

Semi-Automated Soldering Machine

Smith Systems



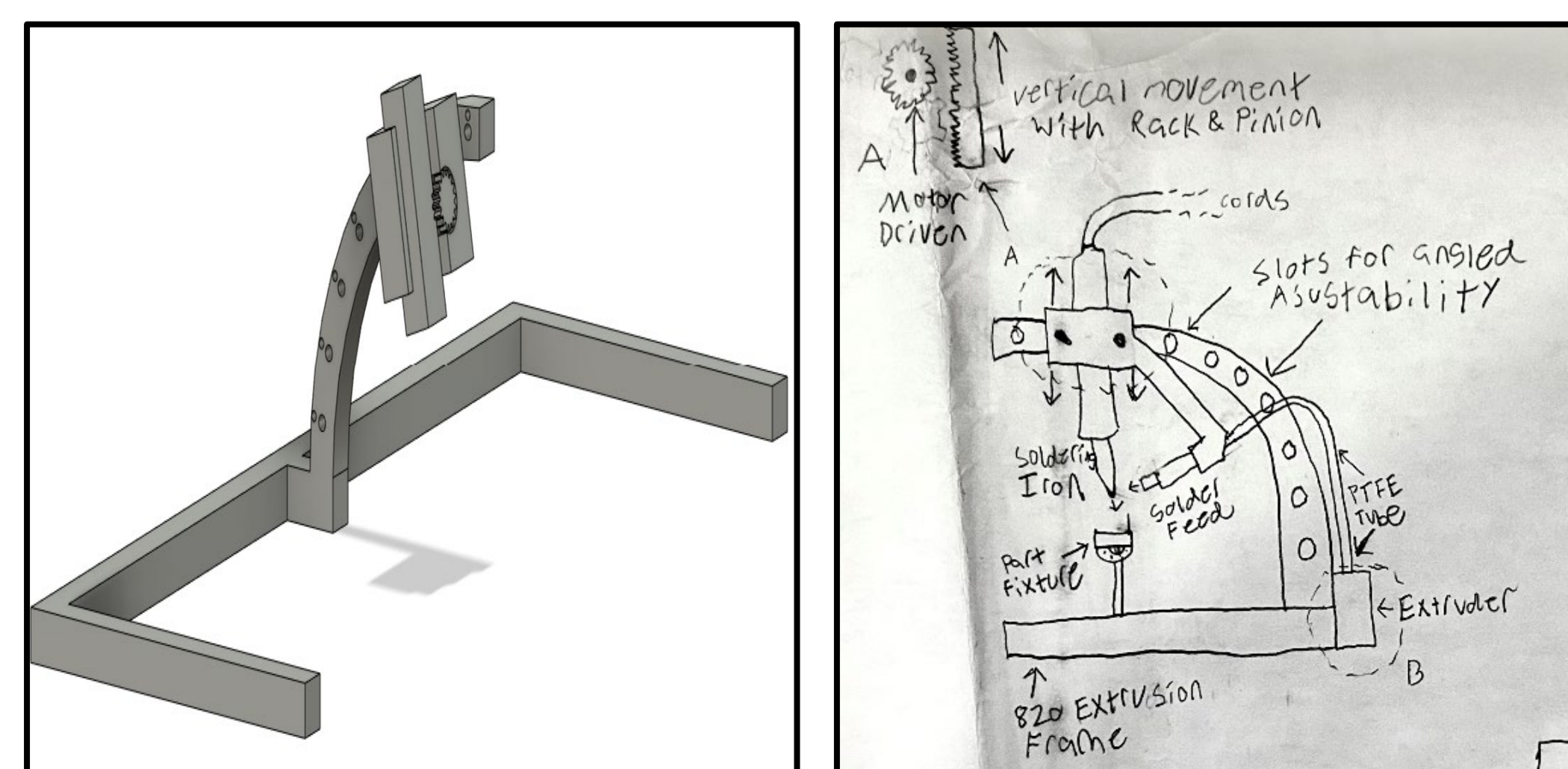
PROBLEM STATEMENT

The current cycle time to produce a single soldered joint is not fast enough to meet the current demand for parts. The Smith Systems team is looking to reduce this time by at least 30%. There were too many steps involved in hand soldering each component. And since everything is being soldered by hand, their operators are experiencing extreme fatigue from performing repetitive tasks. This hand soldering method also results in excessive variance from part to part due to human error. Smith Systems Inc. needs an easier, more efficient, and faster way to solder without removing operators from the equation.

