Cyber Crew

University of Idaho

Members:
-Abdul Alhajeri

-Faihan Aldouseri

-Iulian David

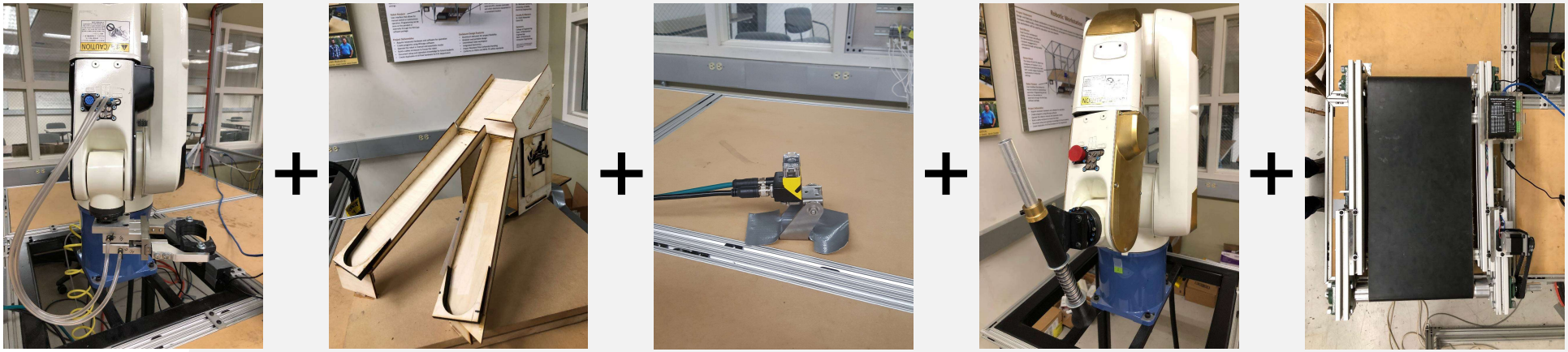
-Mark Leitner

Client:
Ankit Gupta

Advisor:
Steve Beyerlein

Mentor:
Andre Corpus

Problem Definition



Robotic Manufacturing Cell

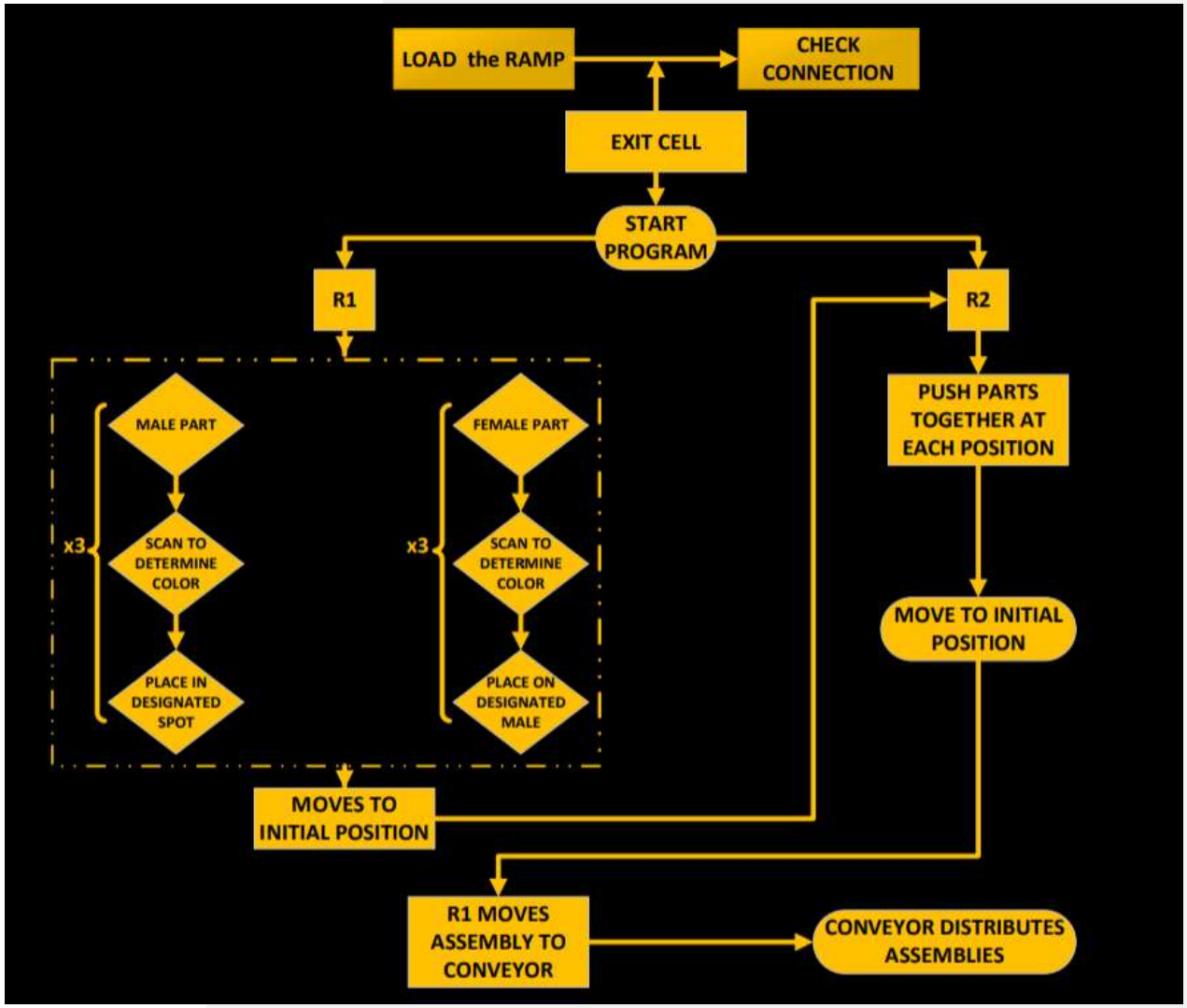
Integrate two robotic entities into a miniature assembly line, in order to make a product involving operations of barcode scanning, part manipulation, fixture design, and supervisory control.

