Restate Scope and Project Plans

EML 4551C – Senior Design – Spring 2013 Deliverable

Active Surface Shaping for Reflectors

Team # 9

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Reviewed by Advisor(s):

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Executive Summary

Over the course of the fall semester, various designs were generated to ensure optimal efficiency of the automated reflector adjustment mechanism. Past designs were taken into consideration to ensure that the mechanism would fulfill the needs of Harris. Of the generated concepts, the best was picked and material selection began. Materials were selected to make the mechanism as lightweight as possible, while staying within the budget provided by Harris. At the end of the fall semester, most of the major components of the adjustment mechanism were ordered, such as the stepper motors and Arduino microcontroller. This ensured that there would be no delay in the delivery of the motors to the team.

Main highlights for the spring semester include final part ordering, construction of the mechanism, programming of the Arduino microcontroller, and finally testing to prove functionality.

Project Scope

The project given to team nine by Harris Corporation is to generate the necessary mechanism and control logic to make automatic hands-free adjustments of a reflector surface. With an older adjustment mechanism shown to the team, and CAD drawings provided of a current design, the team is to automate the existing parallel-pull mechanism. The primary goals are to build one high precision mechanism and construct a visual display to demonstrate that the mechanism is capable of high linear resolution as required from Harris. Given that there is a weight tolerance for additional components; hardware may be added to provide wireless capability and an integrated power supply to make the mechanism fully wireless.

Customer Needs

Given the task to build one high precision adjustment mechanism, certain constraints were given by the Harris sponsor that the mechanism must be able to perform within. The linear range for each adjustment location must be 0.100” with a linear resolution of 0.001” and lifespan of 10,000 linear inches. It is desired that each of the adjustment mechanisms be lightweight as possible, preferably under 80 grams and cost $800 per unit. The visual display should have a Linear Variable Differential Transformer (LVDT) to correspond to each adjustment chord, which measures the displacement accurately and shows this measurement on an output screen.

Technical Plan

With the preliminary programming of the microcontroller currently underway, drive gears are the next big item to address. Research has been done to obtain the most cost effective and feasible solution. Getting customized one-off gears manufactured cost upwards of $1300 each, and there are no off-the-shelf items that will work for this application. At this time, it seems that buying gear stock and turning the gears on the lathe is the best option.

Finalizations to the base piece in CAD are also being addressed to ensure that there is sufficient space for each component. Once this is complete, the CAD drawings will be sent to the machine shop for rapid-prototyping.

The paperwork has been finalized and will be turned in this week to order the final components for the adjustment mechanism such as the gears and the 4-40 all thread rod.

