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# PORTABLE SOLAR POWERED BACKPACK

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*Abstract :* One popular motto in electrical engineering today is "going green." This project will convert the sun's energy into reusable energy. The purpose of this senior project is to develop a solar powered backpack that can charge certain portable USB devices for students. Many students walk around campus with an iPod or cell phone, which has surely died or ran low on batteries at least once when needed most. This backpack will allow students to charge their devices "on the go." When students walk or bike around campus, the solar panels attached to the backpack will allow recharging of their portable USB devices, while using a more "green" form of energy.

*IndexTerms* - **solar power, portable backpack, solar bag, renewable energy**

## I. INTRODUCTION

This senior project idea came to us when we joined the Power & Energy Society (PES). PES offered us an opportunity to install solar panels for low-income families in order to reduce their electricity bill. This was done through PES with the support of Grid Alternatives, an organization which PES members volunteered with. This was the event that led us to decide that a solar powered backpack would not only offer an alternative greener solution to charging USB devices, but also come in handy when students are in need of a USB battery recharger whileon campus. Society is looking for more environmental friendly ways to gather energy; so using renewable energy such as solar panels is becoming more and more popular. With the use of solar panels, the sun's energy can be easily collected and reused. Students and eventually consumers alike would love the idea of charging a USB device on the go. It can be seen everywhere that people need to recharge their batteries, whether they are on campus, in the library, ata coffee shop, biking, hiking, backpacking, traveling or evenat airports. Just about everyone these days has some kind ofelectronic portable device, all of which can be chargedthrough a USB port. Almost any type of portable device thatcharges via USB port can be charged using the solar powered backpack project. campus, especially at sunny CalPoly San Luis Obispo and eventually all consumers with portable USB devices aimed to provide environmentally safe energy without spending a cent of electricity through the use of solar panels harvesting energy from the sun.

## II. LITERATURE SURVEY

Most of the travelers tend to buy multiple facilities in a singledevice. The travelers always face common problems. To discuss those problems many researchers have been conductedresearches on the smart backpack in the past few years. Smartluggage is any bag or suitcase that contains high-tech capabilities such as traveler's electrical devices charging, GPStracking, Electronic Locks, app-enabled controls, Bluetooth connectivity, Wi-Fi connectivity and Electronic scales [7]. The main role of our project is to develop a smart back for travelers to give solutions like safety and location tracking. According to A. Sutar, T. Kocharekar, P. Mestry, P. Sawant desai, Mrs. S. S. Goilkar's research on Smart Bag with Theft Prevention and Real-Time Tracking, they have only describedthe security on the backpack. They have used GPS, GSM andBluetooth modules with a fingerprint sensor. GSM and GPS modules have used to track the backpack and they have used the Arduino Uno board as the brain of the Smart Bag. Tracking coordinates stores in the Arduino board Lookup Tables. Fingerprint and pin patterns were the security method in the backpack and the proximity had been detected by Bluetooth via a mobile application connection [8]. The research which isdone by the Department of Electronics and Communications Technology, University of Science and Technology ofSouthern Philippines on "Design and Implementation of 4-In-1 Luggage Bag" has a biometric lock, location tracking and a luggage kick scooter with a build-in emergency power bank. This research was done for travelers to be reliable whiletravelling or during any occasion that uses luggage bags. The biometric lock was a fingerprint scanning system and used a GPS tracking system with the use of a Arduino Uno board [9].The research that was done by S. Shaikh and M. D. Jakhete was on Smart Travelling Bag Using IoT. The functions they discussed in the research are giving a power resource for the traveler, location tracking via RFID and digitally lock the bagby an RF signal. The research was done by a Raspberry Pie 3

board which is costs about US $164 [10]. According to V. O. Matthews, E. Noma-Osaghae, S. U. Idiake, A. O moseye the bag they produce under A Solar Powered Smart Travelling Bag with An Embedded Video/Audio Player research, they have considered about the relaxing time of the traveler. The waiting time for a flight at the airport, bus station or a subwaytransporting time can be used as a relaxing time. They have used technology which uses electromagnetic fields to automatically identify and track tags attached to objects while reducing error rates as well as human labour of the company. RFID is a low power consuming technology so they have made a re-usable RFID system on bags [12]. According to Shweta M, Tanvi P, Poonam S, Nilashree M theSmart Bag integrated with RF-ID reader, emergency button topress and a buzzer starts while sending the location via SMS. They have used ATmegal6 Microcontroller as the brain of theresearch outcome. Also, that bag has a rechargeable power source through solar panels [15].

