Solar-Tracking Phone Charger

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Abstract: This project uses solar energy from the light, then stores it and finally converts it into electric energy. The electric energy is used to charge any electronics. In our project solar panels absorb the energy and temperature sensors detect the temperature and change the direction of the solar panel to follow the direction of the light. Thus, temperature sensor plays an important role in our project. Then the electricity stores in the capacitor and go into the electronics by wire. In the introduction, the main steps of the project are provided, similarly, the purpose and importance of project are shown. In the discussion section, the details of coding, solidwork drawing and actual work are examined. The experimental setup lists the materials that are used in the project and show how the process is carried out to achieve the goals.

1 INTRODUCTION ON THE PROJECT CONCEPT

The increasing functionality and performance of mobile phones increases the demand for a power recharging and storage technology that can allow phone batteries to last longer and to be recharged more practically. The device that we made in our project provides a way of recharging and storing power for mobile phones that satisfies this increasing need. Our device is a portable external battery (also known as power bank) that contains embedded solar panels, which allow it to be recharged using solar energy. The battery can orient itself to face towards the light source that yields the highest energy. Due to its capacity of being recharge mobile phones and thus is very helpful when traveling long distance. Furthermore, its capability of being recharged by solar energy allows the mobile phone to be moved around while it is being charged, provided that the solar panels are exposed to enough light or some power remains in the batteries, unlike the charging process using electrical energy. If light is not available, the device can be recharged using a conventional power socket. The device is composed of components that are compatible with the Arduino hardware and soft ware; its casing is 3D printed.

2 EXPERIMENTAL SET UP

2.1 Design and drawing

Firstly, all parts needed were ordered online, after the parts were picked up, it's necessary to measure the dimension of parts in order to design the shape, electrical part and mechanical part by drawing by hand. Then the solidworks is needed to setup the 3D shape, all dimensions should suit the real parts.

2.2 Mechanical of solar tracker

Tracker is a dual axis tracker, meaning it tracks in both X -axis and Y-axis. To put it into even more simple terms, it goes left, right, up, and down. This means once the tracker was set up nothing need to change or adjust, since anywhere the sun moves the tracker will follow. This also impresses people at parties because a flashlight can be tracked around. This method gives the best results for power generation.

2.3 Assemble of parts

To start out the Servos are attached to their mounts

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Open up the bag the Servo came in. There will be three screws. Two pointy wood screws with large heads, and one small machine screw. Place the single machine screw to the side, we won't be using it now.

Pick up the large round wooden piece without an arrow on it. The Servo is mounted on the bottom of the piece.

Line the servo up with the screw holes, and then carefully use the two Servo screws to secure it in place. Once in place give it a little tug to make sure it's secure. Find the second wooden Servo mount. We'll be doing the same thing here with our second Servo. Mount it on the "back" of the mount with the two screws it came with.

Grab the very base plate, the four legs, and the large round piece that now has a Servo attached to it. You'll also need 8 of the 6-32 Screws and 8 nuts.

First attach the four legs to the round servo holder. The Servo needs to be inside all the legs, between the the base plate and the round servo holder. Don't tighten the screws all the way, leave them a bit loose.

Now fit the four legs into the base plate. Make sure that when you do this the servo wire is positioned so that it's coming out towards the back where all our electronics will be.

Once all our legs are screwed into the base plate go back and tighten the four screws that attach the legs to the round servo holder.

Lastly, put the four rubber feet on the bottom of the base plate so that the screw heads don't scratch up your work surface.

At this time you can also put together the LED display holder. The LED display just fits between the two wooden holders and is secured by two screws and nuts.

Grab the large solar array face. It's the one that says "Solar Cell Here" on it. We'll also need the two triangle wings, the small rounded corner square piece, and the two small sensor divider pieces. To connect it all we'll need six 6-32 Screws and nuts.

Put the face plate on the table in front of you so that you can read the words. Attach the triangle wing piece with the servo arm on the right side, and the other triangle wing piece onto the left side. We want the plastic servo arm to be facing the inside.

Use four screws and nuts to hold that together.

Now use the three remaining pieces to build the sensor divider. Rounded square first, then the tall skinny piece, and finally the longer piece with the two screw T slots. Once it's all together use two screws and nuts to secure it.

Servos move in 180 degrees. The Servo knows where "zero" degree is and where "180" degree is. Since we don't want or need full 180 degree range on our servos we want to set our "zero" degree to some very specific locations.

Start with the Base plate Servo. Without using the little screws push the Servo Arm that’s attached to the Center into the servo. This may take a little effort, so you may wish to brace the

servo with your other hand. Once together, slowly rotate the Center counter clockwise until there servo stops. This is "zero" degrees on the Servo.

The relationship between battery voltage and capacity is shown in Figure 1.

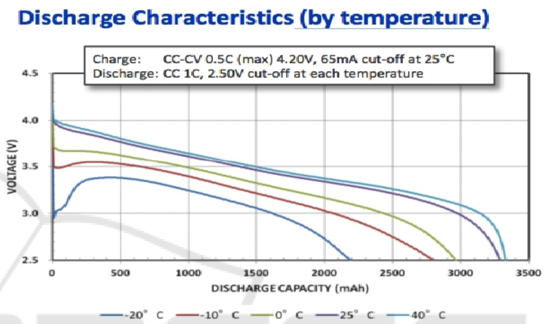

Figure 1: Voltage vs. Discharge capacity.