Protocols

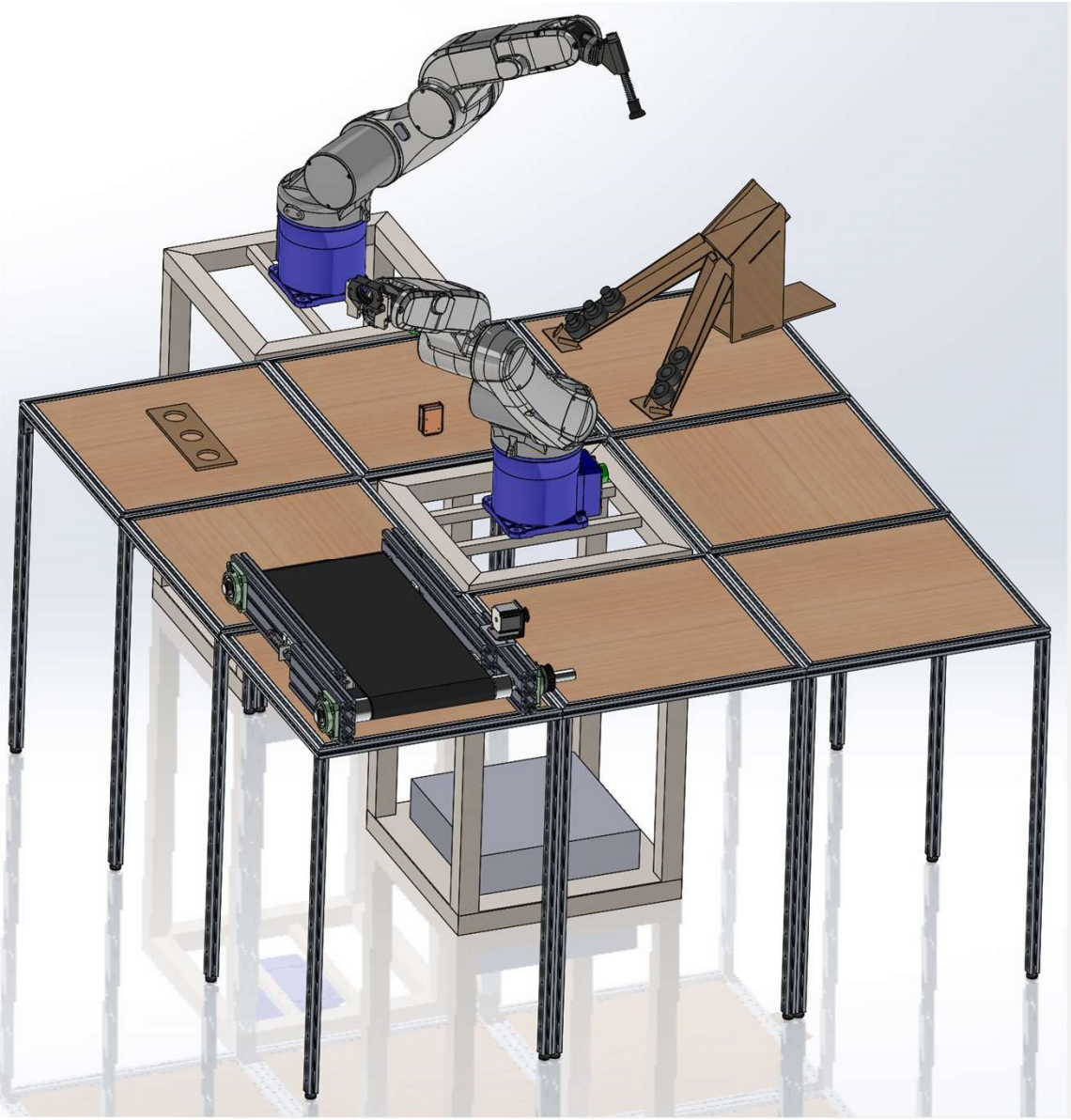
MINI I/O

Scanner Signal

TCP / IP

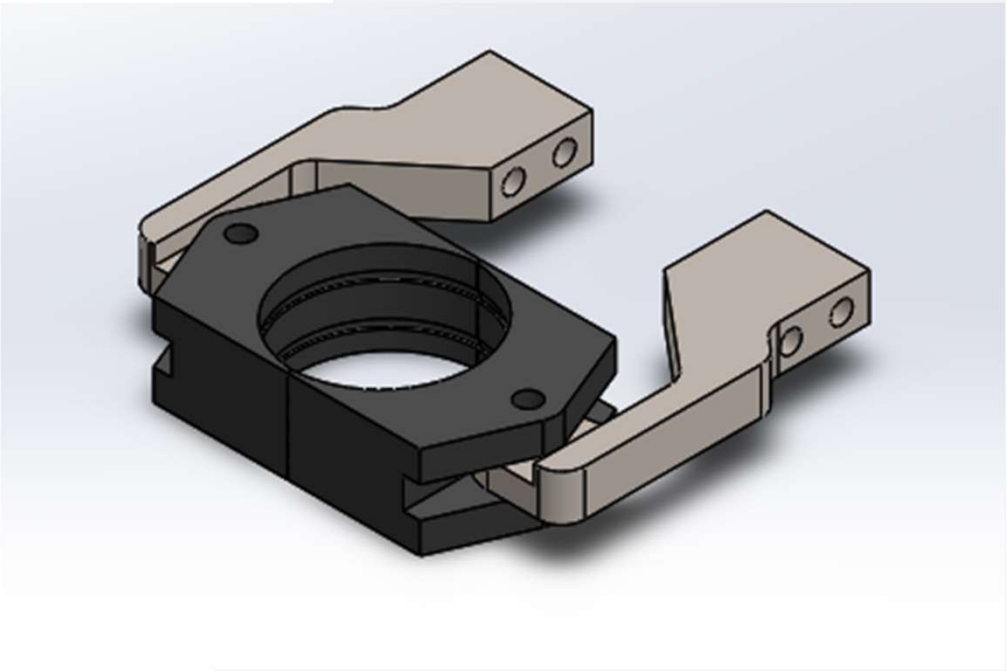


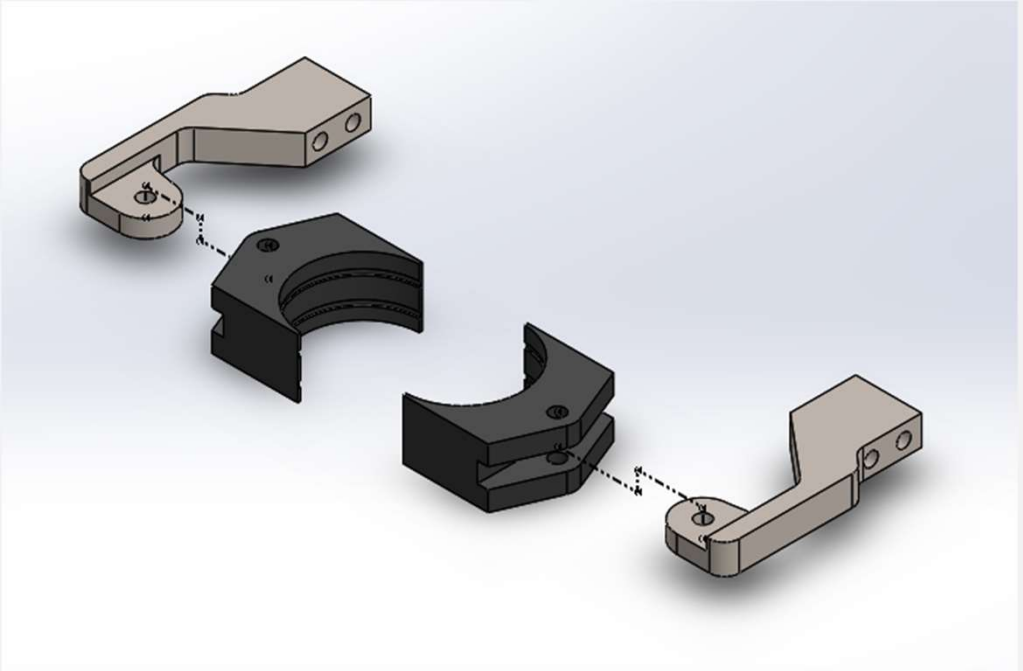
Process Description



