ISES Solar Charging Station

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Needs, Requirements, Project Plan

Document

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Table of Contents

1. INTRODUCTION.....2
2. NEEDS AND GOAL.....2
3. QUALITY FUNCTION DEPLOYMENT.....3
4. HOUSE OF QUALITY.....4
5. PROJECT PLANNING.....4
6. REFERENCE.....6
7. APPENDIX A.....7

INTRODUCTION

The Institute for Sustainable Energy Solutions (ISES) at NAU is a premier research division that works on renewable energy. ISES has in its possession multiple solar photovoltaic modules that can install on a structure and power small electronics such as cell phones and laptops.

The client of this project is Dr. Tom Acker, Professor of Mechanical Engineering at Northern Arizona University. He is a reviewer of ASME Journal of Solar Energy and the director of ISES. His research field includes renewable energy systems, thermal-fluid systems analysis. [1]

NEEDS AND GOAL

Needs: Northern Arizona University currently does not have a place that uses a sustainable, renewable energy source, which students and faculty could use in order to charge small electronic devices.

Goal: The team is to design a solar charging station capable of providing enough power to charge small electronic devices, by using tested solar panels.

Figure 1 shows a possible design of solar charging station coms up by Samuel Monger. It presents an idea of how the station looks like.

Figure 1: Solar Charging Station

QUALITY FUNCTION DEPLOYMENT

Figure 2 shows a Quality Function Deployment (QFD) diagram. The left side of the diagram shows the customer requirements. These are what were determined by discussing the project with those whom came up with the idea for the project along with the project sponsor. The upper portion of the diagram shows the engineering requirements. These are the requirements that seem to be the most important aspects of the project from an engineering aspect. They show what the main points of the project should be. The lower portion of the diagram shows the units and targets for the values of the engineering requirements. The units are what the engineering requirements will be measured and calculated in, and the values are the target values for the engineering requirements. The three that do not have a quantified value are those that do not have adequate information in order to determine a target value that is suitable for the project. The center area shows the relationship between the customer requirements and the engineering requirements. The diagram shows that there is a strong emphasis on cost because the station is to be designed to a small a cost as possible.

		Engineering Requirements					
		Power	Energy	Stress	Cost	Yield Strength	Weight
Customer Requirements	Aesthetically Pleasing				x		
	Educational	x	x		x		
	Withstand Environment	x	x		x		x
	Charge small devices	x	x				
	Safety			x	x	x	x
	Snow removal				x		
	Inexpensive				x		
Units		kW	kWhr	kPa	$	kPa	N
		3	36	x	1000	x	x

Figure 2: QFD diagram

HOUSE OF QUALITY

Figure 3 shows a house of quality. This diagram shows the relationships that exist between the different engineering requirements. The plus signs show a direct correlation between the engineering requirements. The minus signs show an opposite correlation between the engineering requirements. The spaces that do not have any signs in them show that there is no relationship or even a negligible relationship. The diagram shows that there is a direct correlation between power and energy, stress and yield strength, and weight and stress. This means that the higher one parameter becomes, the higher the other parameter becomes. It also shows that there is an opposite correlation between energy and cost. This means that NAU will have to spend less money when there is a higher energy output.

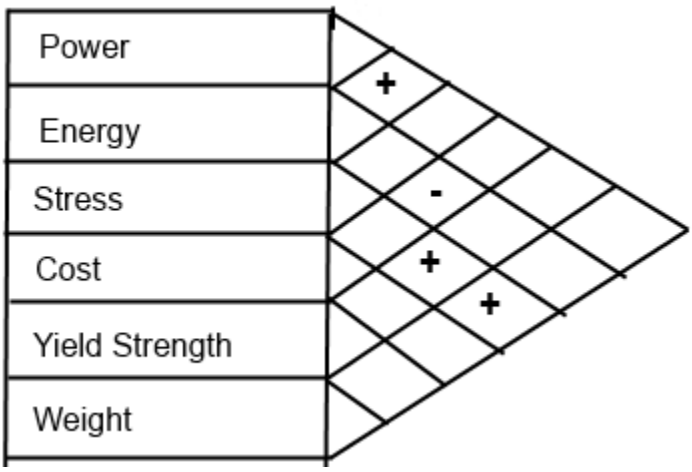

Figure 3: House of Quality

PROJECT PLANNING

In preparation for the rest of the semester, the group has divided the remaining tasks to maximize the amount we can complete in regards to time. The figures below are divided into three months (October, November, and December) and subdivided even further into colored sections. The blue symbolizes the designing phase where the group will be exploring all options that will fit within the constraints provided by the client. Orange corresponds to the computer aided deigns that will be developed from the written and hand drawn designs from the blue section. The yellow sections represent any communication with the community that is affected by the building of the solar charging station. This includes student, faculty, and those living within close proximity to the location selected by the client. The green symbolizes the testing and analysis phases of the project. This is where the group will be testing the solar panels and analyzing the

result to optimize the efficiency and to calculate if connecting to the grid is a feasible option. Finally, the black and red milestone markers represent the due dates for the presentations and reports. All Gantt Charts can be found in appendix A.

In the first Gantt Chart, (figure 3) you can see that we will be making preliminary designs from the 15th until the 29th, at which point we will be switching to making computer aided designs on SolidWorks.

