Solar Tracking
Design Needs and Goals

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Overview

- Introduction
  - -Background on Solar
  - -Client Information
- Needs Statement
- Problem Definition
- Goals
- Objective
- Constraints
- Conclusions

Introduction

- Photovoltaic cells operate at maximum efficiency when pointed directly at the sun. But, solar tracking can be expensive and require a lot of maintenance.

Who What and Why?

- Dr. Thomas Acker
  - Professor of Mechanical Engineering at Northern Arizona University.
  - Worked at the National Renewable Energy Laboratory (03-04)
  - Director of Sustainable Energy Solutions (SES).
  - Gained NAU over $25 Million in research grants.
- Why?
  - Collect more energy for storage.
  - To teach about renewable energies.

Photo courtesy of AZ Daily Sun

Background

- Photoelectric effect.
- Photovoltaic Cells turn sunlight into electricity.
- Trackers are used to direct the cells at the most efficient angle.
- Type of trackers.
- Tracking methods.

Photo courtesy of Maps.Google.com

Nau’s Renewable Energy

Need Statement

"Photovoltaic Cells are not productive when not pointed directly at the sun."

Definition of Problem

Because PV cells get the most energy from facing the sun, a stationary solar panel collects less sunlight to produce energy than one that follows the sun across the sky.

Project Goal

“Design a system that maximizes the amount of sun being absorbed by a solar panel, as well as display power output.”

Objectives

- Track the sun across the sky with a 5° elliptical error margin.
- Reliable, little maintenance.
- Ability to be manually rotated through the full daylight ecliptic.
- Display power output of each photovoltaic cell.

Operating Environment

- 5 ° error margin applies to daylight hours.
- Tracking works from -20 ° to 100 ° Fahrenheit.
- Output display should work even when automatically tracking.
- Tracking should continue under two feet of snow buildup.

Constraints

- Total cost of the system should be under $2000.
- Full system should fit under the footprint of the PV cells.

Constraints (cont.)

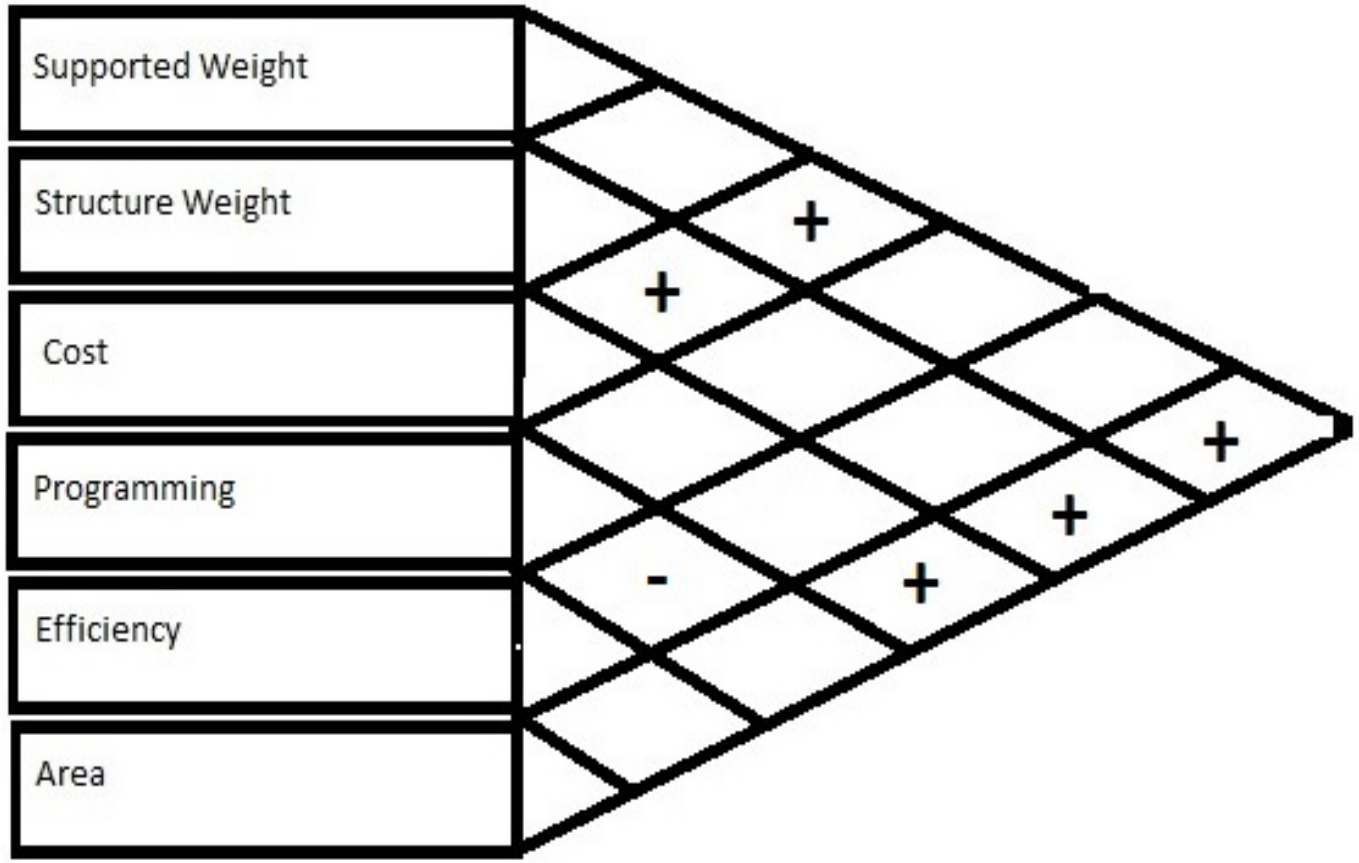
Environmental- Specific to Flagstaff, AZ