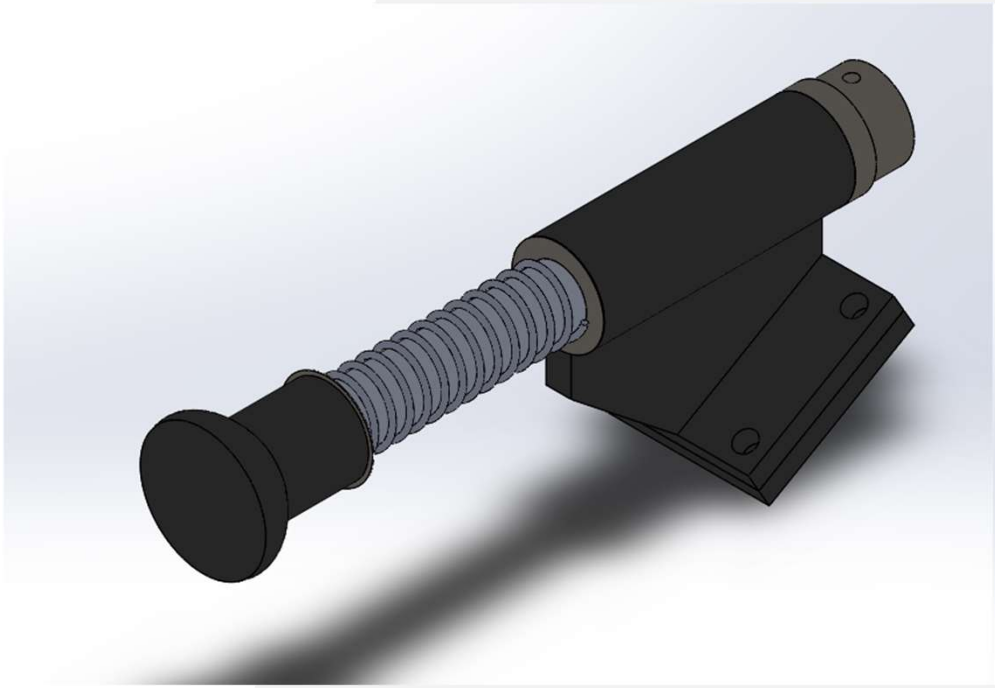
Process Walkthrough

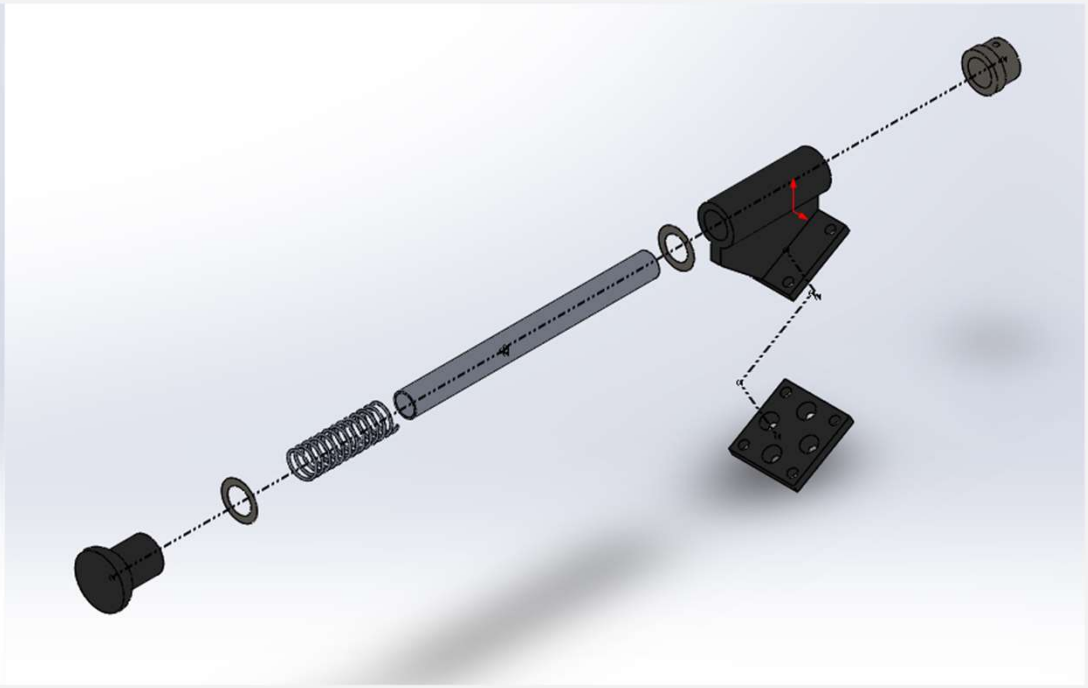
Gripper



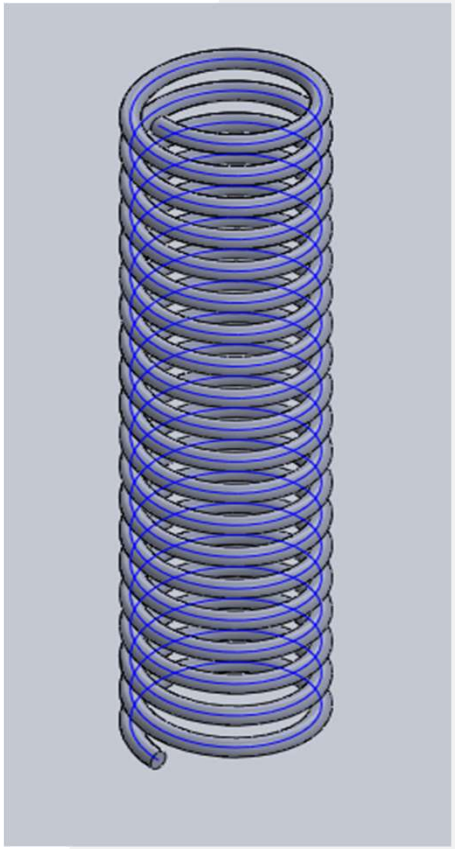


Push Finger





Push Finger



