Mobile Computer Cart

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Progress Report 2

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1. Project Summary

A Northern Arizona University Capstone instructor is looking for one mobile computer cart designed and fabricated by students. The team will work directly with the client Dr. Srinivas Kosaraju to verify if the design meets his needs. The primary objective of these carts is to accommodate a data acquisition computer that can be taken easily outside the engineering building for outdoor experiments. Current available market designs are very expensive and are made to be used indoors only. The computer cart must be fabricated to carry a CPU, data acquisition equipment, two widescreen monitors, attachment to position keyboard and mouse at adjustable height. It must also have some storage space for user to keep additional cables, manuals of equipment. Neither design must exceed the cost of more than $500.00 apiece.

2. The Problem Statement

This section will include all necessary problem formulation information such as needs and goals statements as well as the project's objectives and constraints.

2.1. The Clients Need Statement

Dr. Srinivas Kosaraju's need statement is, "The current available mobile computer carts are too expensive and are not designed for outside use."

2.2. The Problem Definition

2.2.1. Goal Statement

The project goal is to design one mobile computer stations that are less expensive than available marketed products and can be operated in outside conditions.

2.2.2. Design Objectives

Team 12 determined the objectives based off the client's quantifiable expectation on how the computer cart should perform. These objectives will drive the design process and help the team formulate each part of the design in the future. The objective is as follows "Design one inexpensive mobile computer stations that can easily be taken outside to preform experiments, while resisting the outside elements. In addition the cart must hold dual monitors, CPU, testing equipment, reasonably sized, and be adjustable for different users."

3. Current Project Standings

The main components of the designed and assembly are explained in the subcategory below.

3.1 Frame

The frame structure of the cart is designed to support the welded outside sheet metal, protect the equipment, and support the weight of the cart. The frame is made out of steel square tubing. The square tubing dimension cuts were based on the Solidworks assembly. The edges and burrs were further grounded down and sanded so it could be easily welded together. The smooth edges and burrs provide a resistance to contaminations, including rust or oil, that otherwise will weaken the welds. Figure 1 and figure 2 represents the tubing being laid up on a welding table in preparation to be welded together. Leaves and squares were used to get the desired dimensions for each of the tubing members. The frame was also clamped down to the table to make sure no warping occurred due to the intense heat. Welding tacks were first put down, and then each section was welded. After welding the frame sections with protruding weld beads were grounded down. The frame was all MIG welded in the NAU machine shop. The next step to finish up the frame is to attach the front support legs to the cart.

Figure 1: Welding Table

Figure 2: Frame with members welded

3.2 Sheet Metal

The sheet metal welding process is 90% finished. Figure 3 represents the process of welding the sheet metal onto the computer cart frame. The sheet metal was clamped down to the welding table the same way the frame was. The sheet metal was initially tacked down at multiple stops, to prevent warping of the metal that might occur due to the heat. It was very important to allow time for the metal to cool enough before continuing. Care was taken to prevent the welds to burn through the time metal, which would create holes. Once welds were applied around the entire surface edges the metal was grounded down to a smooth finish.

Figure 3: Welding sheet metal

Figure 4 shows the cart with all the sheet metal walls welded to the frame. The next step is to weld the sheet metal shelves. The shelves will be dimensioned to meet the client need of the storage space.

Figure 4: Front and side view of the cart with the sheet metal welded

3.3 Wheels

Attaching the wheels correctly on the cart was one of the most crucial parts of the project. To accomplish this, an axle was welded on the bottom back corner of the cart. To ensure that the axles are even on both sides, a small pair of angle square tubing was made with a hole in the middle of it with the diameter of the axle for a perfect fit. A final hole was made at the end of the axle for a pin to go through which allows for easy removal and installation of the wheel. Multiple tests were done to make sure that the cart met the standards. Initial tests of usability were done in the machine shop by maneuvering the cart around tables, tight spaces and especially doors. By attaching the wheels, the cart felt tremendously lighter, it was easily maneuverable and it fit through single doors.

Figure 5: Wheels

3.4 Monitor Mount

Designing the monitor mount was a very challenging part during the build. The first telescoping tube which was welded at the base of the cart had to be perfectly centered in order to provide balance to the monitors. The second tube which was smaller in cross sectional area fit perfectly inside of the first tube which allowed the user to determine how high the monitors would sit by placing a pin shown in figure 6. The monitor mount was welded onto the telescoping tubing for easy monitor attachment. Multiple tests were done before the welding the telescoping tube to ensure that the monitors fit inside of the cart facing towards the user. The design of the monitor mount allows for a single user to lift the monitors and place the pin inside of it. Figure 7 shows the telescoping tubing and how it attaches to the monitors.

Figure 6: Telescoping Pin

Figure 7: Telescoping attachment

3.5 NAU Logo

To establish the cart as property of Northern Arizona University, it was decided to attach the NAU logo to the cart. In order to accomplish this, a logo was designed using Solidworks. It was designed to allow for a CNC machine to cut out the logo and leave it as one piece. The design put four holes in exact positions so that the logo could be bolted to the frame of the cart. After design, a program was coded in

MasterCam to prepare for the CNC machine. A blank slab of 1/8 inch aluminum was used and the final logo was created and ready for installation. Figure 8 below shows the NAU logo design in Solidworks and the final product.