Starting in November (see figure 4) we will begin asking community members their options on the designs and what features they envision for the project. At the same time, we will be testing the provided solar panels. Following the community outreach, we will begin a second phase of hand drawn design and talking to the client about changes to improve the aesthetics and efficiency of the charging station. Then we will draw the designs again in SolidWorks and ask the community the opinion. During the drawing and surveying period we will analyze the results from testing the solar panels.

In the month of December (see figure 5) the group will be completing the analysis of the solar panels and prepare the submission for the NAU Green Fund.

The presentations and reports (see figure 6) will happen on three different days throughout the semester. The first will be the 9th of October, second will be on the 20th of November, and the final will be on the 4th of December.

CONCLUSION

Northern Arizona University would benefit from a solar charging station capable of supplying power to small electronic devices. A new station will teach the value of solar energy promoting more solar design projects. The solar panel testing results will indicate how effective the current panels are, allowing for proper design of the system. The critical design elements were analyzed using a QFD and House of Quality, determining cost needs to be prioritized. To achieve the project goal and a Green Fund submittal, proper milestones and tasks were assigned for the remainder of the time.

REFERENCE

[1] D. T. Acker. [Online]. Available: http://nau.edu/CEFNS/Engineering/Mechanical/Faculty-Staff/Thomas-Acker/. [Accessed 8 10 2013].

APPENDIX A

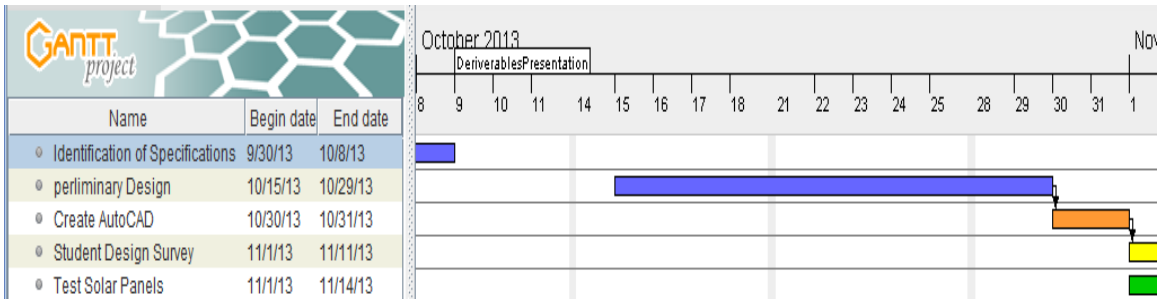

Figure 3: October Tasks

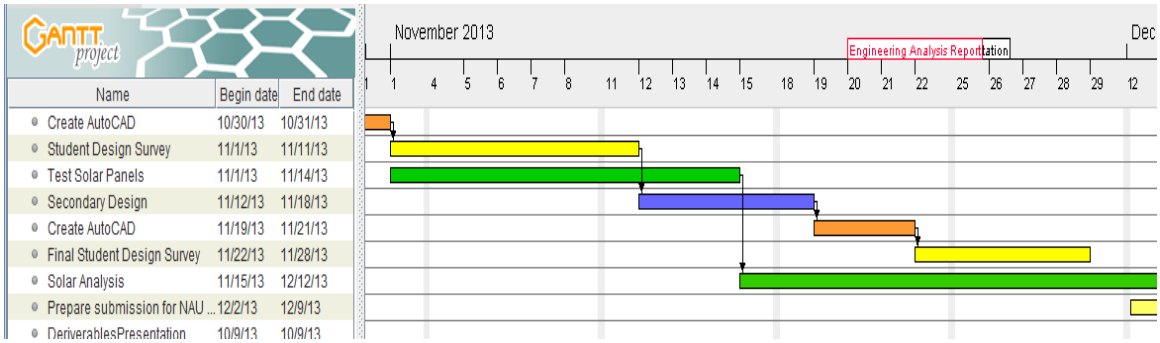

Figure 4: November Tasks

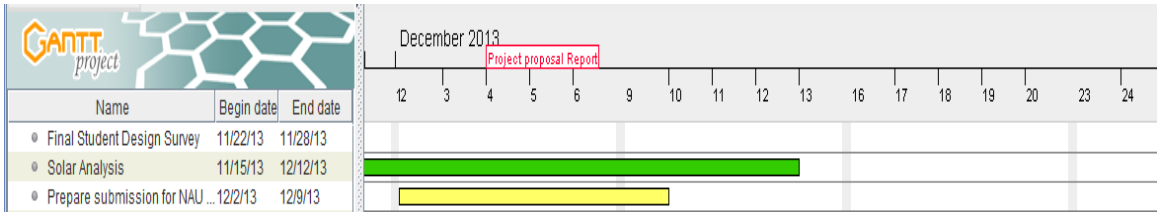

Figure 5: December Tasks

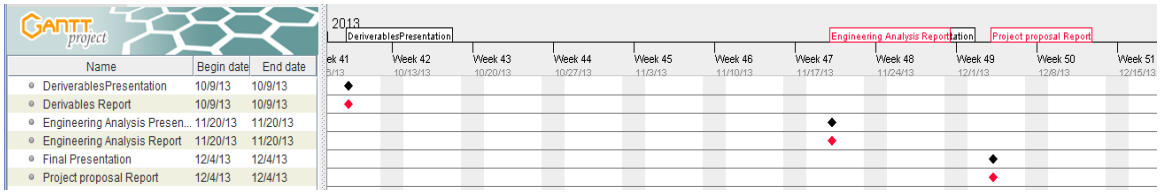

Figure 6: Milestones