Zero Energy Home Project

EDSGN 100

Section: 8

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Abstract

Team Avenger's goal was to develop a durable alternative to charging electronics in the field. We went about doing this by meeting regularly with the group and developing a detailed project plan to execute. First, each team member researched their own renewable energy source. After coming up with that, we collaborated to develop a product that incorporated each person's idea. Zach Biddle researched a flexible solar panel; Zack Beitz looked into hand cranks and mechanical energy, while Shealyn Williamson designed a sturdy stand-alone solar array. The team then came together and brainstormed ideas to utilize everyone's design into one final product. The result of this was a backpack that seamlessly contained all three designs. As a team, we drafted 3D models of the renewable energy sources that we envisioned. Finally, we combined our initial research and created a comprehensive report on our product.

Introduction

Every year hikers wonder off beaten paths only to find themselves lost and with a dead phone battery. Extended search and rescues can also leave rescuers with depleting batteries. Left in the wilderness, these individuals have no way of charging their devices to reach help. The Harris RF Company has been the leader in telecommunication devices and has derived an initiative to avoid these catastrophes. This Initiative is challenging student engineers to develop a functional solution. The

solution must entail a mobile device that is cost efficient, reliable, uses two renewable energy sources, and can be used in isolated areas.

Mission Statement

Our mission is to develop a durable alternative to charging electronics in the field with minimal maintenance that offers a variety of energy options. The product will be lightweight and easy to transport.

Customer Needs Analysis

Customer Needs	Mission Statement
I want a rugged charger	The charger will be durable.
I want it to charge in remote areas	The charger will use renewable energy sources.
I want it to be easy to use.	The charger will require minimum maintenance.
I want it to be light-weight	The charger will be easy to transport.
I want it to have a convenient charging time	The charger will have a realistic charge time.
I want it to be compact	The charger will be small or collapsible.
I want multiple charging options.	The charger will use solar and mechanical power.

Our surveys revealed two primary needs that must be satisfied in order for the Harris Project to be a success. First the charger needs to be something that someone can use in a remote area where there is no access to a source of electricity. Second, the charger needs to be small and compact so it is easy to carry, use, and store. Some additional needs included the charger being durable and provided a charge time comparable to a typical wall charger. In order to meet our customer needs we need to make a charger that is durable, renewable, and easy to use and transport.

Preliminary Research

HIKING BACKPACK:

$77.98

8045DLX-BK Color: Black Features: -Snap buckle secured main compartment.-Zippered side pockets.-Ruggedized bottom.-Front bungee organizer.-Side compression straps.-Adjustable waist strap and key ring. Construction: -Constructed of 600 denier polyester. Dimensions: -Dimensions: 28" H x 12.5" W x 8.5" D. - 10-8

NATURE POWER FOLDING SOLAR PANEL:

$121.99

The Nature Power 18 Watt folding solar panel folds down to a super compact, lightweight package about the size of a book, giving you the freedom to bring environmentally-friendly power just about anywhere. Features easy plug-and-play connections. Includes 8 Amp Charge Controller. I year limited warranty.

25in.L x 15in.W x 0.2in.H full size/6in.L x 6.7in.W x 2in.H folded size/Charges up to 1 Amp per hour/2.25lbs/Charges 12V batteries through the included battery clamp connection using only the power of the sun/Can also be used to charge Nature Power Solar Home Power Kit 400 or 800 (Item#s 24323 or 24324)/Includes tips to charge a laptop directly from the solar panel/Water-resistant design is ideal for marine use or any outdoor applications/O-ring hangers/Velcro closure/Built-in pouch to hold wire and/or charge controller

Customer Review: "Excellent solar panel .Comes with a charge controller. I use it to charge my 12 volt batteries. Works well in all types of light. Would recommend this to anyone who needs a portable solar set up."

SOLIO CLASSIC2:

$100

Battery Pack + Solar Charger

Connections

Charge-In: Micro-USB

Charge-Out: USB

Power:

Max Wattage: 5 Watts

Discharge Rate: Fixed 5V, 1,000mA

Charge Rate: 5-5.5V 450mAh

via Wall: 6 hours 15 min

via USB: 6 hours 15 min

via Solar: 8-10 hours

Battery:3.7V/3,200mAh Li-Poly - User replaceable at end of life (average 3 years)

Play Time:

1 full CLASSIC2 battery provides the following power:

15 hours of Talk Time or 675 hours Standby Time based on iPhone 4

15 hours of Talk Time or 616 hours Standby Time based on Motorola Droid

11 hours of Talk Time or 3103 hours of Standby Time based on HTC EVO

137 hours of music or 24 hours of video based on iPod Touch 4th Gen

8 hours of operation based on Garmin Nuvi 850

Weight/Dims:5.8in x 2.8in. x 1.4in - 10.1 oz.

