

## Senior Design I: Group 7

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# Stand-alone Solar Entertainment



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### Overview

The Stand-alone Solar Entertainment System is a self powering all in one system made for seamless entertainment in a variety of ways. By implementing solar panels direct power can be provided to the system or stored for later use allowing users to worry little about charging or preparing the device. Dynamic power consumption will optimize the battery life, and use less energy. Wireless streaming will allow anyone to hear crisp clean sound from the embedded speakers at any time. LED lighting can create a broad spectrum of moods and ambiances with custom settings, colors, or reactive lighting to the music. A cooling station ensures all guests are refreshed, by using the power of the sun to rapidly cool drinks. All features are controlled with a mobile app boasting an ergonomic design and an intuitive layout. Lightweight, self powering, easy to use, and fun, the Stand-alone Solar Entertainment System will not only change entertainment, it will mobilize it.



## Goals

- Provide easy, intuitive, communication between user and device
- Ensure LEDs create an ambiance around the device
- Deliver clear sound for both high and low tones
- Supply cooling stations for varying sizes of beverages.
- Optimize power consumption so device can be powered solely by solar energy, if needs be
- Alternative 120V AC power supply in situation where solar energy is unavailable
- Deliver a portable design for easy transportation

## Specifications

1. **Power:** Boasting standalone, green, efficient, and dynamic capabilities
  - a. Solar Panel
  - b. Dynamic Power Saving
  - c. Power Consumption:
    - i. Cooling: < 200 W
    - ii. Audio: < 150 W
    - iii. LED: < 80 W
    - iv. Wireless Communication: < 2 W
    - v. Electronics Consumption:< 25 W
    - vi. Charging Station: < 30 W

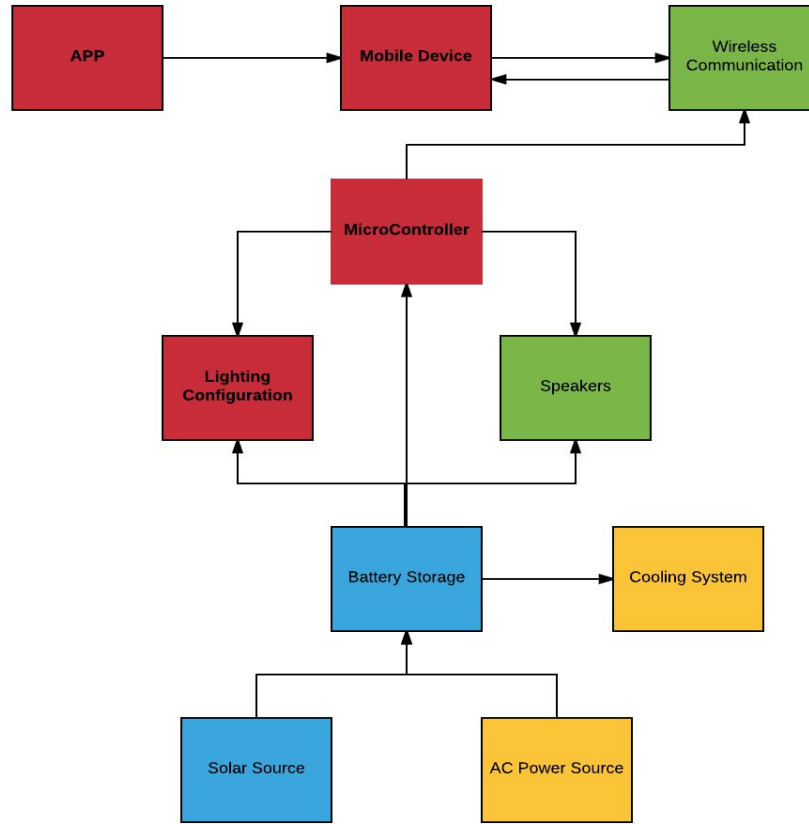


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- d. Battery Life (On full charge): >3 hours
2. **Functionality:** Features provided by the device
    - a. Subwoofer and Tweeters
    - b. Reactive LED lighting
    - c. Drink Cooling
    - d. Charging Station
    - e. Storage Space
    - f. Safety Switch
  3. **Communication:** Fast, ergonomic, intuitive
    - a. Wireless communication
    - b. Wired input
    - c. Mobile Application Interface
    - d. On/off Switches
    - e. Power Statistics Feedback
  4. **Physical:** Mechanical specification of the device
    - a. Size: no bigger than 20 x 35 x 22 inches
    - b. Weight: <40 lb
    - c. Weather proofing to protect electronics



# Block Diagram



Legend	
Dan	—
Hugh	—
Mark	—
Devin	—





## Milestones

Task	Start	End	Weeks	Group Member
<b>Preliminary Reports and Research</b>				
Preliminary Research	5/27/16	6/3/16	1	All Members
Initial Proposal	5/27/16	6/3/16	1	All Members
Initial Draft	6/3/16	7/7/16	5	All Members
Final Document	7/7/16	8/2/16	3.5	All Members
<b>Individual Research</b>				
Speaker	6/3/16	6/17/16	2	Hugh
Cooling System	6/3/16	6/17/16	2	Devin
Wireless communication	6/3/16	6/17/16	2	Hugh and Dan
Application	6/3/16	6/17/16	2	Mark
Power	6/3/16	6/17/16	2	Dan and Devin
Microcontroller	6/3/16	6/17/16	2	Mark
Light Configuration	6/3/16	6/17/16	2	Mark
Table of Contents	6/22/16	7/6/16	2	All Members
<b>Design</b>				
Initial designs	6/17/16	7/8/16	4	All Members
Order and Test Parts	7/8/16	8/2/16	3.5	All Members
<b>SENIOR DESIGN II</b>				
Build Initial Prototype	8/22/16	10/10/16	7	All members



