Senior Design 1

Initial Project and Group Identification Document

Solar Sculpture with Display and Telemetry

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Project sponsored by: Orlando Utilities Commission

Group 10	
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Project Narrative

The intent of this project is to design and implement a solar sculpture for the OUC/UCF partnership contest. Our project will consist of the design of the full-scale sculpture, its internal circuits, and its interactive features, and the execution of this design in a small scale. Our sculpture will have three main components: the photovoltaics circuit that will harvest solar energy and measure the output, the mobile app that will serve as a user interface, and the visual display mounted in the sculpture that will display messages from the app users.

Motivation:

In the midst of the environmental degeneration of our planet, the need for clean energy becomes more and more evident. Solar energy derived from photovoltaics is a solid alternative to conventional forms of energy because it is cost competitive and it does not damage the atmosphere. However, people have shown some uneasiness when it comes to integrating solar panels into their buildings. Hence, we are very motivated to prove that photovoltaics can be incorporated into structures without making them any less appealing. An interactive solar sculpture placed in a location widely accessed by members of the community is an enormous opportunity to teach them about the benefits of clean renewable energy and to encourage the practice of switching to this type of energy sources in the Orlando area.

Figure 1 - Example of solar sculpture in Sydney, Au

Goals and Objectives:

- To work in collaboration with teams from the Mechanical Engineering department, the Art department and professionals from the Orlando Utilities Commission to develop a solar sculpture concept.
- To build a 1/8th scale working model of our concept with a small-scale version of the circuit and prototypes of its interactive features.

Function of the project:

The sculpture will serve as an interactive community exhibit. It will harvest solar energy and transform it into electricity, which we will later use to power the sculpture and its features. Its user interface, a mobile app, will serve the purpose of providing a visual display of the estimated solar energy production in an understandable way for people without any engineering knowledge. In addition, it will allow users to interact with the sculpture by letting them enter a message in the

"tweet" format (120 characters of less) that will be displayed in the screen incorporated in the structure.

Specifications

- **Design**
  - Power
    - Produce a minimum of 850 kWh/year
    - Grid Connected
  - Size
    - 2' to 8' in diameter
    - 5' to 15' tall
  - Location
    - In front of the Orlando City Soccer Stadium
  - User Interface
    - Display Energy Production
    - Display Inverter Efficiencies
    - Relay the information in a way consumers with little to no engineering background can understand
- **Final Deliverable**
  - A 1/8th Scale Model

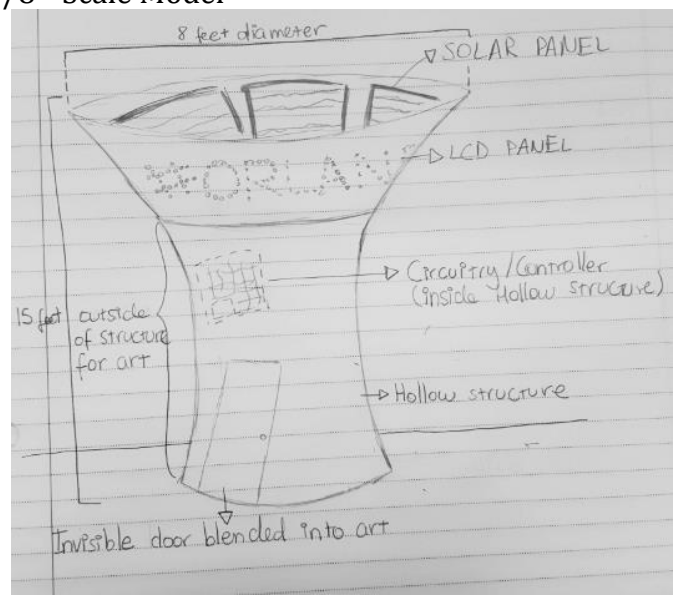

Figure 2 - Initial Project Drawing

House of Quality

			Engineering Requirements				
			Energy production efficiency	Power Output	Power Consumption	Dimensions	Cost
			+	+	+	−	−
Marketing Requirements	Aesthetics	+	↓	↓	↓		↓
	Power Output	+	↑	↑↑		↓	↓
	Ease of use	+	↓				↓
	Cost	−	↓	↓	↓	↓	↑↑
	Engineering Goals		At least 80% effciency	At least 50W	Under 25W	No larger then 8' diameter and 15' tall	Prototype should cost no more than $1000