Comes with:Micro-USB to USB Cable - For charging the CLASSIC2 via USB port/USB port wall adapter, can also be used as a charging cord for Micro-USB devices.

Pencil - Insert the pencil through the center of the CLASSIC2 to easily prop towards the sun.

$59.95

Simply wind the hand crank and you'll generate all the power you need to recharge all your electronics, gadgets and more. Get up to 10 watts of electricity at 120 volts from the K-Tor Pocket Socket, a hand crank generator built for reliability and mobility.

- Portable Hand Crank Generator with up to 10 Watts of Power
- Easy-to-Use Design - large crank arm has an easy-to-grip knob that makes generating electricity a snap
- Dual Compatibility - can be used with both American and European plugs
- Portable Design - weighs less than a pound and is the size of a water bottle
- Generates electricity for flashlights, mobile phones, radios, cameras,

rechargeable lights and other critical devices

*****ALL PATENTED BY MANUFACTURERS!!*****

Concept Generation

Metric #	Need #'s	Metric	Imp	Units
1	1,3	Water Proof	3	lbs/ft^3
2	2,7	Hand Crank (10 Watts)	4	Watt
3	2,7	Solar Panel (18 Watts)	4	Watt
4	4,6	Transportable Design	5	lbs *and* ft
5	5	Capacitors	2	Watt
6	1	Flame Resistent	1	K
7	1	Shock Resistent	3	N

Metric	Water Proof	Hand Crank (10Watts)	Solar Panel (18Watts)	Transportable Design	Capacitors	Flame Resistent	Shock Resistent
Need							
The charger will be durable.	x					x	x
The charger will use renewable energy sources.		x	x				
The charger will require minimum maintenance.	x						
The charger will be easy to transport.				x			
The charger will have a realistic charge time.					x		
The charger will be small or collapsible.				x			
The charger will use solar and mechanical power.		x	x				

Concept generation began with brainstorming metrics that satisfied the customer needs and could be measured. These metrics were then listed in a graph along with their units, value of importance, and the specific needs that they satisfied. Then another graph was created to better visualize what requirements the product must meet. This graph showed the needs versus the metrics and each metric that satisfied a need was given an x in the box corresponding to that specific need.

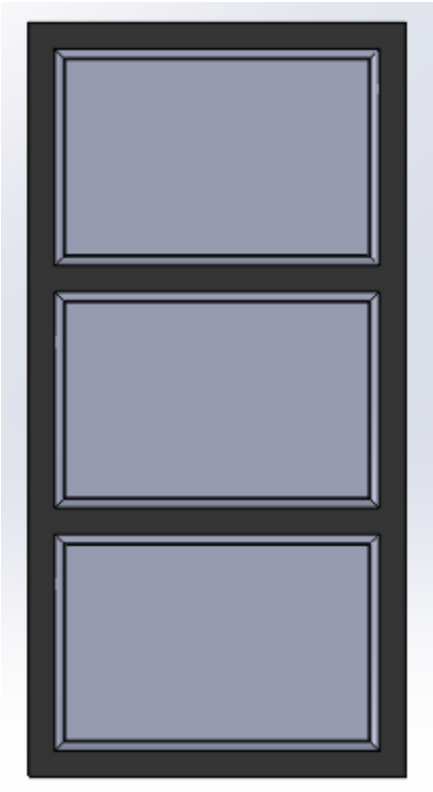
Concept Selection

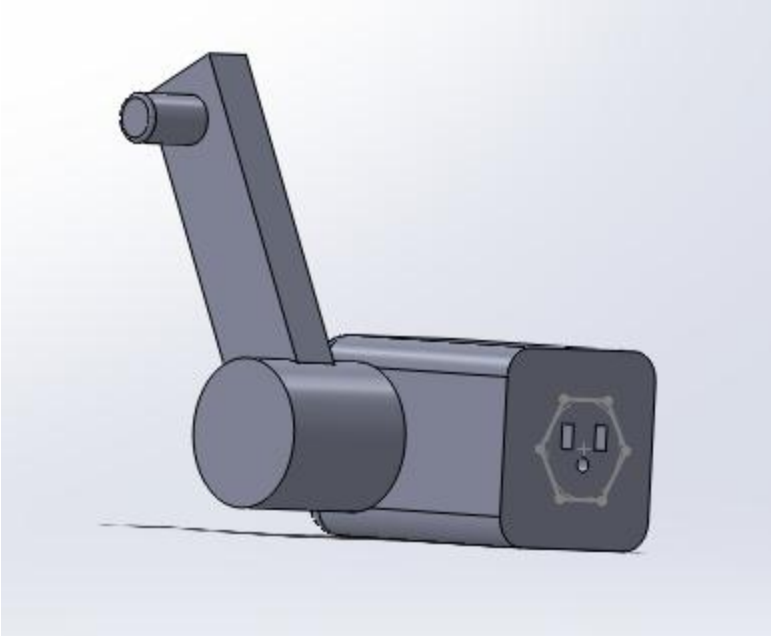
What/How	Solar Sheet	**Hand Crank**	**Solio Classic 2**	Suitcase Design	**Hiker Backpack**	HY MINI	Solar Panel Tablet	Importance	**Importance Weighting**
The charger will be durable.	7	**9**	**8**	7	**9**	5	7	3	0.6
The charger will use renewable energy sources.	9	**9**	**9**	9	**9**	9	9	5	1.0
The charger will require minimum maintenance.	8	**8**	**8**	7	**7**	9	8	4	0.8
The charger will be easy to transport.	6	**7**	**9**	4	**8**	9	8	4	0.8
The charger will have a realistic charge time.	9	**9**	**5**	9	**9**	4	6	3	0.6
The charger will be small or collapsible.	6	**7**	**7**	3	**5**	7	7	2	0.4
The charger will use solar and mechanical power.	9	**9**	**9**	9	**9**	8	9	5	1.0
Total	54	**58**	**55**	48	**56**	51	54		
Weighted Total	41.2	**43.6**	**42.2**	37.6	**42.8**	39.6	41.4		
Use?	No	**Yes**	**Yes**	No	**Yes**	No	No		

