Remote Control Laser Pointer

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Team 12

Project Update 2

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1.0 Introduction

1.1 Overview

Mr. Edwin Anderson, the Support Systems Analyst for the NAU Physics department has requested a device to aid him in safely directing the attention of groups of people toward individual stars and constellations. He currently points out stellar bodies by hand with a 5 mW laser which is not powerful enough for people to see that are not in his immediate vicinity. He wants to use a 20 mW laser so that larger groups of people can see what he is pointing out, however it is too powerful to be operated by hand. If the beam were to make contact with someone's eye, instant blindness could occur.

Our team was tasked with designing and building a system to safely focus the attention of large groups to stars while eliminating the possibility of the laser shining into someone's eyes. The design must be stable and comfortably operable in relevant weather conditions, i.e. typical Flagstaff winter night 2.1conditions. The laser will not operate if it becomes too cold. The main location of use will be the NAU observatory grounds, and other locations in and around flagstaff such as Buffalo Park, Heritage Square and various elementary schools. A primary concern with various locations are differing minimum angles for the laser. For example, if the system was to be used near buildings, the system must not allow the laser to be shined into windows.

The system must point out stellar objects within a reasonable time while retaining a resolution of 0.5°. A reasonable time was determined by considering the case in which the laser moves a maximum amount, generally 120°, in five seconds. This equates to an angular velocity of 24° per second or 0.4189 radians per second. The system must be able to fit into a small car and able to be transported by a single adult. This means the final inclusive design must have fully collapsed dimensions no larger than 48" X 12" X 12" so that it can fit into the cargo compartment of Mr. Andersons Subaru Outback. The design and all components must weigh no more than 100 lbs.

1.2 Current Project Standing

All parts that were on order during the last progress report have arrived and all components, expect for the battery housing, have been constructed. Some components have been remade due to part failure and/or redesign.

The electrical contacts are complete and functional except for the pan block (Figure 1.1). The unit was completed but one of the contact brushes was broken off during finishing work. All of the contacts on the block will be replaced to ensure alignment with the copper rings. The broken contact brush can be seen in Figure 1.1 below.

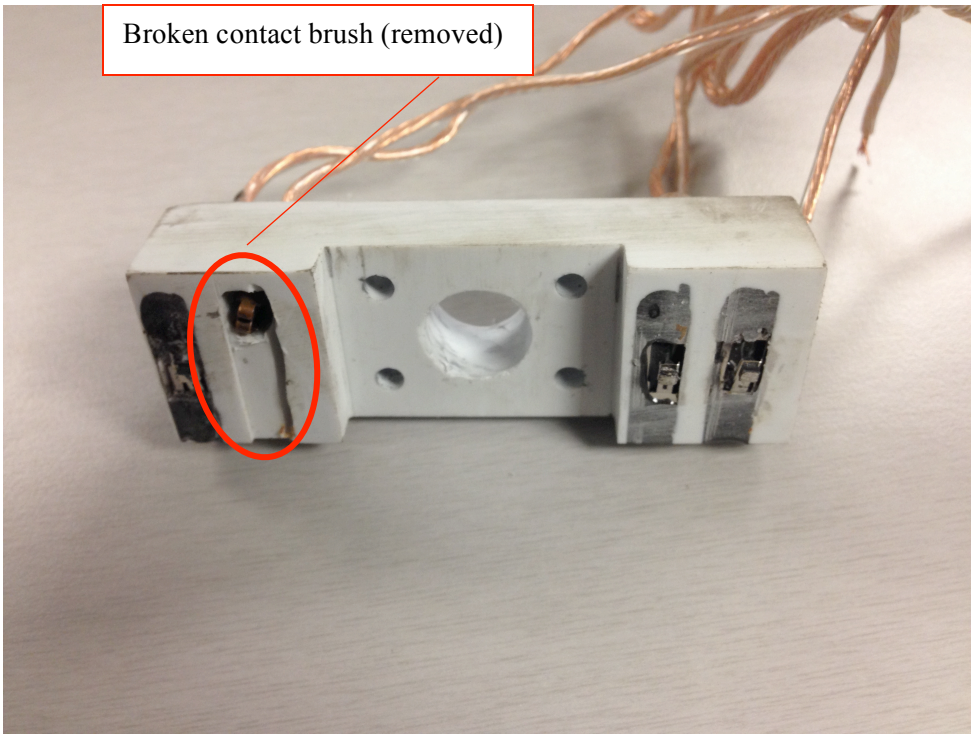

Figure 1.1 – Pan Block

The Delrin housing for the laser is complete and functional. The conduit has been machined and is also functional along with the switch trigger and the solenoid cover. The solenoid has also been tested and provides sufficient force to toggle the laser pointer on and off. The progression of the project is on schedule and the system will be assembled and ready for testing before the end of March. Figures 1.2, 1.3, and 1.4 show some of the completed components.