N_a=11.5 (nr. of active coils)

D_o=0.877” (outside diameter of coil)

d =0.091” (diameter of wire)

D =0.786” (average diameter of coil)

L_0 =3.100”(free length of the spring)

F_{max} =0.441 lbf (max. force needed to clamp assembly)

Spring Constant of Hard-Drawn Wire Spring:

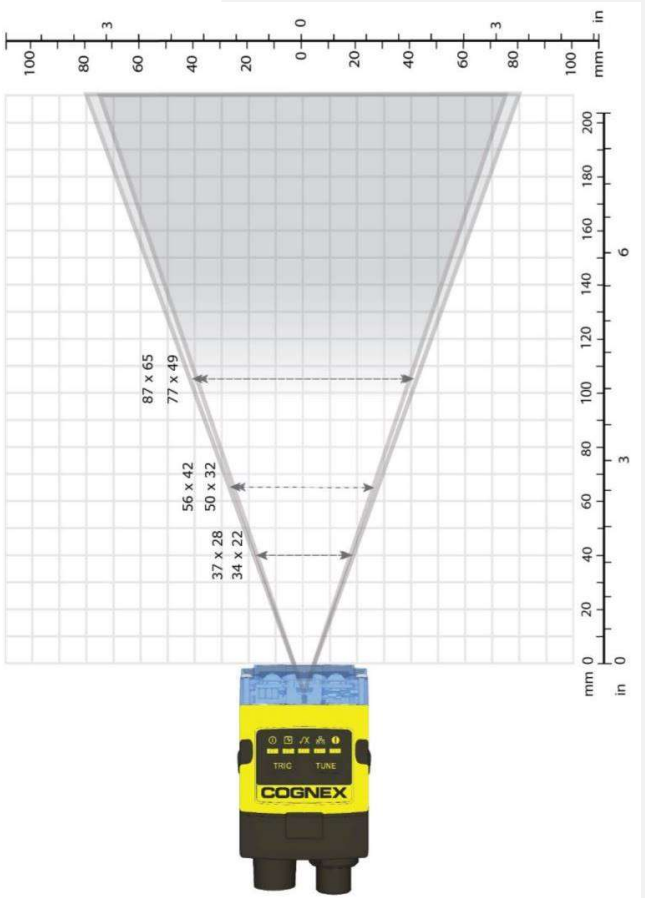
$$k=\frac{d^4 \times G}{8 \times D^3 \times N_a} = 17.65 \ \frac{lb}{in}$$