## III.EXISTING SOLUTION

Solar backpacks typically consist of a conventional backpack equipped with solar panels integrated into the design. These panels capture sunlight and convert it into electrical energy, which is then stored in an internal batteryor used to directly charge electronic devices. the existing system in a solar backpack is designed to provide users witha convenient way to harness solar energy for charging theirelectronic devices while on the go, making them particularly useful for outdoor activities, travel, or emergencies.

## IV. SYSTEM ARCHITECTURE

Solar architecture is an architectural approach that takesin account the sun to harness clean and renewable solarpower. It is related to the fields of optics, thermic, electronics and materials science. Both active and passive solar housing skills are involved in solar architecture. The prototype was composed of 12 solar cells Velcroed onto a backpack that charges up two 2.7 V ultracapacitors. Then, when the ultracapacitors are fully charged, a switch is flicked, and then the phone is charged. The solar bag is a kind of bag that absorbs sunlight through solar panels and converts light energy into electric energy, which is stored in the storage battery. Commonly known as solar backpacks and solar charging bags.

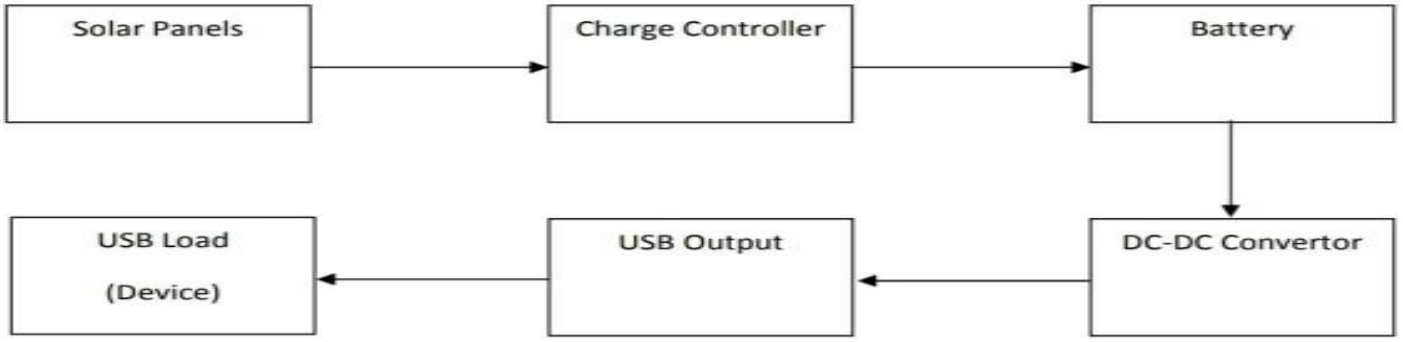
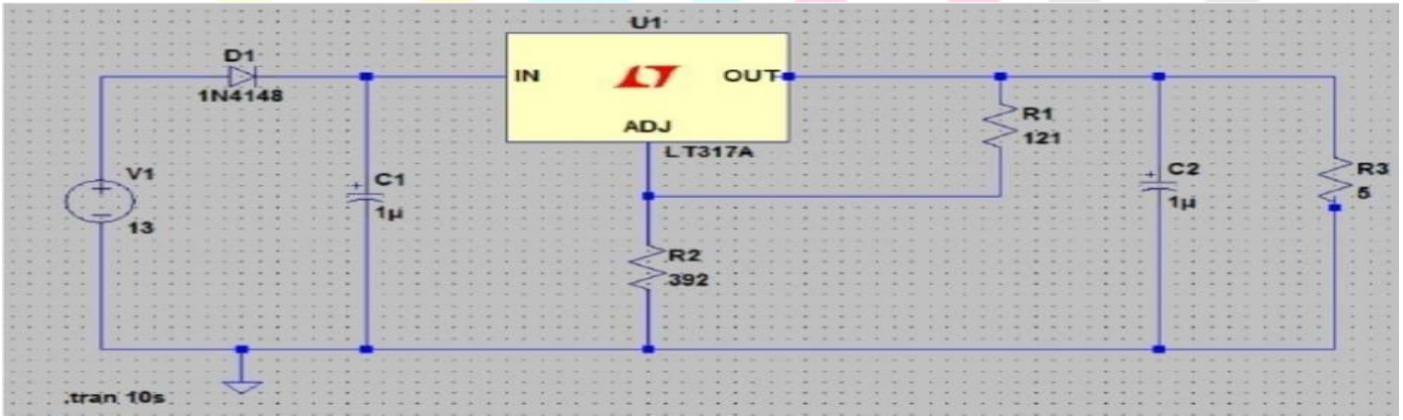



