backpack by hand, guaranteeing secure positioning and waterproof wiring. Multiple prototypes were created and improved upon considering their functionality and user input.

3.5 Testing and Evaluation

The ultimate prototype underwent testing in natural sunlight for evaluating solar charging effectiveness, resilience, and user-friendliness. Examinations encompassed:
Charging Time: Recording the time required to completely charge typical gadgets. Example: (mobile phone).

i. *Energy Output:* Assessing 5-10 voltage/current in varying sunlight conditions with a multimeter.



ii. *Durability Assessment:* Mimicking everyday usage scenarios such as rainfall, weight pressure, and extended usage.

iii. *Potential User Feedback:* Assessing 10–20 individuals regarding functionality, comfort, and visual appeal.

4. RESULTS & DISCUSSION

The Solar Charging Backpack was created in response to the current demand for sustainable and portable charging options. Users may charge their electronic gadgets while on vacation thanks to the backpack included power bank 10,000–20,000 mAh and flexible, lightweight solar panels. Its UV-protected, water-resistant fabric guarantees sustainability in a variety of settings. Strong acceptability and pleasure with its capabilities are shown by experimental evaluations and user feedback, especially among target users, including students, tourists, and outdoor lovers. Some of the most significant performance outcomes are:

1. Effective charging capabilities: Able to use solar alone to charge cell phones and other small gadgets.
2. Sustainable power storage: A power bank has enough energy stored to charge multiple devices.
3. User satisfaction: Good feedback because of the design beauty, simple use, and environmental advantages.

The Solar Charging Backpack successfully fulfils the growing need for portable, environmentally friendly charging options. In a world where electronic devices are used completely, this product provides a useful substitute for conventional power sources. Combining solar technology into a useful backpack design offers a creative way to address the common issue of dying batteries during outdoor activities, vacation, or journeys.
From an environmental point of view, using renewable solar energy reduces dependency on electricity, which is consistent with worldwide green energy trends.

5. CONCLUSION & RECOMMENDATION

The Solar Charging Backpack is an important development in the introduction of renewable energy technology into everyday products. In without electricity or outdoor environments where conventional power access is not available, it successfully meets the modern need for sustainable, portable charging solutions. The device shows both creativity and environmental responsibility with its ecofriendly materials, simple design, and useful features like flexible solar panels and high-capacity power banks. Response and user testing verify how applicable it is to target audiences, including tourists, students, and outdoor lovers. In addition to satisfying the needs of today busy lives, the Solar Charging Backpack is a multipurpose and environmentally friendly product that encourages increased understanding and use of environmentally friendly innovations in daily life.

i. *Improve the Capabilities for Charging*
   Increase battery capacity and solar panel efficiency to handle more demanding electronic devices and allow quicker charging.
ii. *Establish Innovative Technology*
   For actual time battery and charging status monitoring, include features like integrated indicators or mobile app access.
iii. *Increase Environmentally Friendly Branding*
   To draw in eco aware customers, highlight in your marketing the usage of recycled materials and sustainable production techniques.
iv. *Improve Market Reach*
   To increase awareness and trust, establish partnerships with digital stores, outdoor equipment manufacturers, and educational institutions.

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