Belt Tension Data Logger

Ashworth

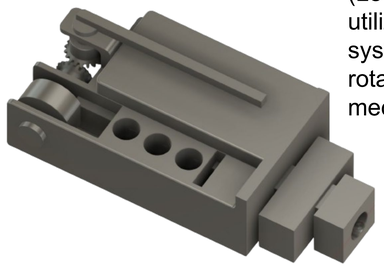
PROBLEM STATEMENT

The team is tackling challenges with the sponsor's fifth-generation conveyor belt tension monitor and data logger. Ashworth is seeking solutions to issues like time-consuming attachment processes, electronic configuration problems leading to wiring damage, and data loss in cold environments. The project focuses on a combination of mechanical engineering for attachment and electrical engineering involvement for data logging. The goal is to provide a more efficient, reliable, and consistent solution, reducing downtime, enhancing productivity, and preventing supply chain disruptions, benefiting both the sponsor and end consumers.

REQUIREMENTS

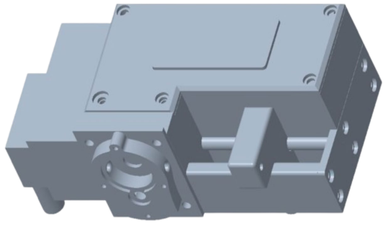
#	Description
1	Height restriction of 2 ¼"
2	No exposed threads
3	Device should function for 2 hours in -40°F to 450°F
4	Easily machined parts
5	Impact resistant
6	Capable of surviving a load of 400-600 lbs. of tension exerted by the conveyor belt

CONCEPTS

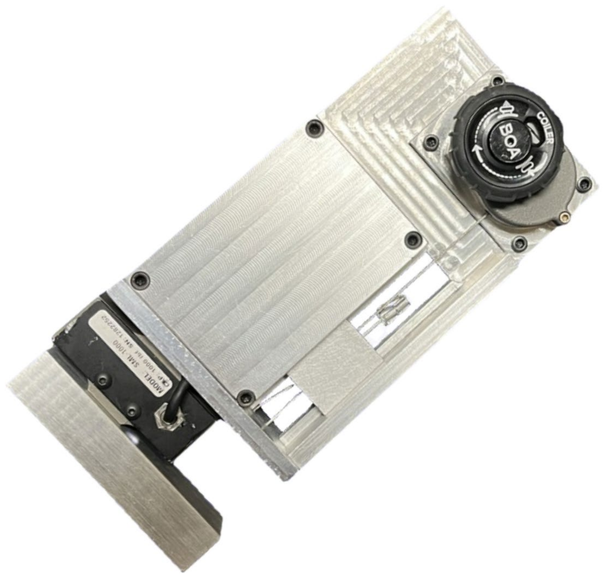


(Left) This concept utilizes a bevel gear system to translate rotation to the locking mechanism

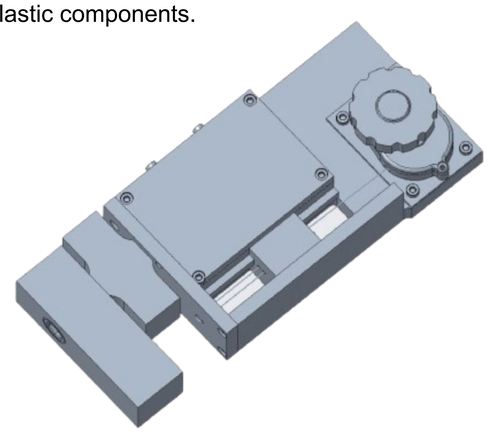
(Right) This concept uses rounded sliding rails and ratcheting system.

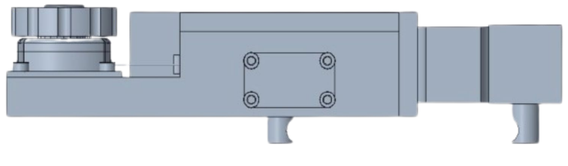


FINAL DESIGN, APPROACH, PLAN.



Pictured above is the completed and assembled prototype. It includes a mostly aluminum construction. With some slight improvements, the device would be ready for the 450-degree ovens. The current prototype is only suitable for freezer use, due to the use of plastic components.

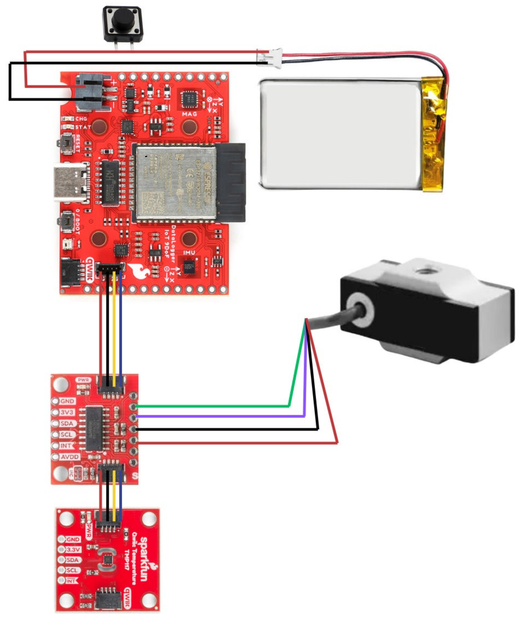




RESULTS

The team conducted multiple tests on the prototype tension monitor following various standards. Firstly, a battery test was performed to ensure it could operate for 8 hours on a conveyor belt, as per the sponsor's requirement. Remarkably, the battery lasted for 24 hours before depletion. Secondly, a tension test was conducted to gauge its ability to accurately measure different loads. Additionally, the team procured the current model for comparison with the prototype. Lastly, a temperature test was carried out to assess the insulation's capacity to withstand high and low temperatures, safeguarding the electronics within the prototype.

Wiring Schematic



We have integrated three SparkFun components—the Data Logger IOT, Qwiic Scale, and Qwiic Temperature Sensor—alongside a 3.7V 20000mAh battery and a two-state button switch for power control. The Data Logger IOT collects and processes data from the Qwiic Scale and Qwiic Temperature Sensor, then saves it to its onboard MicroSD card for later analysis. The Qwiic Scale measures the weight or force acted on the load cell, while the Qwiic Temperature Sensor monitors temperature fluctuations inside of the electronics housing.

SUMMARY AND CONCLUSIONS

The prototype belt tension data logger features Wi-Fi capability, a temperature sensor, and a sturdy aluminum housing. Off-the-shelf parts were used where possible, making repairs and manufacturing easier.

- The ratcheting mechanism has proven to be a viable solution to the problems of the previous model.
- Aerogel insulation has proven to be effective in our small-scale tests up to 425 degrees Fahrenheit.
- The device is ready for a full-scale test, on a spiral cooling freezer.

FUTURE WORK

The device requires further testing and modification to achieve the 450-degree temperature rating. One way this could be done is by fabricating a load cell housing using a high temperature case to protect and insulate the load cell. As well as replacing the plastic parts with a more heat friendly material. Programming to make a more user-friendly way to access the data would be a good addition. As well as more research into electronics with a smaller form factor.

TEAM & ACKNOWLEDGEMENTS

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- Mike Gross. **IT Director at Ashworth**

References

1 https://www.ashworth.com/