CTE Major Grant: Follow-on Report
Acquisition of a Laser Cutter for Mechatronic Prototyping

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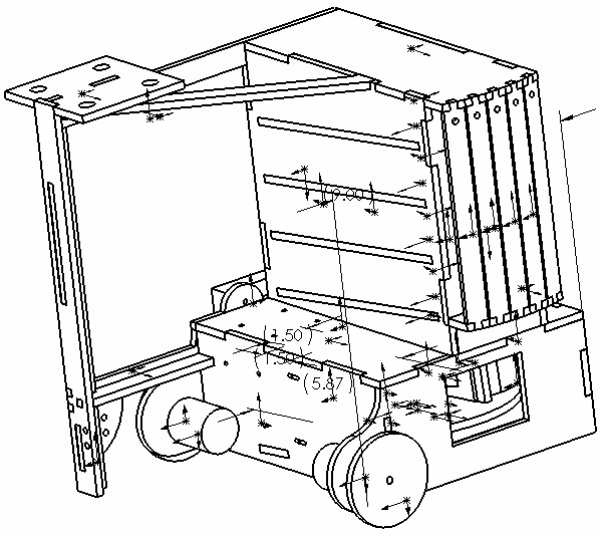
Project Description

Prior to the CTE Major Grant, the UC Santa Cruz campus had limited capabilities in the area of rapid prototyping. While there were (and are) several machine shops available on campus, they are essentially professional shops that take contract work from researchers and faculty. Students can, and do, learn to operate the milling machines and lathes in order to produce prototypes as required for their own projects; however, the access is limited and expensive for the students. Additionally, working with these kinds of machines can be quite dangerous, and requires a certain level of maturity from the students. Lastly, the machine shops are geared towards producing objects out of metal, usually aluminum, which is often overkill for student-type projects.

Using partial funding from the CTE (and matching funding from the school of engineering), a LaserPro-USA Explorer II 30Watt CO_2 computer-controlled laser engraver/cutter was purchased at a very large discount. The device has several advantages over the machine-shop approach to rapid prototyping. Firstly, the accuracy attained by the laser cutter is several orders of magnitude better than can be expected from student machinists. In fact, the accuracy is generally better than computer-controlled milling machines due to the very narrow width of the cutting laser (~0.005 inches). Secondly, it is much safer. This is due in part to the material used—generally acrylic or plywood—which requires much less force/heat to remove. The other reason is that the laser-cutter is a safety-locked device. The material is loaded onto the bed and the lid closed. If the lid is opened for any reason, the laser immediately shuts off. The material used with the laser cutter is much less expensive than aluminum. Lastly, complex three dimensional shapes can be assembled out of two dimensional cutouts based on interlocking parts.

Project Impact

The acquisition of the laser cutter has had a very beneficial impact on both the Mechatronics class (CMPE 118/L) as well as the Capstone design sequences (CMPE/EE 123A/B).



The mechanical prototyping is now integral to the Mechatronics class, with both a required lab that has the students build and assemble to body of a typical robot project. Additionally, all of the student teams in the Mechatronics class used the laser cutter to build their final robots for the class. In addition to allowing the easy and convenient building of the physical robots, it also pushes the students to using Computer Aided Design (CAD) software to assemble 3-D models of

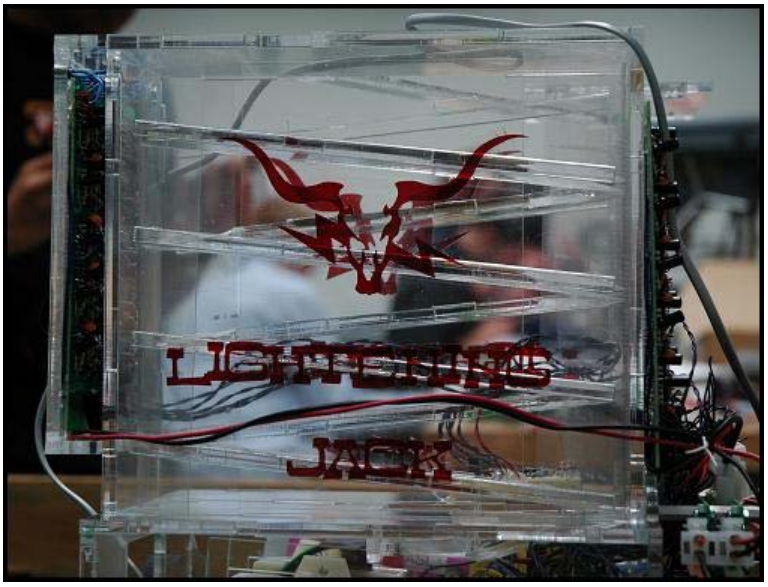
the robots before they ever build them. This allows the teams to debug mechanical fit and build before ever cutting a single part.

While the integration of the laser-cutter into the Mechatronics class has been a large success, the adoption of it into the Capstone design sequences has been much slower. Typically, the teams that prototype with the laser-cutter have at least one member who has been through the Mechatronics class.

Student teams have used the laser-cutter to prototype a fluid pump, several enclosures, gear trains, and bracket mounts for motors. Notwithstanding the rapidity of rollout, those teams which have taken advantage of the laser-cutter have demonstrated a quantum leap improvement in their mechanical prototypes.

Final Budget Report:

We were very fortunate to connect with Kurt Koser, the USA representative of LaserPro. Due to a desire to connect with the educational market, we were able to receive a very large academic discount on the Explorer II (roughly a 50% discount), which placed the laser-cutter within the reach of the $15K available from the Major Grant. Since the grant only supplied 50% of this price, the rest was paid for by the School of Engineering.



Additionally, when we placed the order with Koser, LaserPro had sold out of the 18" x 22" model, and he agreed to supply us with a larger (and usually much more expensive) model at no additional charge.

The budget for the Major Grant was $15K, the total granted was $7500, which has been spent (and supplemented by the school of engineering), in order to purchase a 22" x 34" 30W laser-cutter.

Future Plans

We plan to do a bit more advertising of the capabilities of the laser-cutter, especially outside of the School of Engineering. With it precise cutting ability, rapid prototyping in acrylic and wood is quite easy and produces stunning results.

We feel that the laser-cutter is an asset both to the School of Engineering, and to the University as well. Aside from minor cleaning, nothing is consumed in running the laser-cutter, and therefore wide ranging use should be encouraged.

We have used the laser-cutter to make several small trinkets for a visiting class of first graders, who now have etched acrylic disks as souvenirs. While this kind of outreach is much longer term, in 11 years or so, we may very well see a few incoming freshman who remember their visit.