Figure 1.2 – Laser Housing and Solenoid

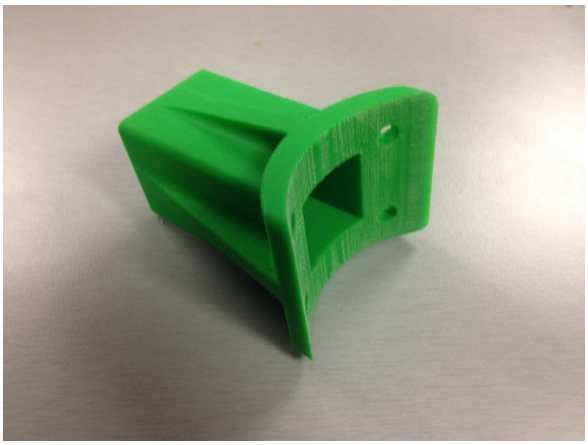

Figure 1.3 – Solenoid Cover

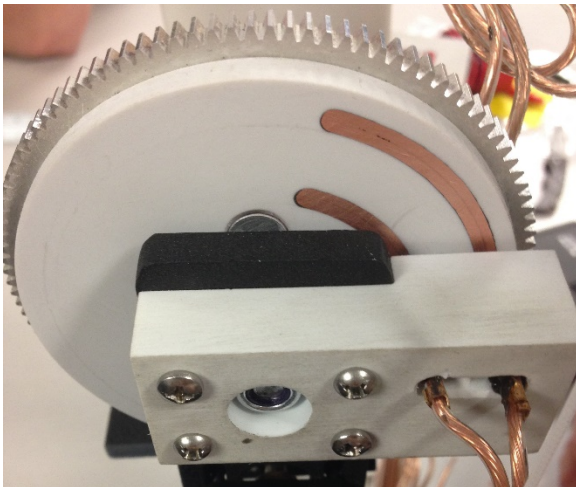

Figure 1.4 – Limited Slip Ring

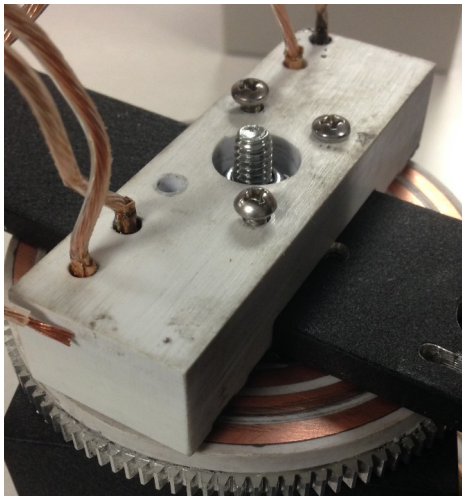

Figure 1.5 – Pan Slip Ring

2.0 Design Modification

2.1 Spare Electrical Contacts

During assembly of the block contacts, one contact was damaged and was removed. Although our client will not likely damage any of the components during normal use, there exists a need for our client to have replacement parts. An additional set of block contacts will be fully constructed as replacement parts in the event that the original components fail for any reason.

2.2 Slip Ring Redesign

The original design for the slip rings was not ideal when the system was first assembled. The slip rings were larger in diameter than the main drive gear, which prevented for gears from meshing completely. The components were redesigned with a smaller diameter. Both slip rings have been built and allow the gears to mesh properly.

3.0 Project Plan

3.1 Remaining Tasks

The remaining tasks have been divided amongst the team members as shown in Table 3.1. The system will be ready for testing by the end of March and the project will continue to be on schedule. Note that the team member listed is the primary for the task. All other team members are secondaries.

