Harris Project -

EDSGN 100: Section 16

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Team 5: Terrible Trio + 1

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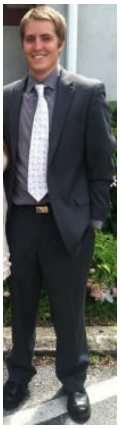

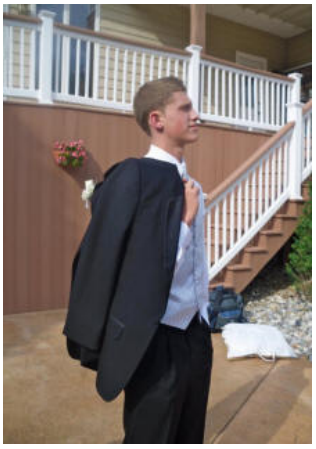

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Abstract

In our modern-day society that is becoming ever more focused on electronics and making them accessible everywhere, it is necessary to create ways to charge these devices, without always having a wall outlet. The project that was brought forward to us by the Harris Corporation was to create a product, using two forms of alternative energy that could power a cell phone, or a similar device, for a specific situation.

Mission Statement

The Terrific Trio + 1 aims to create an innovative product that will harness unique energy sources. We will work as a team to design a new product with some of the most abundant energy sources available to someone in a desert. Not only will this product create energy from alternative sources, but will also potentially save lives.

Introduction

Our report encompasses the steps our team took to turn our research and brainstorming into a concept creation of our "Use Case". The "Use Case" that the Terrific Trio + 1 chose was to develop a charging system using multiple forms of alternative energy, that could power a phone in the desert for one day. As this project is a real-life situation, it provides a valuable situation that explains the engineering process.

Use Case

- Create a device that uses two forms of alternative energy that can power a BlackBerry Torch.
- The device will operate in a desert, providing enough electricity for an entire day.
- Our specific device will provide clean drinking water, as a result of our process, making it a perfect fit for the desert environment.

Preliminary Research

Solar – The most common and simplest energy source. Bright and warm sun rays are almost everywhere, so it is not a problem to get them. Solar panels should face sun light at different angles to get energy from these rays.

http://iblog.net.ua/2010/04/05/zaryadka-akkumulyatora-10-alternativ-obychnomu-zaryadnomu-ustrojstvu/

Wind – The second most abundant energy source and it is fairly cheap as well. Wind turbines are used to generate electro-energy.

http://www.geek.com/articles/mobile/charge-your-iphone-with-wind-power-2010129/

Hand crank – By turning the crank, the coils move around the magnet, and convert energy used to spin the coil into electrical energy. So it converts mechanical energy to electrical energy

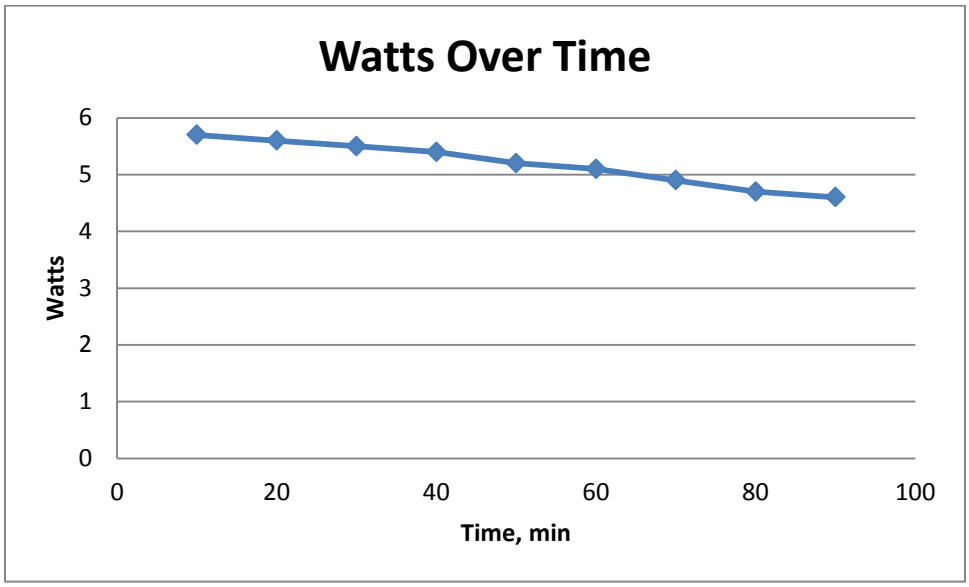
http://iblog.net.ua/2010/04/05/zaryadka-akkumulyatora-10-alternativ-obychnomu-zaryadnomu-ustrojstvu/

Body Heat (37 degrees Fahrenheit put off by human body) – In theory, a resting male can put out between 100 and 120 watts. 80% of body power is given off as excess heat.