Fig 1.1 System Architecture Diagram

## SIMULATION



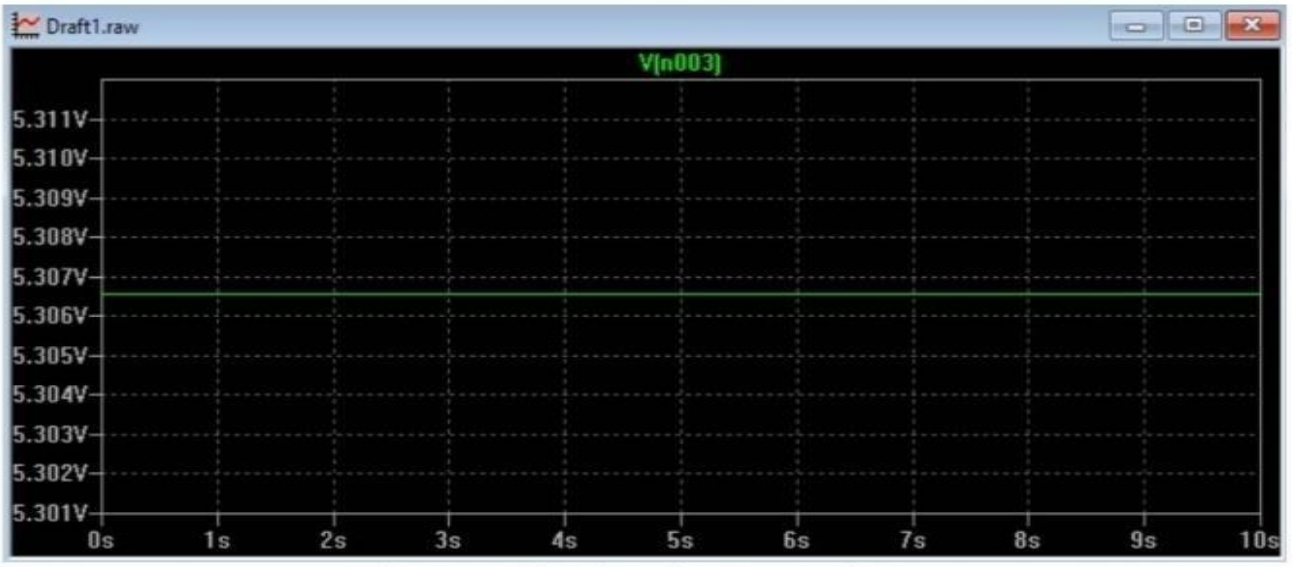



Fig 1.2 SIMULATION

## V. COMPONENTS REQUIRED

- SOLAR PANELS
- CHARGE CONTROLLER
- BATTERY
- DC-DC CONVERTOR
- USB OUTPUT
- VOLTAGE SENSOR
- LCD DISPLAY
- LED LIGHT
- ARDUINO