2.4 Assemble of Sensors

Take Connectors. Snip off the ends of the wires and then strip the wires.

Grab four Light Sensitive Resistors. The legs are way too long. Remove 2/3rds of their legs.Push one Light Sensitive Resistor into each of the four Connectors. The should go in easily.Thread one Female JST Connector through each of the four holes around the Sensor Divider.

Now have 8 wires handing down through the Top around the Sensor Divider.

A diagram of the full circuit with the battery indicators is shown in Figure 2.

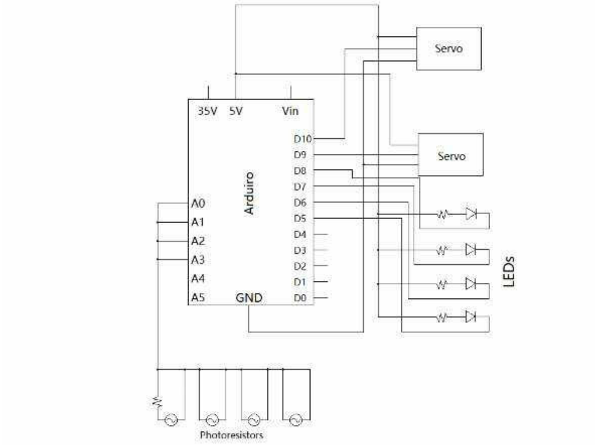

Figure 2:The full circuit with the battery indicators.

3 MATERIALS

Breadboard, Photoresistors, Ardunino, Jumper, Servo Motor, Resistor (10k ohm), Tactile Switch, Diode,LED,Voltage regulator switch,Porttermind Block 2x5,Porttermind Block 2x4,
Cable Wraps,Screws.

4 RESULTS

The theoretical output voltage of the circuit to the USB boost converters, which powers the Arduino board and the phone, is 5V. The battery capacity is 3400mAh.

The tracking system is very sensitive as it is capable of responding to small changes in angle of light in high speed.

The functionality of the device makes it useful when one is travelling long distances, or to places where access to the power socket is limited. The device can also double as both a house ornament and renewable power supply. It can also be useful for outdoor events, such as an outdoor party.

The values of the voltages of the battery at its corresponding power remaining in the battery used for the coding of the battery indicator may be very slightly inaccurate. These values changes as the temperature of the battery changes, and in the code only the values at temperature of 25 degrees is used.

Table 1: Table of results

	Length of Time Needed to Fully Charge a Running Samsung Galaxy S5 with 73% Battery (minutes)	
	DU Battery Saver	Battery Doctor (Battery Saver)
Charging circuit	35	40
Power socket	35	40
Laptop	40	61

5 SOLIDWORK DRAWING

The Solidwork Drawing is shown in Figure 3.

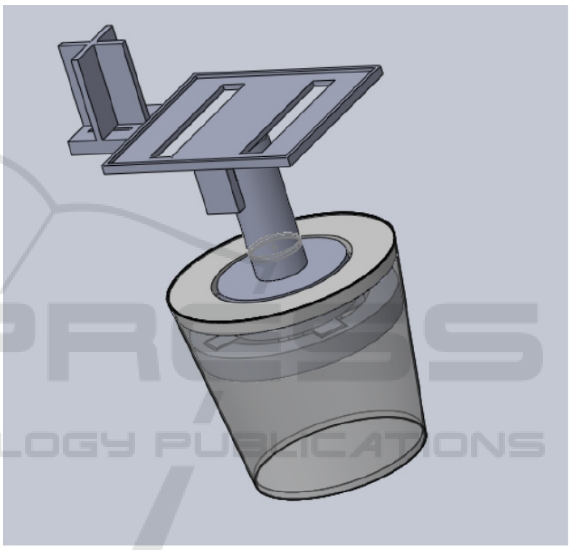

Figure 3: a sample design of solidworks.

6 DISCUSSION

The solar tracking system is able to rotate 180 degrees horizontally and vertically and its effectiveness in tracking the light is limited to this. The solar tracking system will not be able to follow the light after it reaches its maximum.

The speed of the charging circuit in charging the cell phone, according to two phone battery saving applications; the DU Battery Saver and Battery Doctor (Batter Saver), is as fast as the power socket, and faster than charging by connecting the phone to the laptop. According to DU Battery Saver, when the phone battery is at 73%, charging the phone using the power socket, the charging circuit and the by connecting it to the laptop takes 35 minutes, 35 minutes and 40 minutes, respectively. According to Battery Doctor (Battery Saver), it takes 40 minutes, 40 minutes and 61 minutes to charge the phone using the power socket, the charging circuit and the by connecting it to the laptop, respectively, when the phone battery is at 73%.

7 CONCLUSION AND FUTURE APPLICATION

One of the most important features of this project is that it is able to track the source of energy. It incorporates a solar tracking system that is able to turn 360 degrees in both vertical and horizontal direction. This helps to get a great amount of solar energy. The solar energy is converted to chemical energy and stored in the battery. In this project not only can charge the electronics but also can indicate the remaining amount of the battery. This prevent to overcharging the electronics thus protect the electronics. In the future study, improvement of the shape can be made to increase the efficiency of the converting process.

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