Bike power – "A typical bike generator can produce 100 watts. By pedaling for an hour a day, 30 days a month, that's 3 kWh"-

Hydrogen Fuel cell – Hydrogen is the simplest element, it has only one proton and one electron. Hydrogen is rich in energy. Fuel cells convert the energy produced by a chemical reaction into

electric power. The fuel cell will produce electricity as long as hydrogen is supplied. NASA has used liquid hydrogen since 1970s to propel space shuttle. Hydrogen fuel cells power the shuttle's electrical systems, producing clean byproduct pure water, which the crew drinks.



Through our preliminary tests and research, we estimate that we need a device that can consistently provide at a minimum of 5 Watts of Power in order to power our Blackberry Device.

Needs-Metrics-Matrix

Needs-Metrics Matrix	Solar Panel (5 W)	Wind Turbine (30 W)	BioFuel Cell (charge 1270 mAh)	Small Compact Size (no bigger than 1 square foot)	Micro USB Port	Produces 10 Watts per hour	Robust Materials (Aluminum and Steel)	All Processes are Internal	Product Costs (Approx.) $25 Dollars To Produce	LCD of Energy Production
The charger runs on an alternative energy source.	x	x	x							
The charger functions for only one device.					x					
The energy is dependent on the function of the device.						x				
The device is versatile.	x	x	x	x			x			
The device fulfills the "Use Case."	x	x	x	x	x	x	x			
The device uses two forms of alternative energy.	x	x	x							
The device considers safety.							x	x		
The device is fiscally responsible.									x	
The device is environmentally friendly.	x	x	x							
The device went through multiple concepts.	x	x	x							
The device was compared to other devices on the market.	x	x	x							
The device provides information about its energy consumption and charging requirements						x				x

Customer Need	Importance (0-5)
The charger functions for only one device.	3
The energy is dependent on the function of the device.	3
The device is versatile.	4
The device fulfills the "Use Case."	5
The device uses two forms of alternative energy.	5
The device considers safety.	4
The device is fiscally responsible.	3
The device is environmentally friendly.	4
The device went through multiple concepts.	3
The device was compared to other devices on the market.	3
The device provides information about its energy consumption and charging requirements.	4

- The main focus between the Needs-Metrics-Matrix and the importance of the needs reverts back to the “Use Case”. Three of the metrics, the Solar Panel, Microbial Fuel Cell, and Robust materials all are catered to the “Use Case”. Finally, the two highlighted Needs were determined to be the most important because they deal with key components of the “Use Case”.

Concept Selection

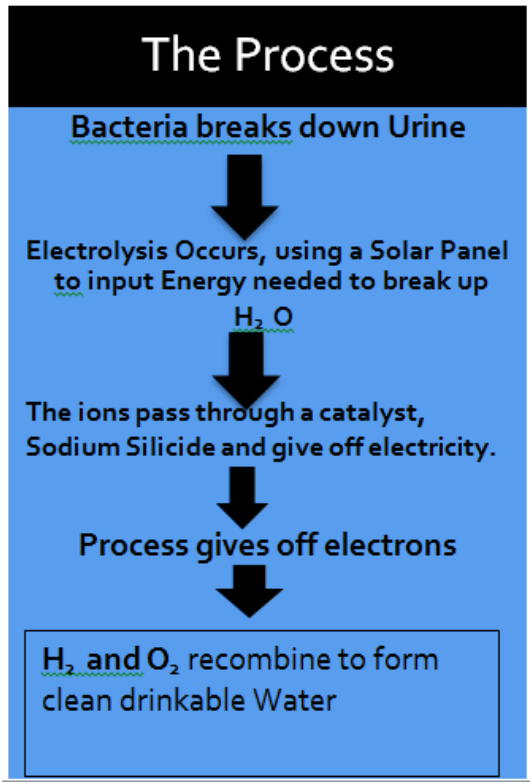
Concepts					
Selection Criteria	A Microbial Fuel Cell	B Solar Power	C Mechanical Power	D Magnetic Power	E Wind Power
Solar Panel (6V)	+	+	0	-	0
Wind Turbine (30W)	0	0	0	-	+
BioFuel Cell (1270 mAh)	+	+	0	0	0
Small Compact Size (1 ft^2)	0	-	0	+	0
Micro USB Port	+	+	0	+	+
Produces 10 W	+	0	0	0	0
Robust Materials (Aluminum and Steel)	+	-	0	+	-
All processes internal	-	+	0	+	-
Costs $25	+	-	0	-	-
LCD of Energy Production	0	0	0	0	0
Sum +'s	6	4	0	4	2
Sum 0's	3	3	10	3	5
Sum –'s	1	3	0	3	3
Net Score	5	1	0	1	-1
Rank	1	2	3	2	4
Continue	Combine	Combine	Yes	No	Combine