- Be able to handle upwards of 65 Mph winds.
- Zero damage from snow or hail.
- Operate with up to 2ft of snow resting on top.
- Ability to operate from -20°F to 100°F.
- No visible oxidation after 10 years.

Quality Function Deployment

		Engineering Requirements					
		Supported Weight	Structure Weight	Cost	Programming	Efficiency	Area
Customer Requirements	1. Tracking	•	•	•	•	•	
	2. Manual Override			•	•		
	3. Inexpensive	•		•		•	•
	4. Display			•	•		
	5. Weather Resistant	•	•	•			•
	Units	lbs.	lbs	$	C/C++	%	ft.^2
		100	250	2k	yes/no	95	100
		Engineering Target					

House Of Quality



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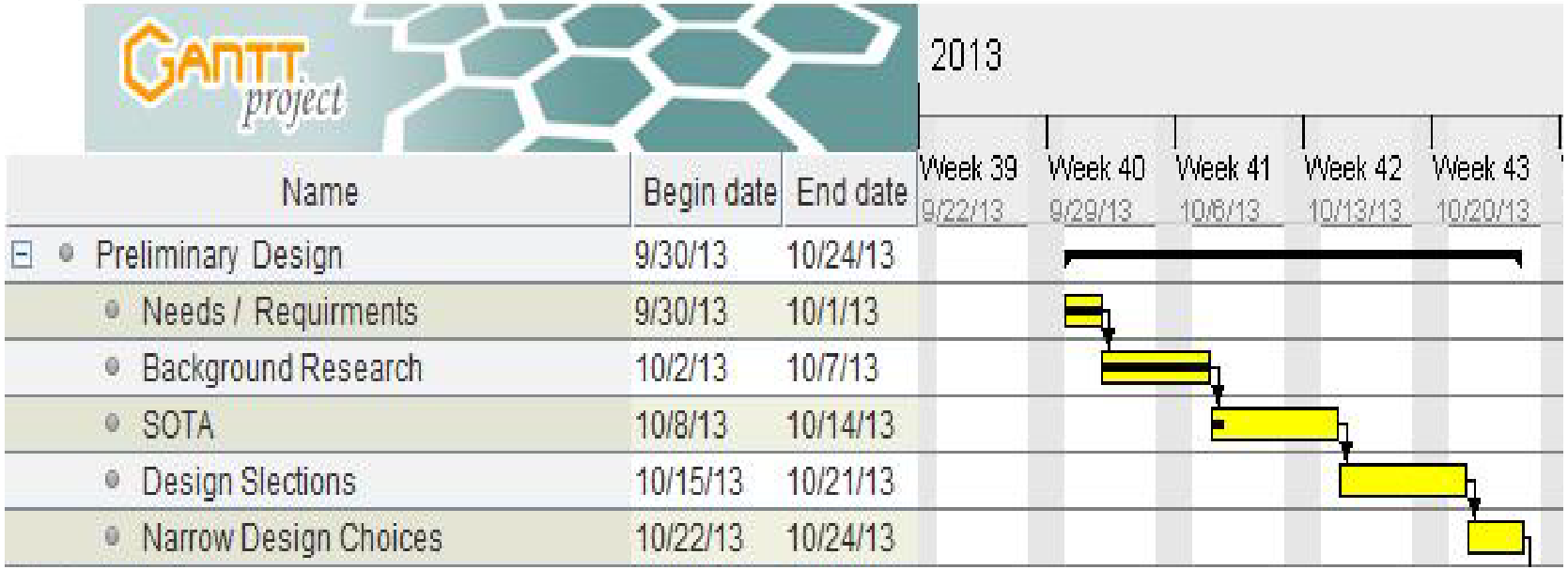

Name	Begin date	End date
Preliminary Design	9/30/13	10/24/13
Needs / Requirments	9/30/13	10/1/13
Background Research	10/2/13	10/7/13
SOTA	10/8/13	10/14/13
Design Slections	10/15/13	10/21/13
Narrow Design Choices	10/22/13	10/24/13

Recap:

Client

Background on Solar

Needs and goals

Requirements and constraints

Quality function deployment

Team schedule

Conclusions

Project Goal:

Design a system that maximizes the amount of sun being absorbed by a solar panel, as well as display power output.

Questions?

References

- [1]http://www.pvtech.org/news/germany_breaks_monthly_solar_generation_record_in_july
- [2] http://www.theguardian.com/environment/2012/nov/26/saudi-arabia-solar-strategy
- [3]http://nau.edu/Sustainability-360/Sustainability-Experts/Thomas-Acker/
- [4]http://nau.edu/CEFNS/Centers-Institutes/Sustainable-EnergySolutions/About/