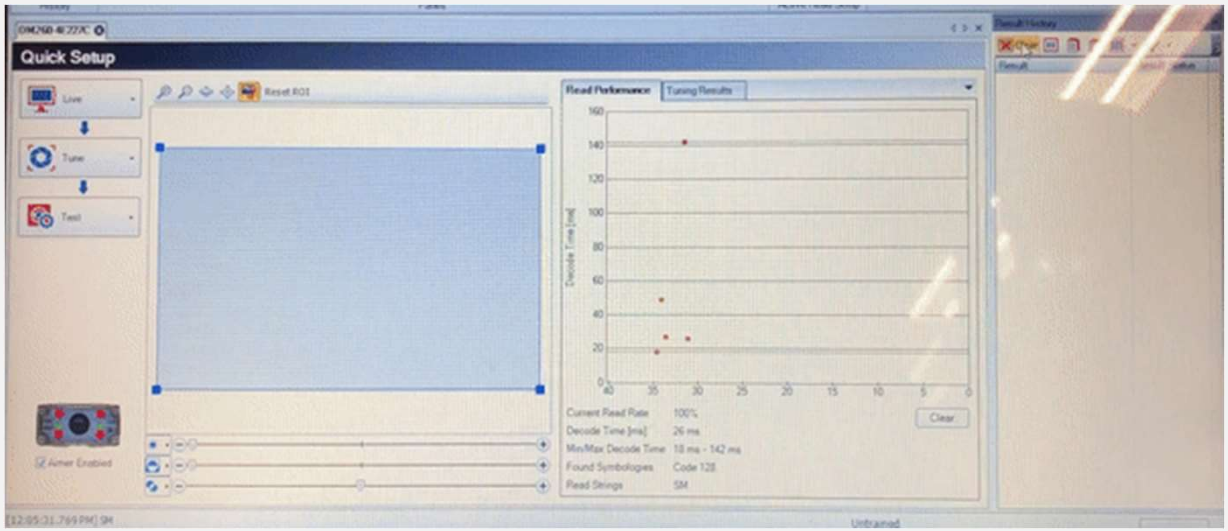
Difference of the Length:

$$(L_0 - L_s) = \frac{F_{max}}{k} = 0.024"$$

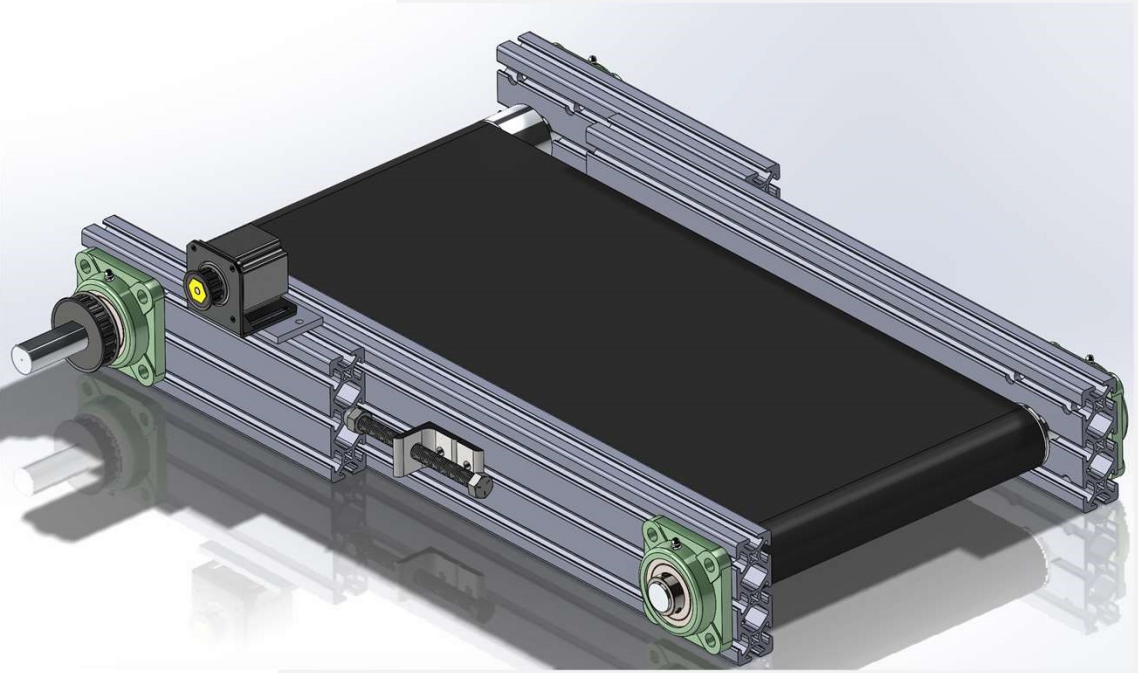
Ramp

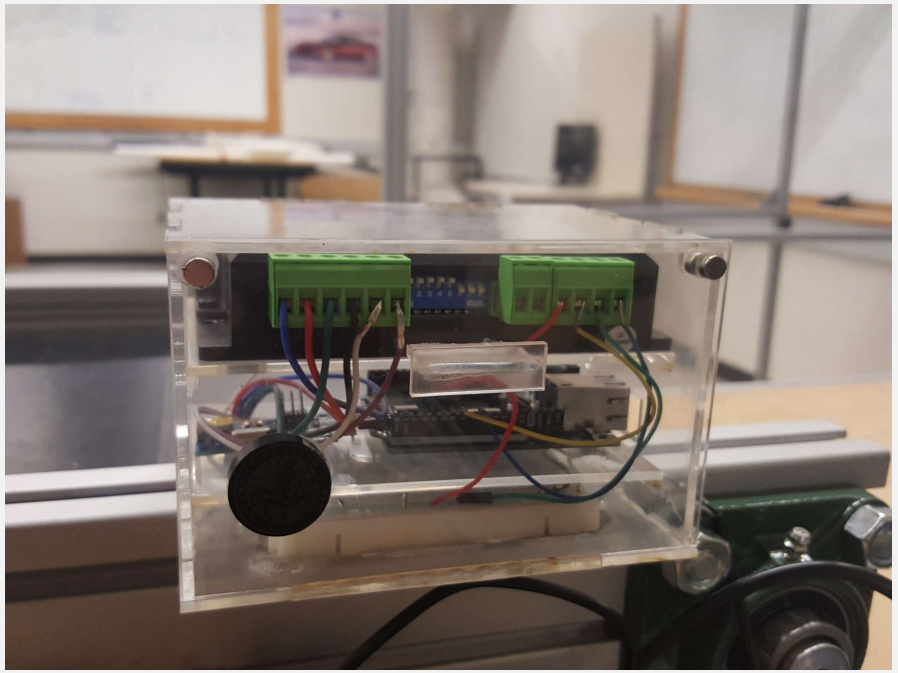
Scanner

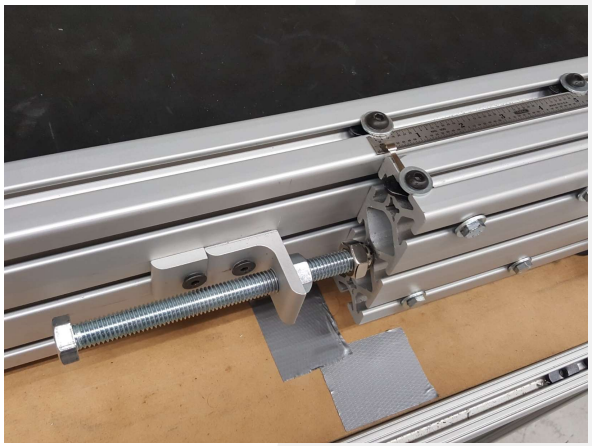

in
mm
87 x 65
77 x 49
56 x 42
50 x 32
37 x 28
34 x 22
TRIG
TUNE
COGNEX


Quick Setup
Live
Tune
Test
Reset ROI
Read Performance
Tuning Results
Aimer Enabled
Current Read Rate
Decode Time [ms]
Min/Max Decode Time
Found Symbologies
Read Strings
Clear