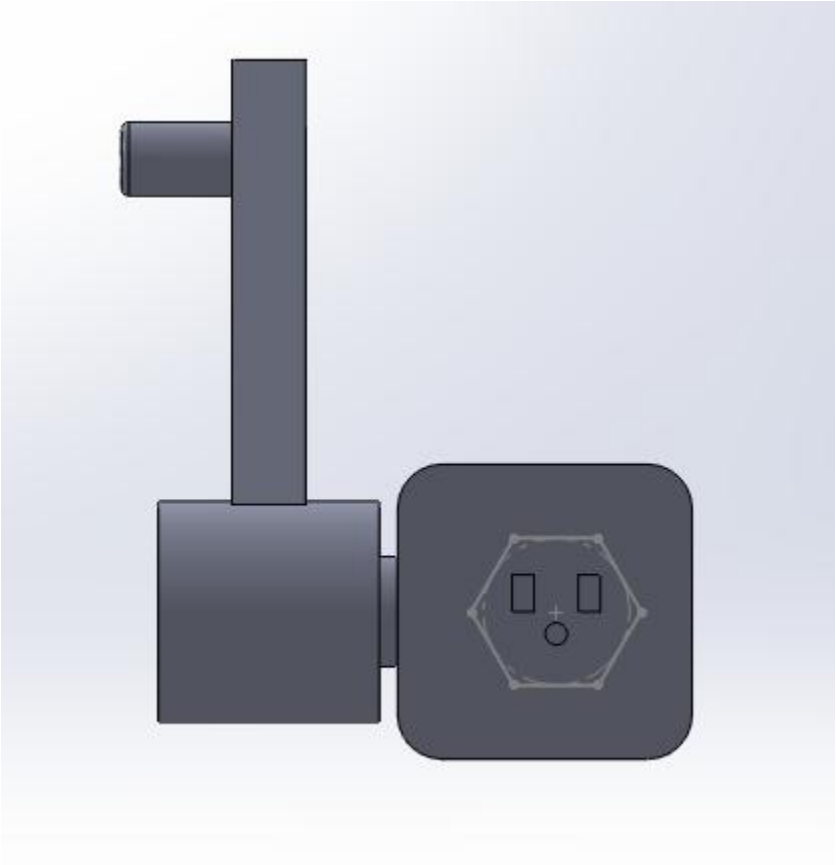
Using the Concept Generation graphs the team developed several concepts to be considered for the final product. Each of these products was placed in a graph versus the needs and given a value for how well it satisfied each specific need. The needs were then given an importance weighting based upon how important they were to

the final product. Each value for each need was then multiplied by its weighted value and the columns for each concept were added up. The three columns with the highest sums were chosen to be used in the final product.

Design Sketches







Conclusion

Several conclusions were reached during the process of creating and designing a product for the Harris Project. Mainly teamwork is essential for any group to succeed. Without teamwork each step is harder to achieve and only creates a greater divide amongst the team. Working together helps the group form stronger bonds and improves the quality of the final product. After researching possible ideas for the product it was obvious that solar power and mechanical energy were the two most reliable and plausible solutions to charging a device in a remote area. The device also needed to hold up in arduous environments and be easy to use. We decided the best way to charge a device was to keep it fully charged at all times so you didn't have to wait on it to charge. In order to do this we incorporated our three products into a backpack with the solar energy doing the constant charging and the hand crank used as a backup for when solar energy isn't a viable option.

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