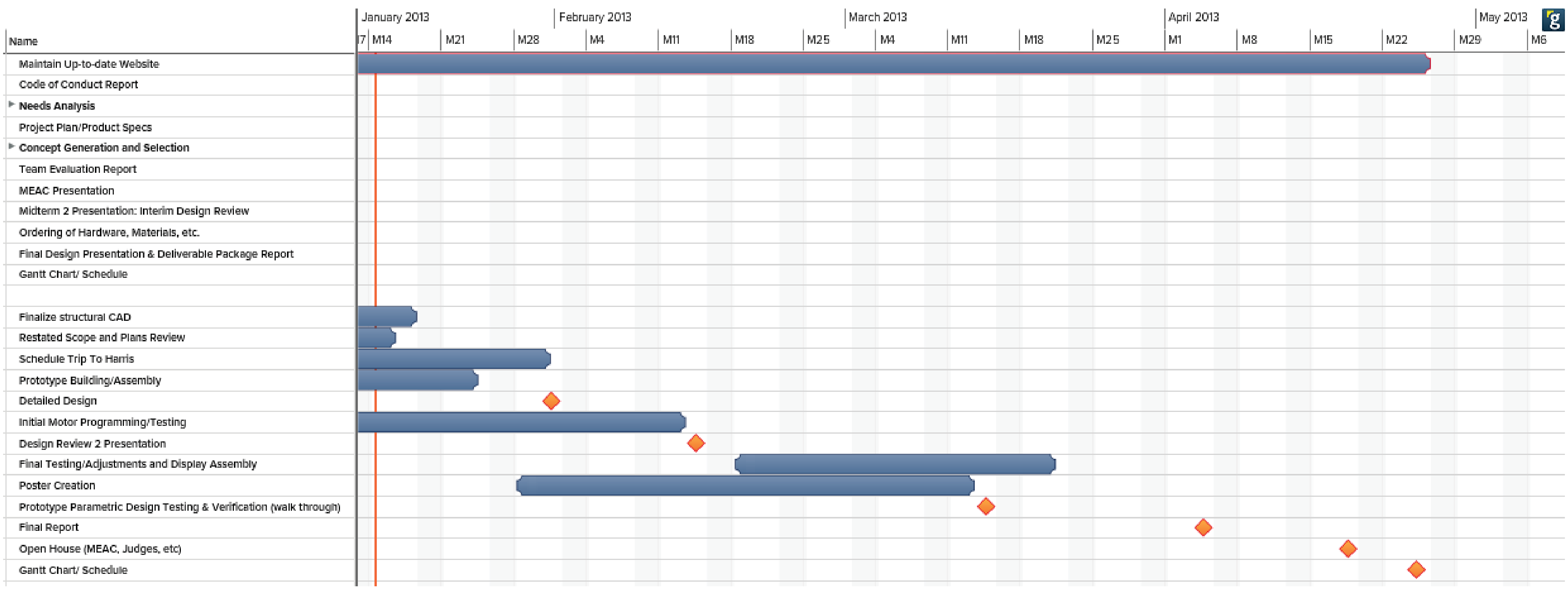
Once adjuster mechanism is functional, efforts will be made to make the system completely wireless, if time, budget, and weight limits still allow for such. With focus currently on getting a prototype mechanism built, the team will order components for the visual demonstration in the near future.

Budget Expenditure for Team 9

Last Updated: 01/14/2013

Component	Purpose	Quantity	Unit Cost	Total Cost	Date purchase order submitted	Date purchase received
Arduino Nano	Microcontroller	1	42.79	42.79	12/7/2012	1/7/2013
Faulhaber AM1524	Stepper motor	3	117.6	352.8	12/7/2012	1/7/2013
Texas Instruments SN754410	Motor driver chip	2	2.33	4.66	1/15/2012	Pending
4-40 all thread	Gearing system	1	3.13	3.13	1/15/2012	Pending
18 Teeth, 64 D.P., 20° Pressure Angle, 1' Foot Long Brass Pinion Wire Stock.	Pinion	1	23.73	23.73	1/15/2012	Pending
36 Teeth, 64 D.P., 20° Pressure Angle, 1' Foot Long Brass Pinion Wire Stock.	Gear	1	50.71	50.71	1/15/2012	Pending
400mAh Polymer Lithium Ion Battery	Power supply	1	7.95	7.95	1/15/2012	Pending
1000mAh Polymer Lithium Ion Battery	Power supply	1	11.95	11.95	1/15/2012	Pending
Extrusions for Aluminum T-Slotted Framing	Visual Demonstration frame	2	31.59	63.18		

Total Budget	2500
Cost of Adjustment Mechanism	477.82
Cost of Visual Demonstration	63.18
Budget Available	1959



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Name
Maintain Up-to-date Website
Code of Conduct Report
Needs Analysis
Project Plan/Product Specs
Concept Generation and Selection
Team Evaluation Report
MEAC Presentation
Midterm 2 Presentation: Interim Design Review
Ordering of Hardware, Materials, etc.
Final Design Presentation & Deliverable Package Report
Gantt Chart/ Schedule
Finalize structural CAD
Restated Scope and Plans Review
Schedule Trip To Harris
Prototype Building/Assembly
Detailed Design
Initial Motor Programming/Testing
Design Review 2 Presentation
Final Testing/Adjustments and Display Assembly
Poster Creation
Prototype Parametric Design Testing & Verification (walk through)
Final Report
Open House (MEAC, Judges, etc)
Gantt Chart/ Schedule