Table 3.1 – Remaining Tasks

Task	Team Member
Design/Machine Battery Box	Eddie Hoopingarner
Assemble Battery Unit	Cole Middlebrook
Machine Spare Copper Contacts	Jeb Duncan
System Assembly	Jeb Duncan
Wiring for Power Supply	Michael Orrill
System Testing	Michael Orrill
Safety Analysis	Eddie Hoopingarner
User Manual	Eddie Hoopingarner

The battery box is the last component to be machined. The box will be made out of quarter inch sheet metal and will be fastened using rivets or weld. A slot will be cut out for the installation of a voltmeter. The voltmeter is used to view the remaining power in the battery. Holes will be drilled in the top or side of the box for the electrical cables. A lid will be designed with a carrying strap or bar. A slot will be made in the side of the box with an opening and closing door attached. This slot will allow access to the battery for charging. The battery box will be designed to suspend from the three cross bars of the tripod (see figure 3.1 for rough concept).

Figure 3.1 – Battery Box Concept

3.2 Parts Completed

Several components of the system have been completed and assembled. The switch trigger, solenoid cover, limited slip ring, pan slip ring, laser housing, block contacts, electrical conduit, and laser spacer have all been completed. Once the wiring is completed, the components will be assembled and the system will be ready for testing.

3.3 Schedule

The tasks required to complete the project are separated based on dependencies and tracked using a Gantt chart shown in Figure 3.1 below (i.e. ordering stock before machining a part). The remainder of the project plan includes deadlines for testing, writing a user manual, and preparing for the UGRADS presentation.

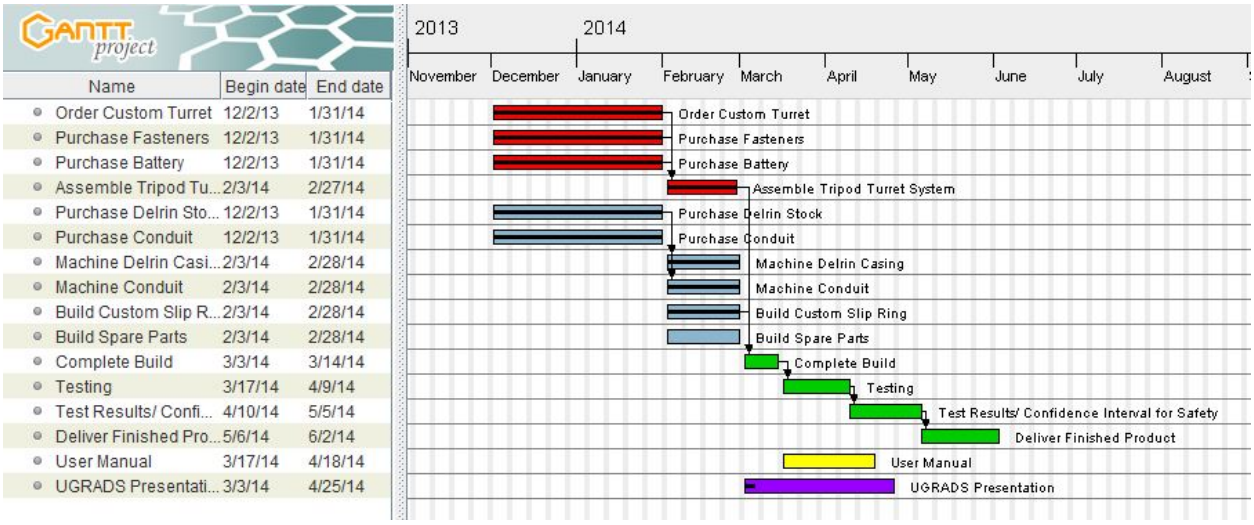

Figure 3.3 - Project Plan – Gantt Chart

Before March 14th, the design should be built and ready for testing. Components may or may not be prototyped using the FDM machine in order to produce a prototype of the design sooner. Testing should be completed by April 9th and compilation of the test results completed about a month afterwards. The user manual is not dependent on other tasks but will be completed by April 18th. The UGRADS presentation is also independent of other tasks but will be finished by April 25th when the presentation is scheduled. The schedule is subject to minor changes, but will be utilized to manage the project plan and to ensure completion and delivery of the product to our client Mr. Anderson.

4.0 Conclusion

Upon receiving the camera turret and all parts that were on order, the need for design modifications became apparent. The initial pan slip rings were too large in diameter and interfered with the gear meshing. The slip rings were redesigned and rebuilt with a smaller diameter. There was a need for replacement parts after the electrical contact head was damaged during handling. The client will receive the system with replacement parts. If the components fail, the client will refer to the user manual for instructions for the replacement. The battery box is the last component to be machined for the completion of the system. The user manual will be completed by April 18th. All major components have been received and all small components have been either received or ordered. The final components will arrive by March 14th and assembled before March 21st. All other parts have been or will be purchased locally.

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