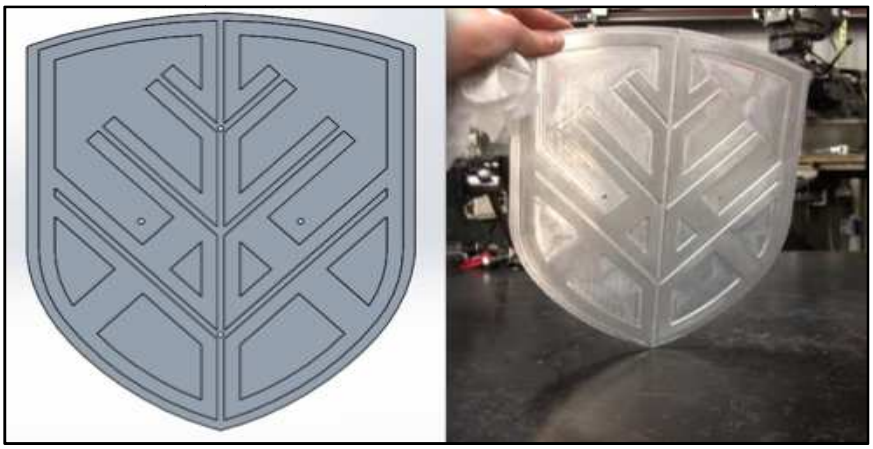

Figure 8: NAU logo in solid works and final product.

4. Next Steps

With majority of the building and installation done, the next step is to finalize the finer details. The frame and the sheet metal for the shelving on the inside need to be cut and installed. The shelf for the keyboard will be designed, cut and fabricated. The lid and the door are fabricated and install on the cart to finish the enclosure. Weather stripping will be purchased and installed with the Plexiglas to insure that the cart is waterproof. After the installation of the Plexiglas, the lid and the door, testing will be done. The finished product will be tested for waterproof feature and easy maneuvering. The final grinding and sanding will be completed to ensure that the cart is prepped for paint. The cart will then be painted and the operations manual developed.

5. Project Progression

A Gantt chart is used to give our team a rough estimate of the progression of the project, deliverables and designs goals. It serves as an outline of the milestones that we will encounter during the manufacturing and project review steps. Since the last progress report, the team has made and assembled most of the cart's parts. The frame of the cart is 90% complete and the sheet metal is mostly done except in the inner shelves. During the spring break, the team will finish the building process of the cart and completes assembling all the remaining parts. The building and assembling of the cart's parts should be finished by the second hardware review. The cart will then be tested to ensure that the interior is completely sealed and that the cart meets all the requirements of the project. After that, the team will proceed with painting the cart which will be the final work done on the cart. The team will then create a poster and an operational manual for the cart before presenting it in the walk-through and UGRADS presentations. The spring 2015 Gantt chart progression plan can be seen below in Figure 9.

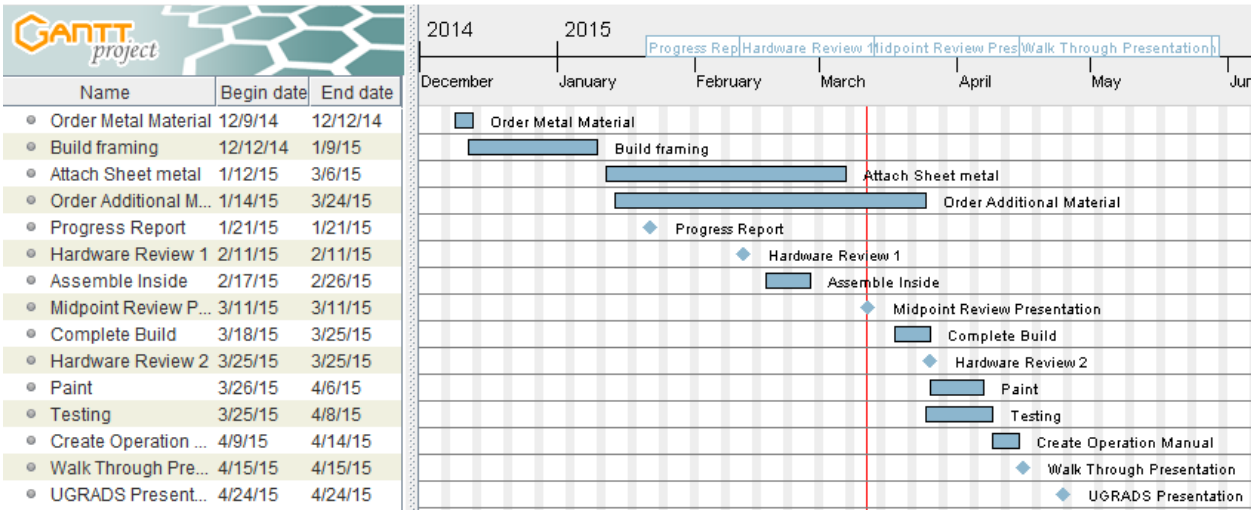

Figure 9: Gantt Chart

6. Conclusion

The project so far has been progressing as planned. About 90% of the frame of the cart has been completed and most parts have been built and assembled. The team will complete and assemble the remaining parts during the spring break as the building of the cart is expected to be fully completed by the second hardware review. This will allow for an adequate time to test the sealing and weather-proofing features of the cart before doing the paint job and presenting the cart in the UGRADS presentations.

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