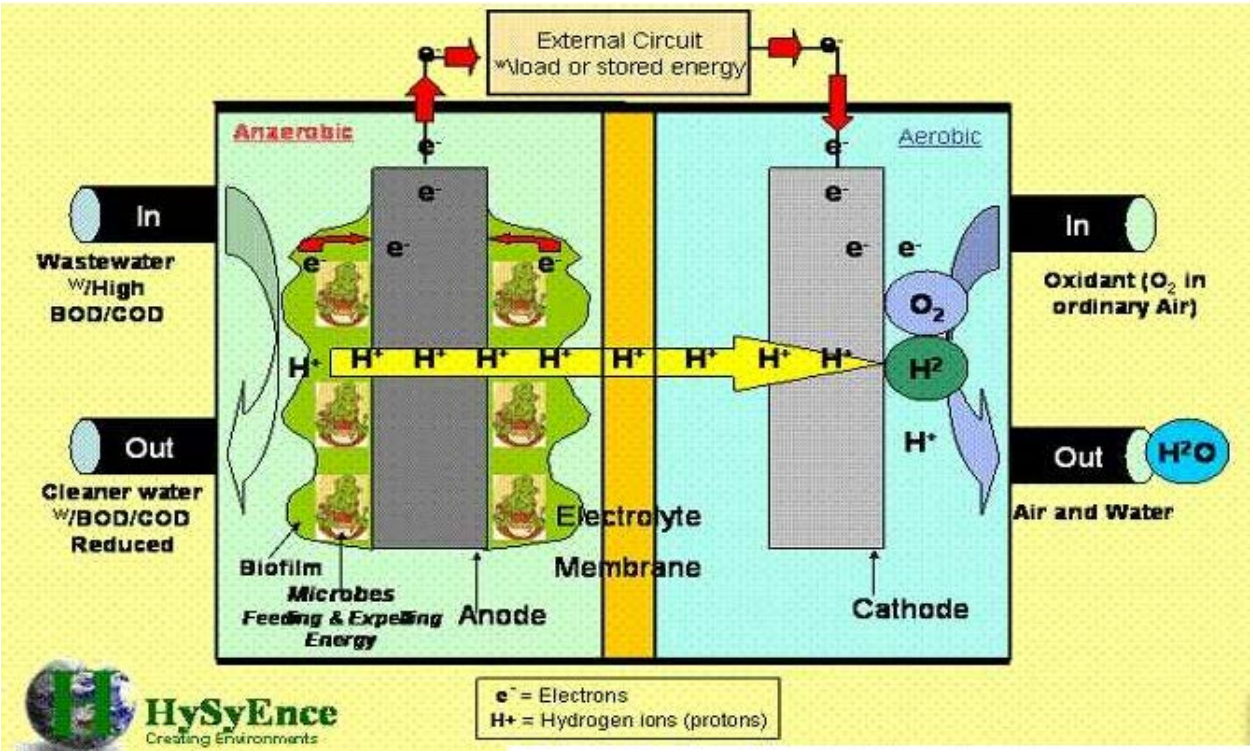
- After the initial Concept Selection, we noticed that we could narrow our choices down, and combine a number of the energy sources in order to create the best all-around design.