Table 1 - House of Quality

Hardware Block Diagram

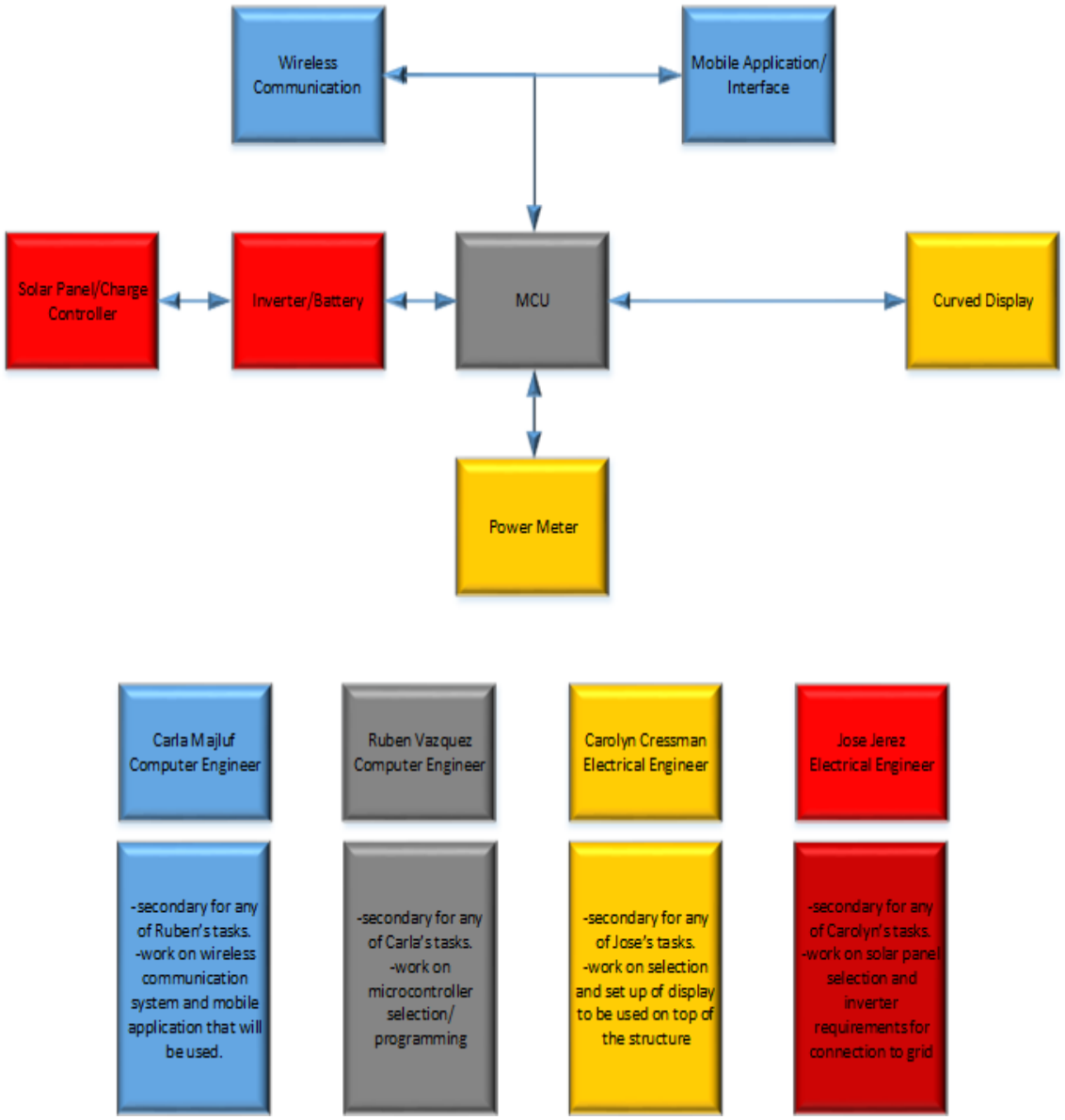

Diagram 1 - Hardware

Software Block Diagram

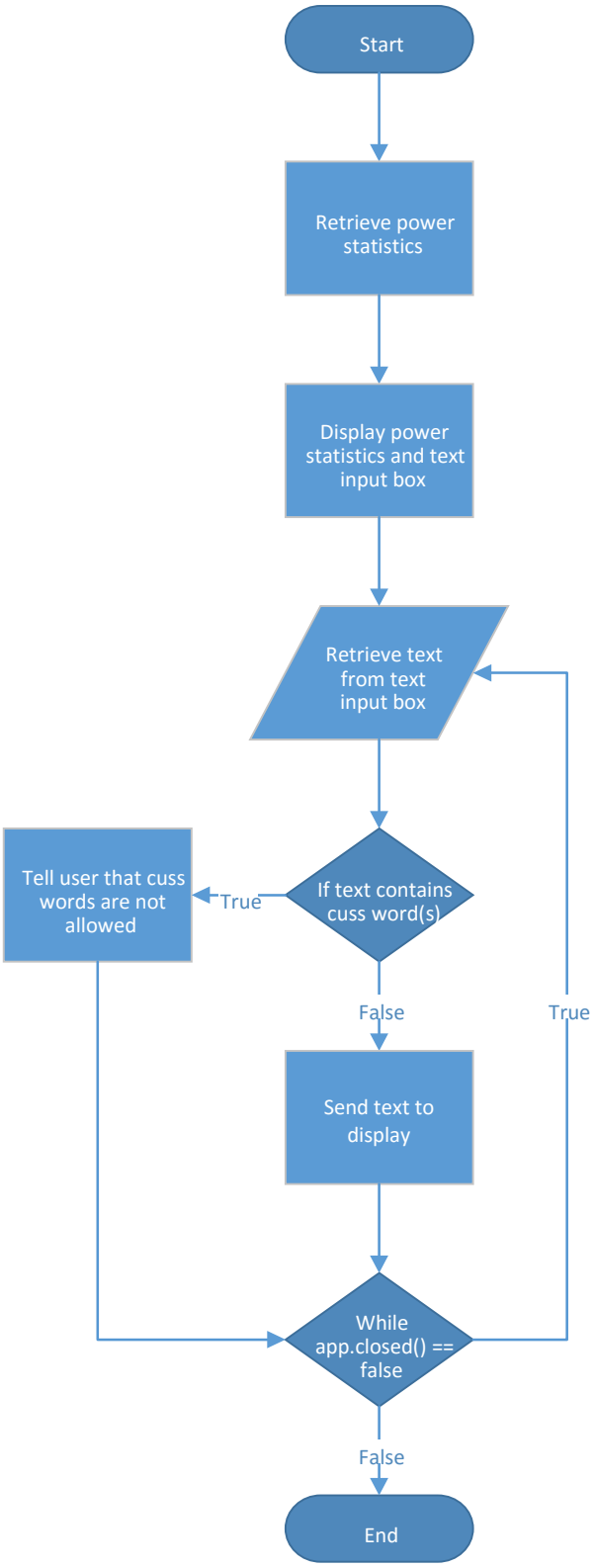

Diagram 2 - Software

Estimated Budget

Initial Estimated Budget for Full Scale Design		
Total Est. Budget		$30,000
Est. Electrical Budget		$10,000
Est. Mechanical Budget		$10,000
Est. Art Budget		$10,000

Item	Est. Price/Unit	Est. Quantity	Est. Total Cost	Responsible Party
Solar Panels	$400	4	**$1,600**	**Electrical**
Inverter	$1,500	1	**$1,500**	**Electrical**
Displays	$200	10	**$2,000**	**Electrical**
Cables for Display			**$500**	**Electrical**
Microcontroller	$200	1	**$200**	**Electrical**
PCB	$200	1	**$200**	**Electrical**
Power Meter	$300	1	**$300**	**Electrical**
Wireless Communication	$200	1	**$200**	**Electrical**
Display Mounts	$60	10	$600	Mechanical
Materials for Structure				Mechanical
Materials for Art				Art
Total Est. Electrical Cost			**$6,500**	

Table 2 - Full Scale Project Budget

Initial Estimated Budget for 1/8 Scale Design				
Item	**Est. Price/Unit**	**Est. Quantity**	**Est. Total Cost**	**Responsible Party**
Solar Panels	$400	1	**$400**	**Electrical**
Inverter	$150	1	**$100**	**Electrical**
Displays	$40	4	**$160**	**Electrical**
