



PROBLEM STATEMENT

The School of Engineering and Technology at Western Carolina University is going to start a Robotics and Automation certificate. There will be 3 courses, which consist of two hands-on and one based on theory of automation. The course will have a state-of-the-art laboratory for the hands-on portions. The course will provide equipment from several different well-known vendors, to assure the students are versatile when going to the work force. A multi-disciplinary engineering team will be tasked in creating several stations. The station will consist of major components: 80/20 for reconfigurability and scalability, sensors, motors, conveyor system, robots, PLCs, and pneumatics. Overall, the team will create a real-life operating station for the upcoming students to enhance their robotic and automations skills.

REQUIREMENTS

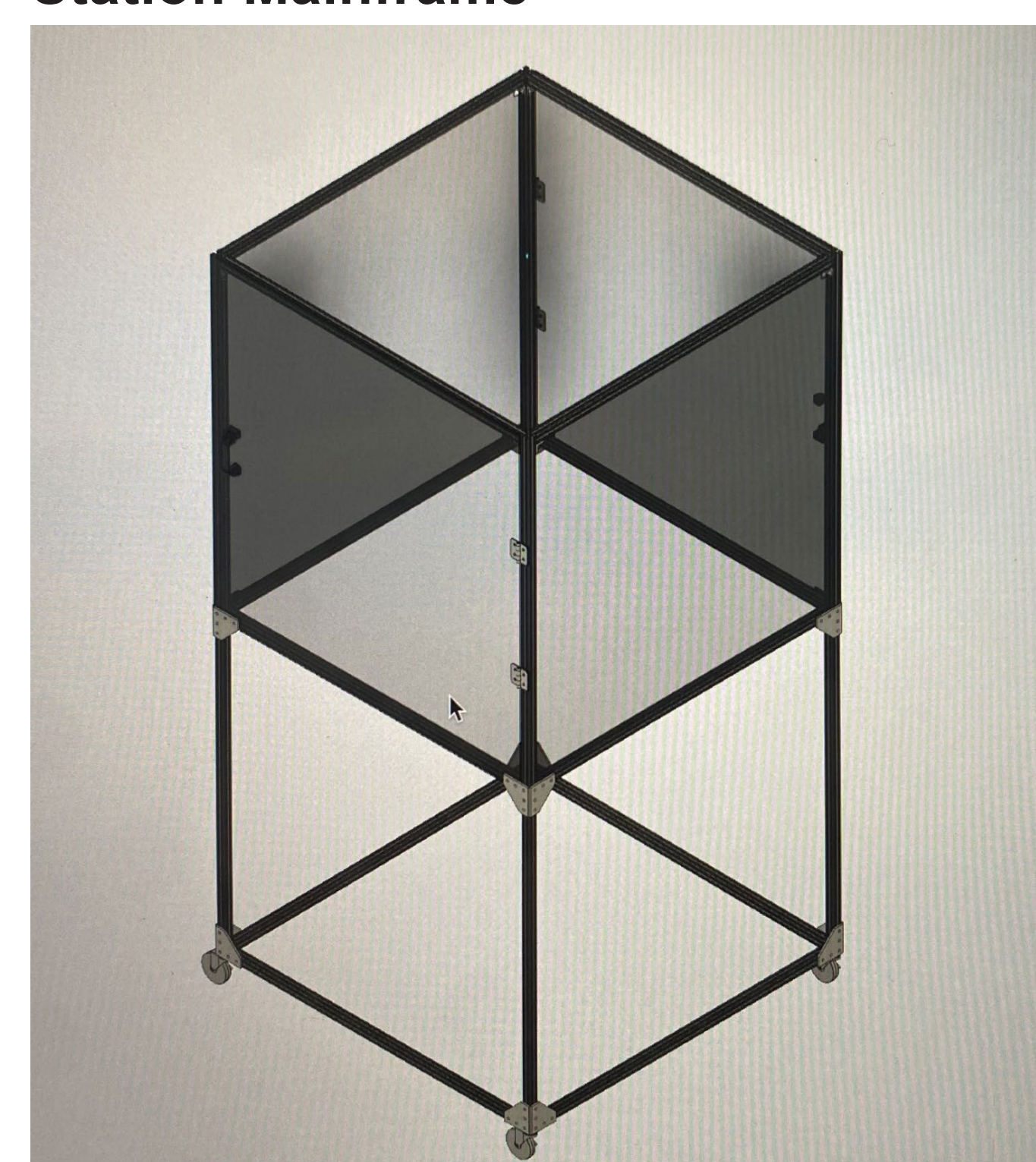
- The following requirement matrix was provided to the team:

#	Description
1	80/20 Extrusion and Casters - Allows for easier relocation
2	Conveyor system - Provides practice on programming logic controllers
3	Robotic arm - Provides practice on programming logic controllers
4	Stations use 24VDC & 120VAC - Use a common voltage level
5	Max size - 14' by 4' - Size restriction for classroom sizes
6	Ethernet connections - Allows for communications between PLCs and modems
7	Estops, safeguards, and Sensors - To ensure the safety of the students/staff
8	Reconfigurability and stations - Easy to add/remove stations
9	Low cost - Budget set to around 10k
10	Space to add more hardware - Allows for future implementations to stations

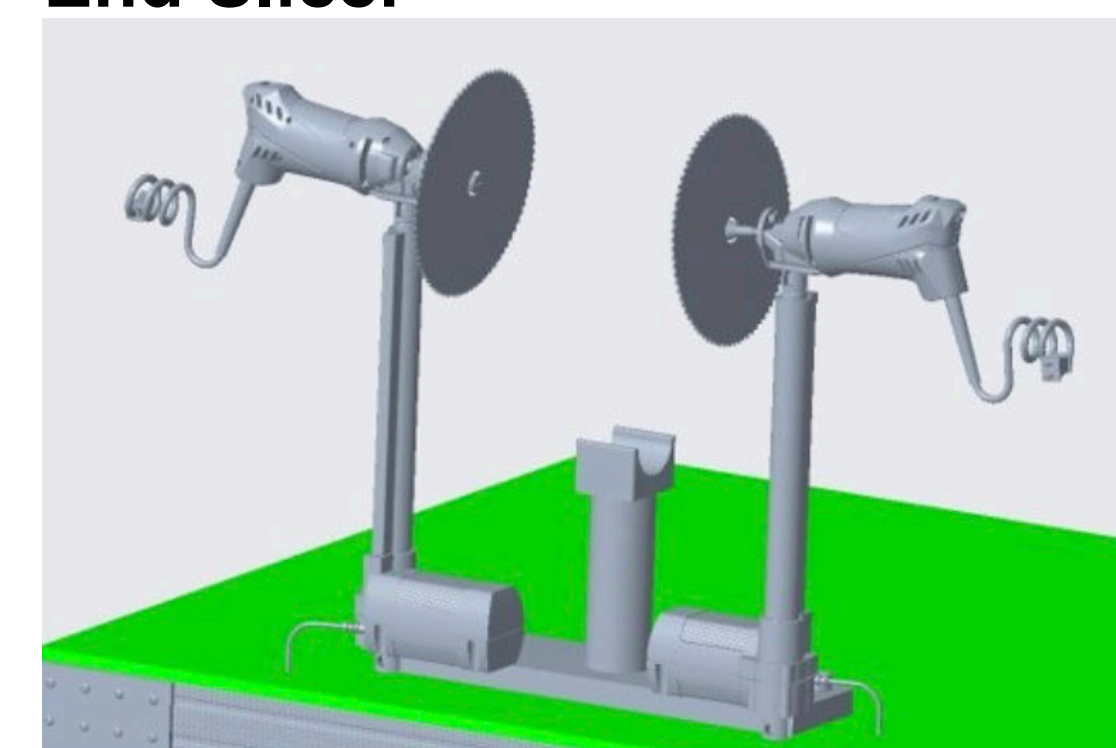
FINAL DESIGN, APPROACH, PLAN

The final design of the team consist of 1-2 stations which will have a conveyor system and a robotic arm. The conveyor system is to move the product from station to station while the robot arm is used to place the product where it should be as well as collect the final product. The stations consist of cutting, flattening, and embossing devices. The framework will be constructed out of 80/20. There will be programing logic controllers to manage the desired operations. With safety in mind, team 25 implemented several safety mechanisms to ensure the safety of the students, which consist of E-stop devices and safety panels. Finally, the stations were made to be handicap accessible to promote inclusion. Finally, the team created a process and a design. That will allow aluminum cans to go through cutting stations then be flattened. After the can will be embossed and the excess will be sheared. The overall product will be a small souvenir of an aluminum can having WCU (Western Carolina University).