		A Microbial Fuel Cell & Solar		**BE Solar and Wind**		**C Mechanical (Reference)**		**D Magnetic**	
Selection Criteria	**Weight**	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Solar Panel (6 V)	**5%**	4	0.2	5	0.25	3	0.15	0	0
Wind Turbine (30 W)	**5%**	0	0	5	0.25	3	0.15	0	0
BioFuel Cell (1270 mAh)	**5%**	5	0.25	0	0	3	0.15	0	0
Small Compact Size (1 ft^2)	**20%**	4	0.8	2	0.4	3	0.6	5	1
Micro USB Port	**10%**	3	0.3	3	0.3	3	0.3	3	0.3
Produces 10 W	**15%**	4	0.6	4	0.6	3	0.45	2	0.3
Robust Materials (Al & Steel)	**5%**	3	0.15	2		3	0.15	5	0.25
All processes internal	**5%**	4	0.2	2	0.1	3	0.15	4	0.2
Costs (X) $	**5%**	2	0.1	1	.05	3	0.15	3	0.15
Screen for Communication	**5%**	3	0.15	3	0.15	3	0.15	3	0.15
	Score	2.75		2.1		2.4		2.35	
	Rank	1		4		3		2	
	Continue	Develop		No		No		No	

- After combining concepts, we were able to score our concepts and in the end, the Microbial Fuel Cell and Solar concept scored the highest and was chosen.

Microbial Fuel Cell





http://blog.cafefoundation.org/?attachment_id=6308

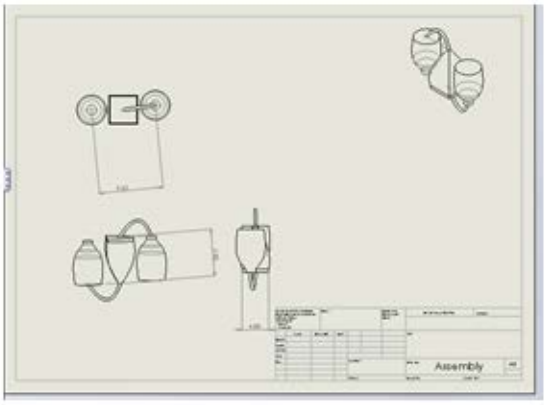
Existing Technology

- Two pieces of technology exist that allowed us to develop our product: the PowerTrekk and Sewage Treatment advances.

http://nextgenlog.blogspot.com/2011_02_01_archive.html
http://cleantechnica.com/2010/01/08/sewage-gets-the-solar-treatment-from-sunpower-corp/

- The PowerTrekk uses a similar Fuel Cell technology, the main difference being that only clean water can be used in the PowerTrekk. This piece of technology produces around 5 W of power and uses the same catalyst, Sodium Silicide, to produce the electricity.
- The Sewage Treatment technology that allows us to gain clean drinkable water from urine comes from technology being used in China and Singapore. In these areas, they have developed the bacteria and process necessary to take sewage, treat it, gain small amount of electricity, and then output 100% clean drinkable water.

Final Design



- 5-10 W of Power
- No bigger than 1 ft^2
- Cost less than $100
- Can be linked together with more fuel cells.
- 100% clean

Final Description

When the Terrible Trio + 1 set out to create our Final Product for the Harris Corporation, we told ourselves that we did not want to be conventional and create anything that would be considered basic. We noticed that almost everything that could be thought of had already been an existing product, until we heard of the MicroBial Fuel Cell technology. The technology may have already existed, but the application of charging a small cellular device in the atmosphere that was described in our “Use Case” was unprecedented. We estimate that the device will provide us we 5-10 W of Power that will enable a phone to charge for up to 10 hours of talk time, however, this is just the power gained for each time the Fuel Cell is given input of urine. The Fuel Cell in 100% renewable and it can be refilled as often as possible to supply limitless charging ability.

Conclusion

When the Harris Project was initially brought to our attention, all of our team all had one reaction, we have to do what? The thought of having to design a product based on specific customer needs and specifications was something we understood that engineers had to do, but we found it slightly intimidating that we would have to do this with such little engineering

experience. After everything was completed, the team can definitely agree that this Harris Project will be remembered throughout our entire careers as our first project as engineers. The entire Engineering Process was entirely up to us as a group to work through every problem that arose in order to create a suitable product. We can say confidently that all of us will move forward to our goal of becoming World-Class Engineers, knowing that we have a true foundation and understanding of what is expected of us as engineers.

References

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