REQUIREMENTS

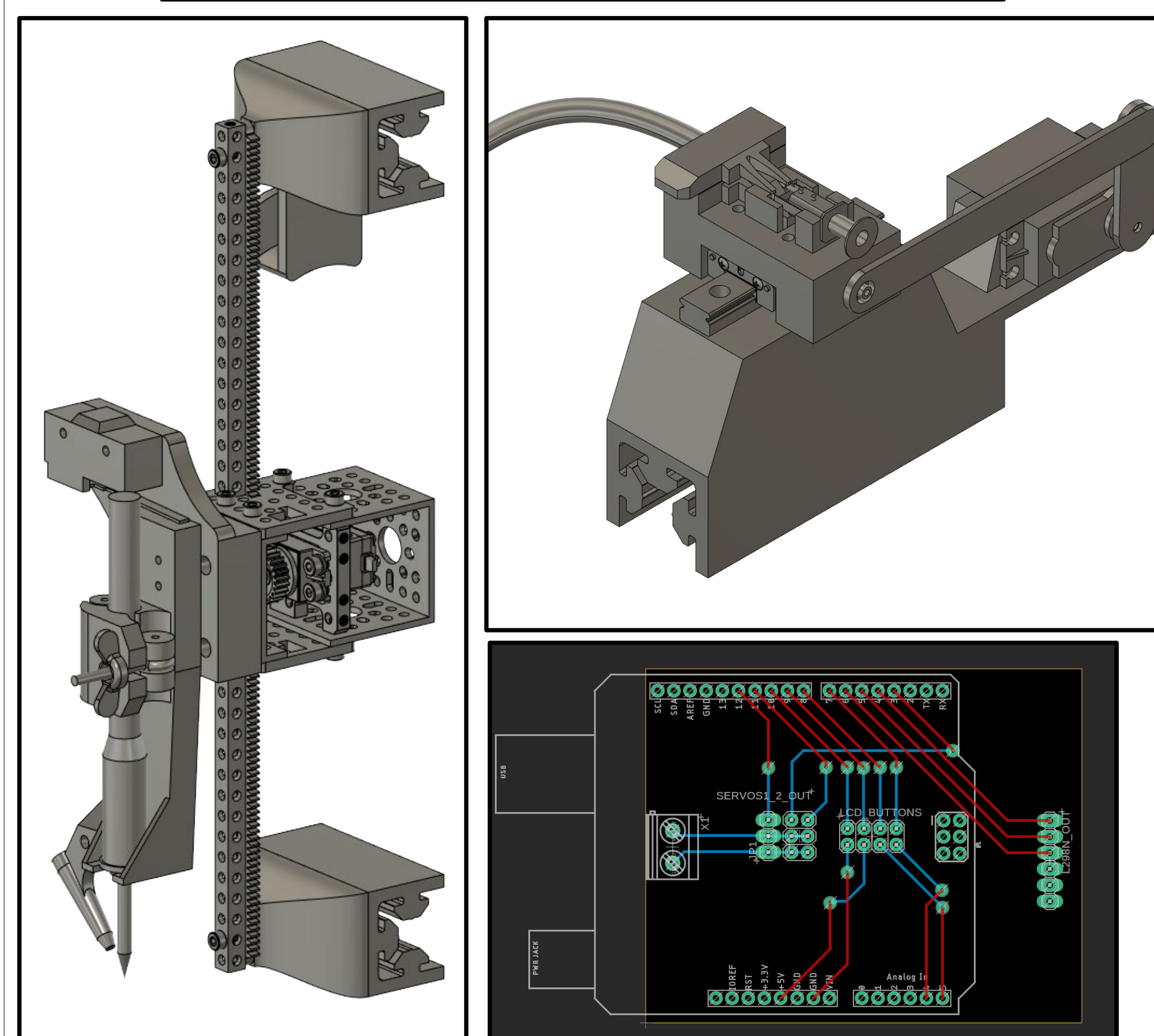
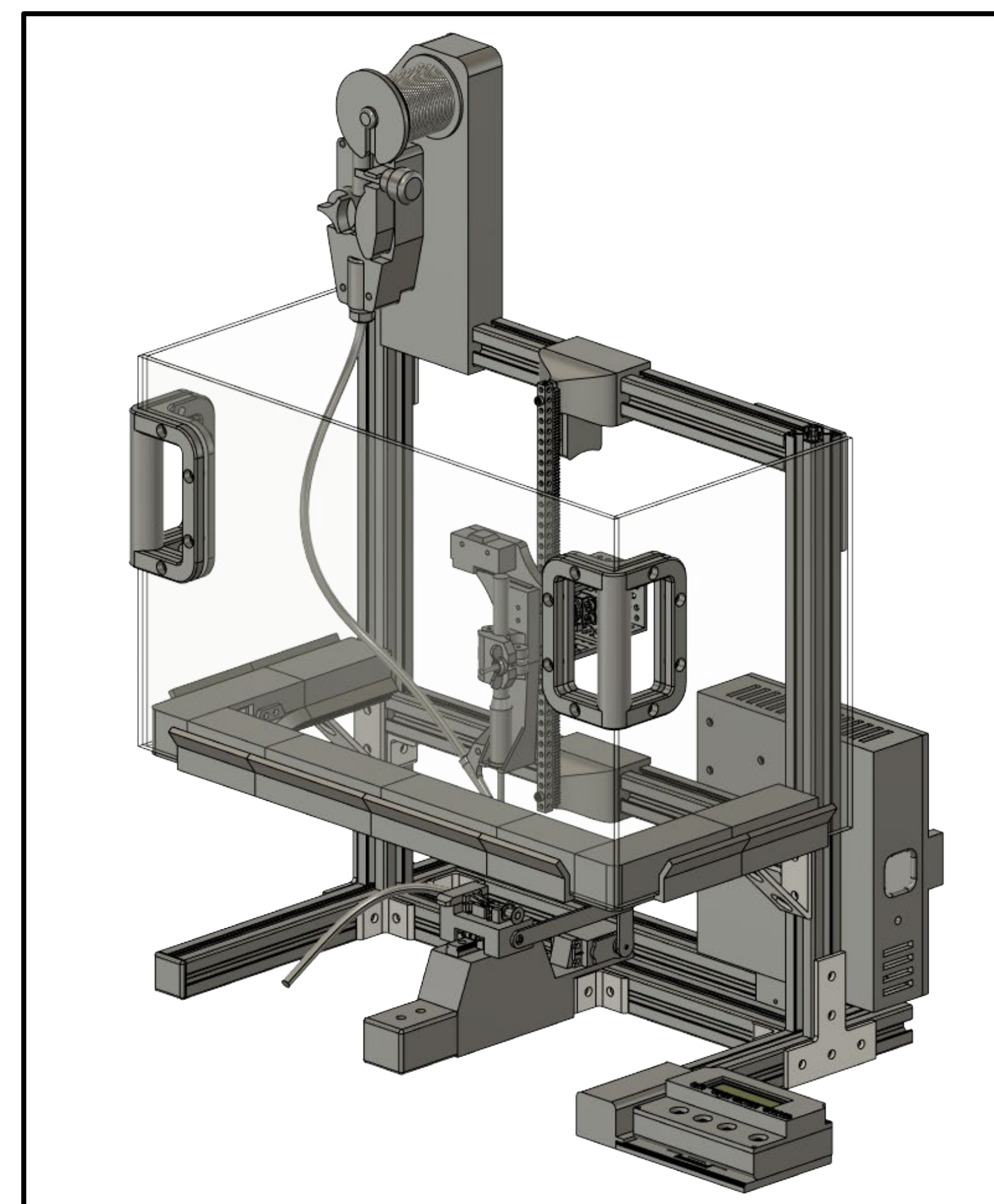
| # | Description |
|---|----------------------------------------------------------------------------------------------|
| 1 | The total budget must not exceed \$5,000. |
| 2 | Must meet the requirements of J-STD-001 Class 3. |
| 3 | Must fit onto a table surface that is 30" by 60" and no taller than 30". |
| 4 | The total soldering time must be reduced by a minimum of 30%. |
| 5 | Must have a repeatable design with complete documentation. |
| 6 | Must have designed safety measures to protect the hands of operators from burns and impacts. |
| 7 | Must be able to solder at least two types of joints: bobbins and thermistors. |
| 8 | Operator input should be required to begin the soldering process. |