## VI. HARDWARE

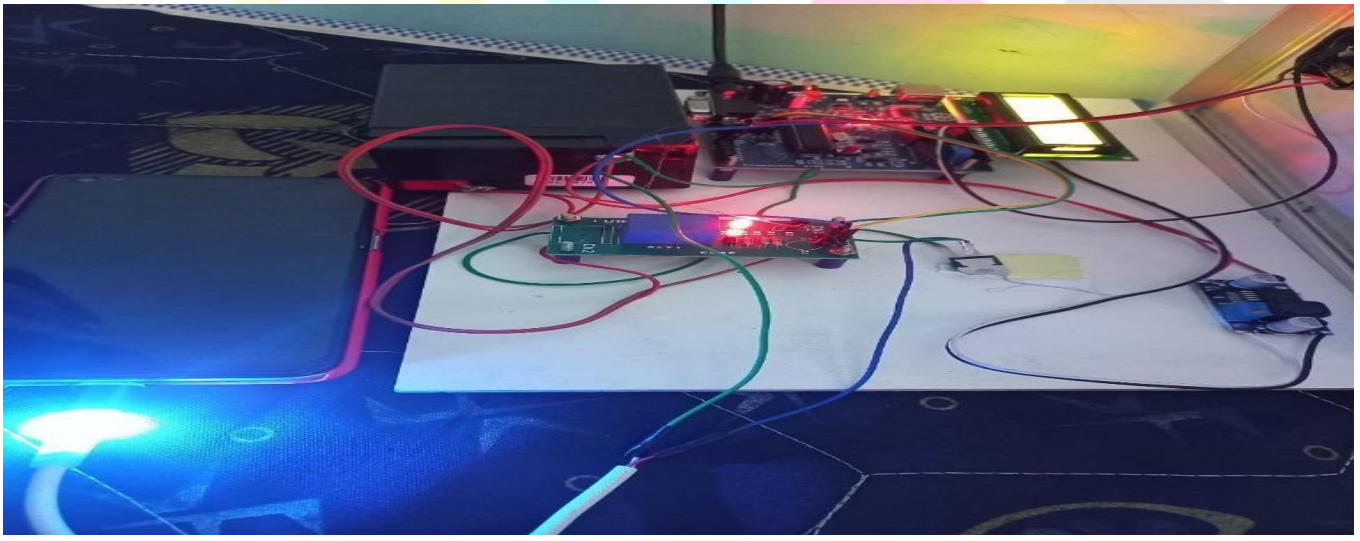


Fig 1.3.3 Hardware picture

## METHODOLOGY

Next-generation of backpacks are the smartbackpacks. This smart backpack has special features such as measuring the air quality around the traveler,a power bank that charges by a solar panel,identifying the real-time health status of the traveler,and identify the security level of the bag. All these features are integrated into the backpack and can be tracked using a mobile application and web application. All the data collected by the backpack isuploaded to the cloud and using algorithms those dataare converted to useful information and presented to the user.

## VII. CONCLUSION

The main three objectives of this research are to provide a new backpack design, provide traveler's health status, and inform about traveler's security. It also addresses the following specific objectives; itassures the safety of the backpack from theft, facilitates tracking the location which benefits the user and gives the traveler an undying power resource. The mobile app which is published to the users, can take updates about health and security features. The mobile application supports both Android and IOS users. The smart backpack has been fully designed, implemented, and tested using world standard testing methods practically to use it to the world. From the given accelerometerdata, the Al provides more than 75% expected results and analyzing four air quality sensor data, the air pollution detection system also provides around 78% accurate outputs. The traveler's health status measuring system also provides 76% expected results.

## VIII. FUTURE SCOPE

In the future, we can make the solar panels weatherproof so the backpack can be used in any season, instead of having to detach the solar panels when it is raining. In addition, the design can be altered to charge laptops instead of only USB devices. Another useful improvement can be to add a detector to know when the battery is fullycharged. It can also be useful to find out why the current increased at 90% shaded, when the voltage dropped, according to the data in Table.

2. Lastly, it can be helpful to place the solar panels in a better position so they do not need to be detached when unzipping the backpack, whilestill generating the max current possible. The major challenges that require further development are effective andefficient power management, weather conditions like thunderstorms and winds, Increasing the security level ofthe bag and minimizing the bag building cost. As another future work of our research, we will be focusing on expanding the security features with the help of various machine learning algorithms and neural networks. Also, different technologies are going to be addressed the SIM card signal issue, most of the travelers face inside the jungle. To add more components for thebackpack the system can add an audio documentary system to collect logs of the traveler and store in cloud space.

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