Station Mainframe



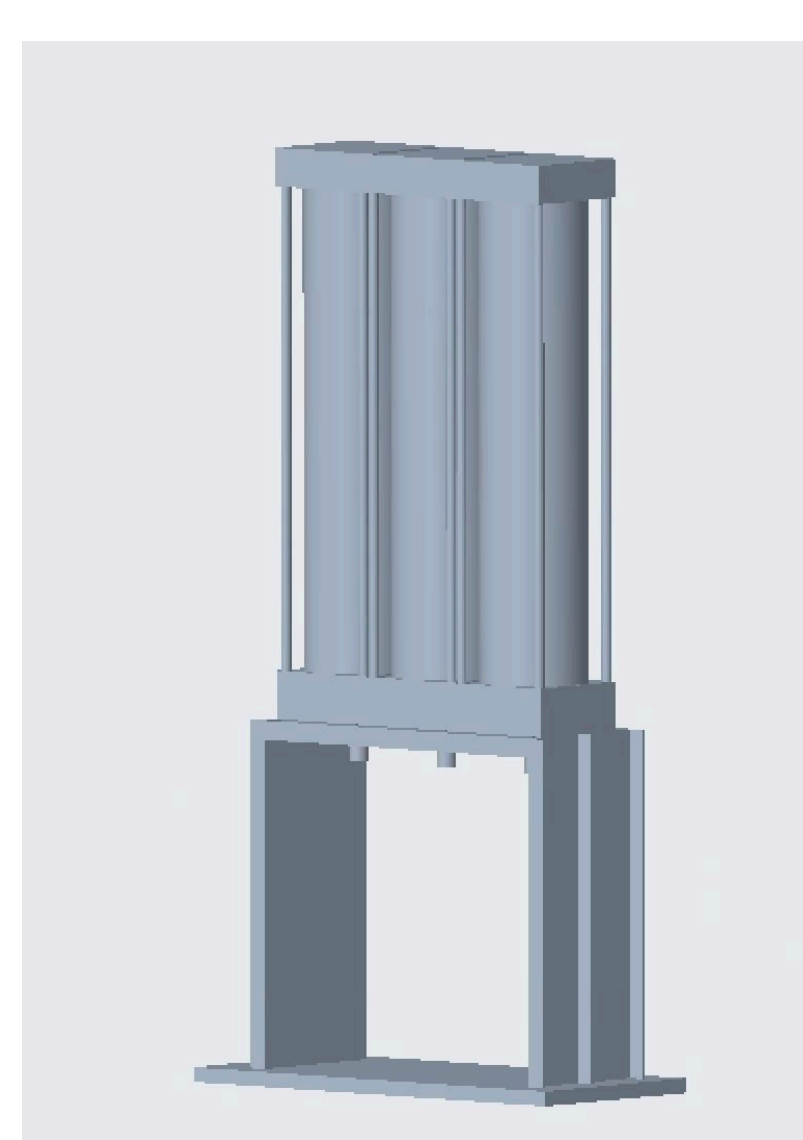
End Slicer



Stamping Die



Press Station

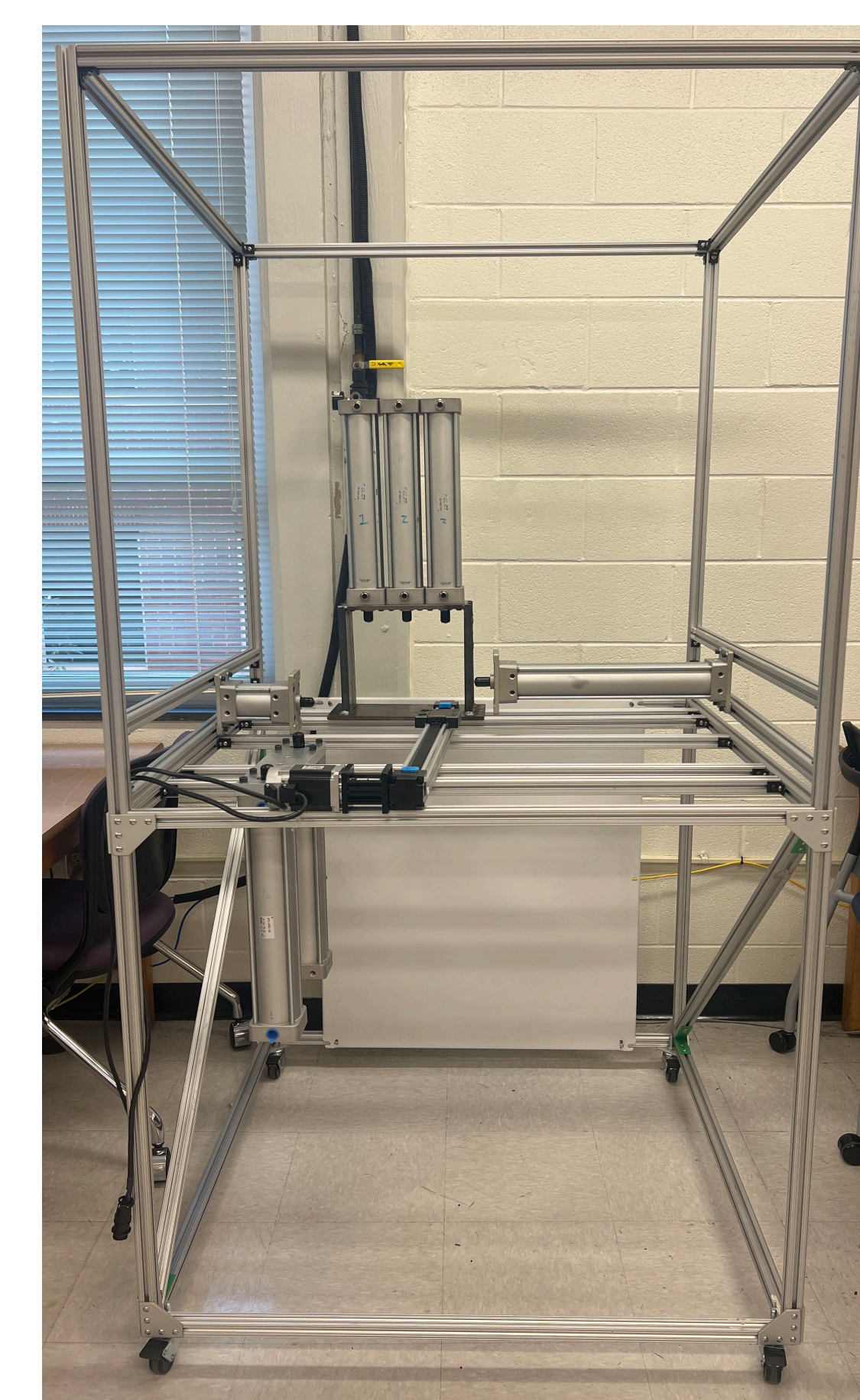


RESULTS

The team completed the following:

- Constructed the frame from 80/20
- Welded the frame for the pressing station
- Wired the PLC panel that would be used to control the process of the stations

Frame



PLC Panel



Robotic Arm



Press Station



SUMMARY AND CONCLUSIONS

In conclusion the team worked deliberately to complete the task assigned. The team was able to create the process of the automation, the framework and devices. The team did encounter several setbacks along the way, the biggest one was a funding issue. As well as a few regular setbacks but nothing the team was not able to overcome and strive forward. Although there is a bit more work to be done to the stations the team was able to satisfy and complete majority of the requirements placed.

- The stations have been constructed from 80/20 with casters attached that will allow for future classes to alter as needed or practice with the current stations.
- There will be a robotic arm and a conveyor system the students will be able to use to enhance their knowledge.

FUTURE WORK

The robotic station was built with the purpose of rearranging and adding more stations in the future. The changes are not certain, but the students will have the creativity to change the stations as needed. While the team was tasked with building the mainframe there were strict time constraints that caused some items to be left in a prototype state of to be unfinished.

TEAM & ACKNOWLEDGEMENTS

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References

- [CAD Models | McMaster-Carr](#)