Test and Redesign(if necessary)	10/10/16	10/31/16	3	All members
Finalize Prototype	10/31/16	11/14/16	2	All Members
Final Report	TBD	TBD		All Members
Final Presentation	TBD	TBD		All Members

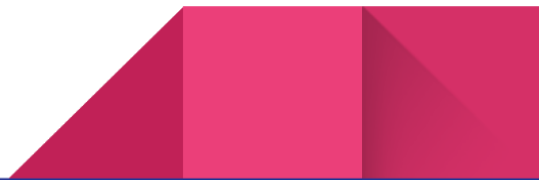
## Estimated Costs

Quantity	Item	Estimated Cost
1	Solar Panel	\$300
2	High Capacity Lithium Ion Batteries	\$250
2	Voltage Regulation Components	\$50
1	Wireless Modules	\$50
1	Electrical Components	\$100
1	PCBs	\$350
1	Cooler	\$20
1	Structuring Components: Wood, Screws...	\$25
5	LED Strips	\$125
2	Microcontrollers	\$60
5	Thermoelectric Peltier Plates	\$40
2	Speakers	\$40
	<b>Total Estimated Costs</b>	<b>\$1,410</b>



## Engineering marketing trade-off matrix

		T	Output	Efficiency	Dimensions	Cost	Cooling
		H	Power	$\eta$			
		D					
		-	+	+	-	-	-
1) Sound Quality	+	↑ ↑	↓		↓ ↓	↓ ↓	
2) High Power	+	↓	↑ ↑	↑	↓ ↓	↓	↓ ↓
3) Portability	+		↓		↑	↓	↓
4) Cost	-	↓ ↓	↓	↓	↓	↑ ↑	↓ ↓
5) Ease of Use	+				↑	↑	





## Marketing Specifications

Marketing Requirements	Engineering Requirements	Justification
1,2,4	Total harmonic distortion should be $< 0.1\%$	Class A,B, and AB amplifiers are able to obtain this level of THD
1,2,4	Should be able to sustain output power that averages $\geq 100$ watts with a peak value of $\geq 150$ watts	Power range provides more than adequate sound
2, 4	Efficiency ( $\eta$ ) $> 40\%$	Achievable with several different classes of amplifiers
2,3	Should be able to adequately cool drinks placed in compartment	Peltier plate technology adequately able to cool
1-5	Dimensions should not exceed 20" x 35 " x 22 "	No bigger than a cooler, able to be placed outside near pool or taken to the beach for entertainment

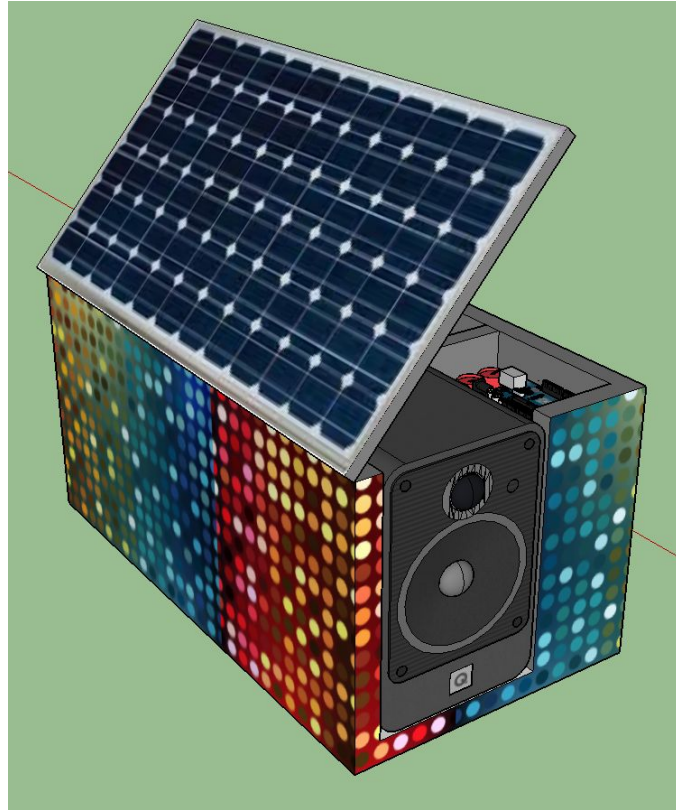




### Marketing Requirements

- 1.) Excellent sound quality
- 2.) High output power
- 3.) Portable
- 4.) Low Cost
- 5.) Easy to use

### Simulated Design





## Conclusion

The Stand-alone Solar Entertainment System is a revolutionary device redefining all-in-one entertainment. The product will boast many technologies integrated into one compact device with a focus on 4 domains, power, functionalities, communication, and size. The power consumption needs to be intelligent if the device is to run off solar power or even battery storage, so that there is no waste in energy. The functionality should be diverse to provide many features to truly incorporate the term "all-in-one." Communication techniques for both wireless and button interfaces allow easy accessible customizations to be made for a personal experience. Small size that provides portability and convenience for quick trips or established events. Combining all these features in one smart product is what causes the Stand-alone Solar Entertainment System to be the focal point of entertainment.