CONCEPTS



FINAL DESIGN, APPROACH, PLAN

The plan was to create a basic motion machine that could be controlled via an Arduino uno to solder parts. The frame was to be made from 8020 to provide versatile structure for the components. A standard soldering iron would be mounted to a rack and pinion gear to provide vertical motion. The cables and parts would be held in place by another carriage at the bottom of the machine. This carriage could slide from side to side with a servo. Finally, the solder would be fed to the iron by a wire feeder and a Bowden PTFE tube to create the soldered joint.

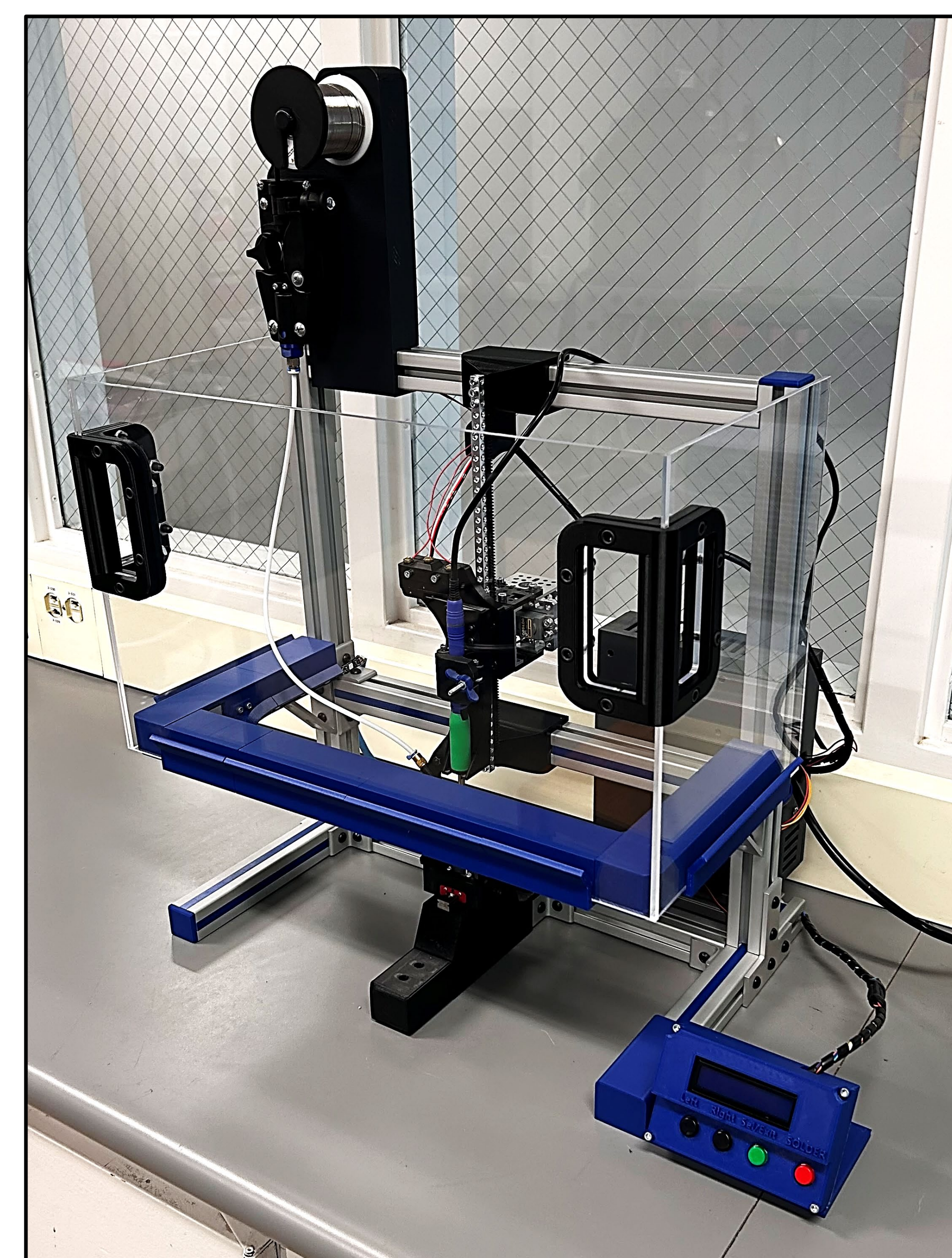


RESULTS

- Old cycle time: ≈60 seconds
- New cycle time: ≈30 seconds
- Approximately 50% decrease in soldering times

The testing included running the machine 30 times over the span of an hour, and checking to ensure that each solder joint it made was up to the J-STD-001 Class 3 standard. This testing allowed the team to discover some faults that needed to be worked out.

With the flaws worked out, this machine is ready to be given to the sponsor. This solution checks off all the requirements set in place by Smith Systems other than #7: having the ability to solder at least 2 types of joints.



SUMMARY AND CONCLUSIONS

Upon the final weeks of the project, the team took the machine to its final state. With much difficulty and many setbacks, the team produced a high-quality machine with the ability to accomplish the original tasks given.

- Repeatability- the machine operates in a manner such that the process can be completed many times in a row.
- Quality- The machine was designed and built with components that are trustworthy, giving the user good faith that the device will endure the workload.
- Safety- Safety measures were implemented into the design to ensure the user is comfortable while interacting with the machine

With these points in mind, the team made great effort to produce such a machine that will offer Smith Systems years upon years of improved productivity in the workplace.

FUTURE WORK

Smith Systems has a range of components that are soldered in-house. This machine can be adapted to solder many different pieces. Given more time, the team could develop various fixtures and code to adapt the machine for these parts.

TEAM & ACKNOWLEDGEMENTS

- Dakota Hudson: ET
- Adam Scott: ECET
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- Professor Jerry Denton: Faculty Mentor
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- Tammy Welch: Smith Systems
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