Cables for Display			**$100**	**Electrical**
Microcontroller	$200	1	**$50**	**Electrical**
PCB	$200	1	**$50**	**Electrical**
Power Meter	$300	1	**$100**	**Electrical**
Wireless Communication	$200	1	**$40**	**Electrical**
Display Mounts				Mechanical
Materials for Structure				Mechanical
Materials for Art				Art
Total Est. Electrical Cost			**$1000.00**	

Table 3 - 1/8th Scale Project Budget

Milestones

Week	Task	Date Completed
Senior Design 1		
1	Project Idea and form groups	
2	Role assignments	
3	Initial Project Documentation	
4	Meet with Art and ME Teams	
5	PCB and App design research	
6	PCB and App design research	
7	Schematics	
8	Microcontroller	
9	PCB Layout	
10	PCB Breadboard prototyping	
11	Table of Contents	
12	Draft of Senior Design Document	
13	Order Parts	
14	Database design	
15	Final Senior Design Document	
16	Test Parts	
Senior Design 2		
1	Build Prototype	
2	Build Prototype	
3	Build Prototype	
4	Build Prototype	
5	Testing and Redesign	
6	Testing and Redesign	
7	Testing and Redesign	
8	Testing and Redesign	
9	Finalize prototype	
10	Finalize prototype	
11	Finalize prototype	
12	Finalize prototype	
13	Peer Presentation	
14	Final Report	
15	Final Report	
16	Final Representation	

Table 4 - Milestones