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Designing an Economical Vertical Conveyor to Model Industry Practice in Technology Lab

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Designing an Economical Vertical Conveyor to Model Industry Practice in Technology Lab

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Introduction

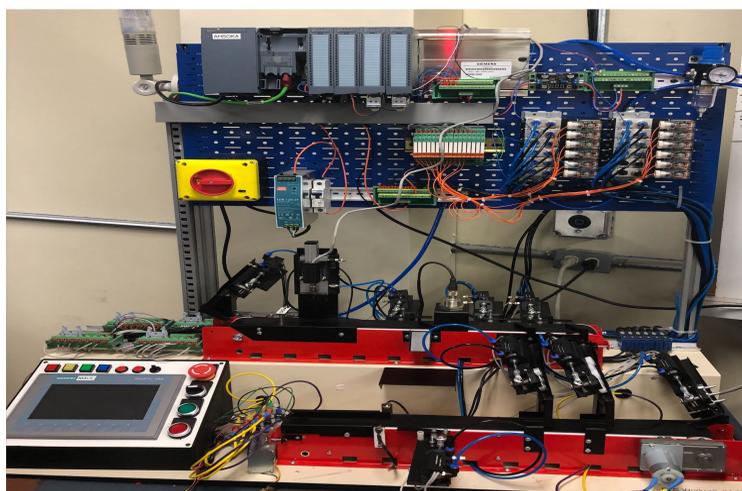
The robotics lab at East Tennessee State University is in progress to simulate an industrial work environment where robotic arms integrate with conveyor belts. Initial plan is to connect smaller conveyor belts via modules to mimic industrial conveyor belt line at low cost.

Objective

- Build an industry grade far more versatile automated conveyor belt system at minimal cost.
- Simulate an industrial facility in the Robotics lab to educate relevant workforce development training to the classroom.

Commercial PLC Module with horizontal conveyor Belt System

The current conveyor belt system costs about \$35,000. The system has operation limits such as,, being scalable, moving sensors, and replacing components.



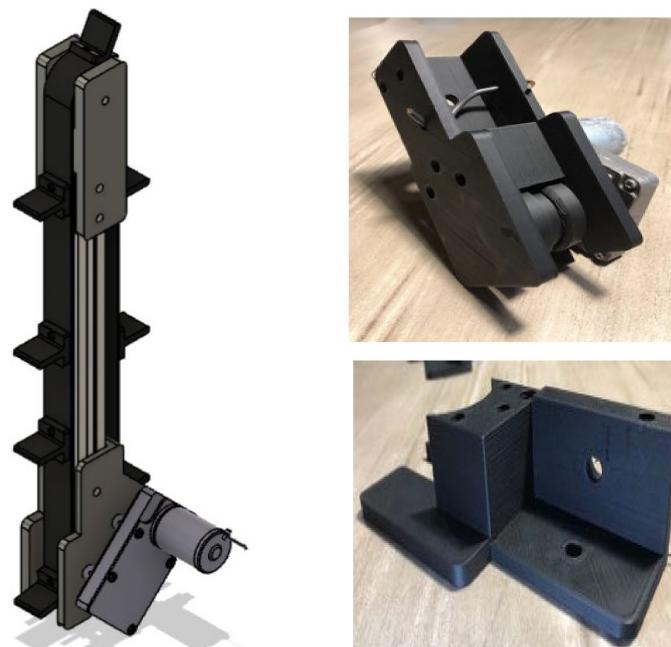
Initial plan is to create a modular system of conveyors dispensers, and other units that mimics industry style using 3D printing and inexpensive parts. This will allow smaller institutions the ability to have custom educational automation set-ups at a much lower price point.

Benefits of Vertical Conveyor Belt

- Customizable with a wide variety of attachments and perforations
- Space optimization
- Surfaces are less likely to accumulate debris
- Loading-unloading can be operated on both sides of the conveyor simultaneously

3D Design of Proposed Vertical Conveyor Belt

The following pictures showing 3D drawing of the vertical conveyor and 3D printed parts to assemble.



Advantage of Proposed Vertical Conveyor Belt Design

- T-slot aluminum allows for ease of mounting
- Belt cleat spacing can be customized without altering design
- The crowned design of the pulleys self-center the belt
- Cost per module is approximately \$200
- Easily modifiable

3D Printed Assembly Parts

- Motor Mount
- Assembly Mount
- Drive Pulley
- Idle Pulley
- Idle Pulley Mount 1
- Idle Pulley Mount 2
- Belt Cleats

Cost Analysis

- Estimate of 3D printing material cost: \$15.68
- Motor: \$52.49
- Drive Flange: \$2.40
- Bearings: \$1.99
- 6mmx30mm shaft: \$1.49
- Countersunk M4 Screws: \$4.29
- Rivet Kit: \$24.99
- Brass Heat Sink Inserts: \$16.98
- T-slot aluminum: \$6.43
- Belt: \$40.00
- Other Hardware: \$15.67

Total Cost: \$182.41

This system is comparable to \$30K system unit if buy commercially.

Conclusion

Work in progress: Build a vertical conveyor belt module. This addition will:

- Allow a new level of variability of work cell set-ups
- Teach students about industry practices such as utilizing 3D space in a facility
- Give students the opportunity alter this basic module to fit it to their use or for continual improvement.