Conveyor







Conveyor

Friction constant of the nylon on dry aluminum

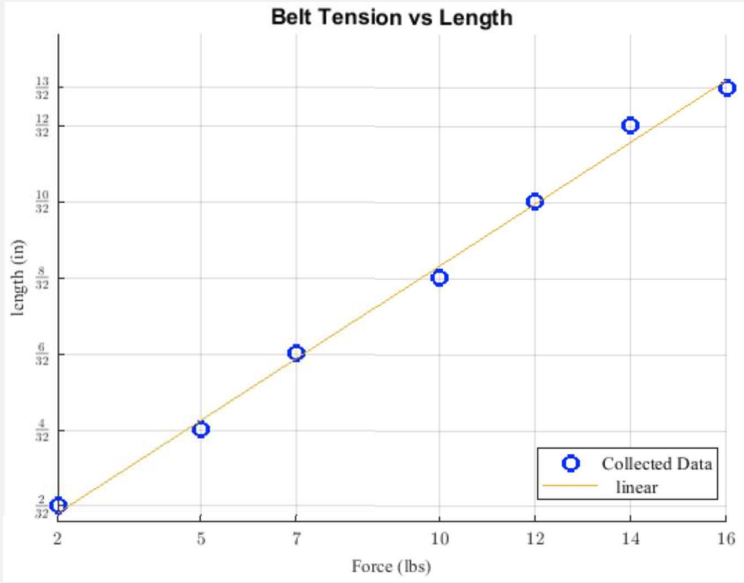
$$\mu_k = \frac{F_t}{N} = 0.21$$

Belt tension calculation

$$\theta_d = \pi$$

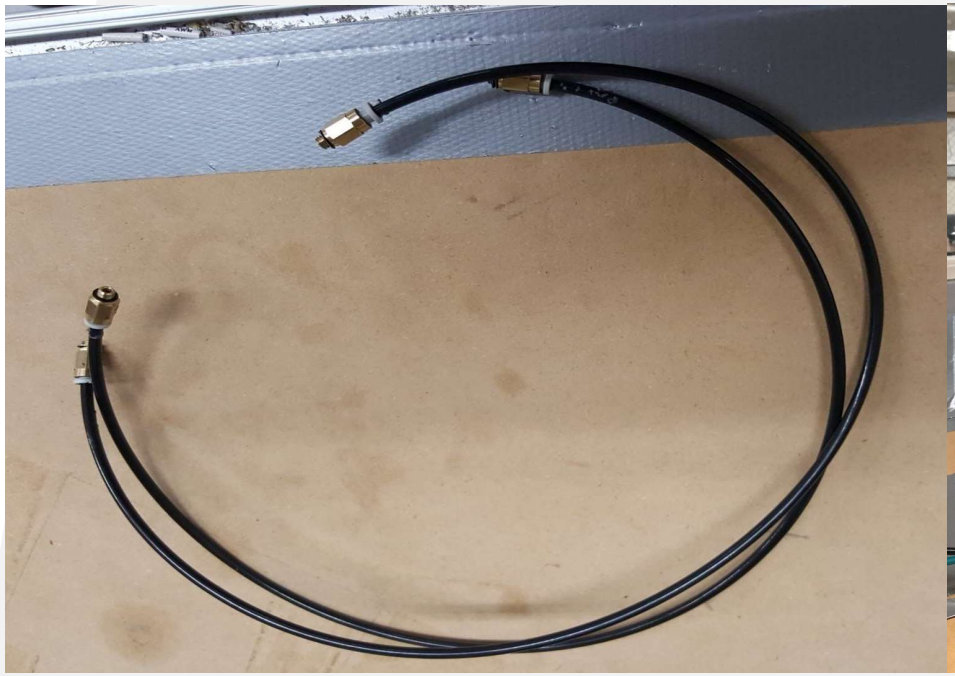
$$\frac{F_1}{F_2} = e^{f\theta}$$

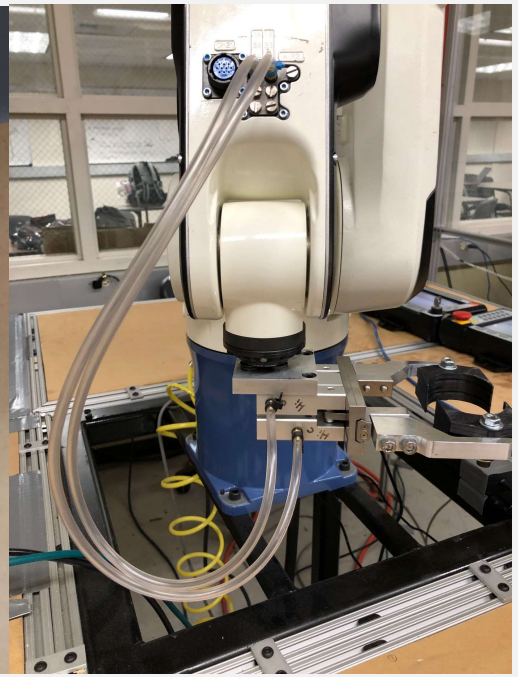
$F_i = \frac{F_1+F_2}{2} = 4\ lbs$ (Initial Tension)
$F_1 = 5.26\ lbs$ (Final Tension)



Design Validation

Problem	Test	Test Subject	Result	Action
Pneumatic hoses leaking air, making loud noise	Rotate Joint 6 (Tool Joint) 360 degrees	Robot	Hoses popping out of socket	New, more flexible air hoses





Design Validation

Problem	Test	Test Subject	Result	Action
Starting the motor via ethernet	If statement to tell whether it is connected via Serial Monitor, using Robot 1 as a server, Arduino as a client	Conveyor	Arduino not receiving a signal via ethernet from Robot 1	Use the scanner as the client, and Arduino as the server to receive a signal

Design Validation

Problem	Test	Test Subject	Result	Action
Conveyor stutter due to high friction with the pin	Running the motor at various speeds and torques	Conveyor	Higher speeds cause lower torque, and lower speeds cause higher torque	Use a low speed/high torque combination to ensure the conveyor does not stutter

Design Validation

Problem	Test	Test Subject	Result	Action
Belt slippage over the bearings, moving to one side	Varying the tightness of the belt using adjustable mechanism	Conveyor	Tightening the opposing side to the sliding produces less slippage	Insert measurement devices on each side, so each side can be measured and accurately positioned. Also increase the depth of the bearing lips.

Thank You

Lead Instructor
Dr. Steven Beyerlein

Shop Manager
Bill Magnie

Shop Assistance
Jacob Miller

Client
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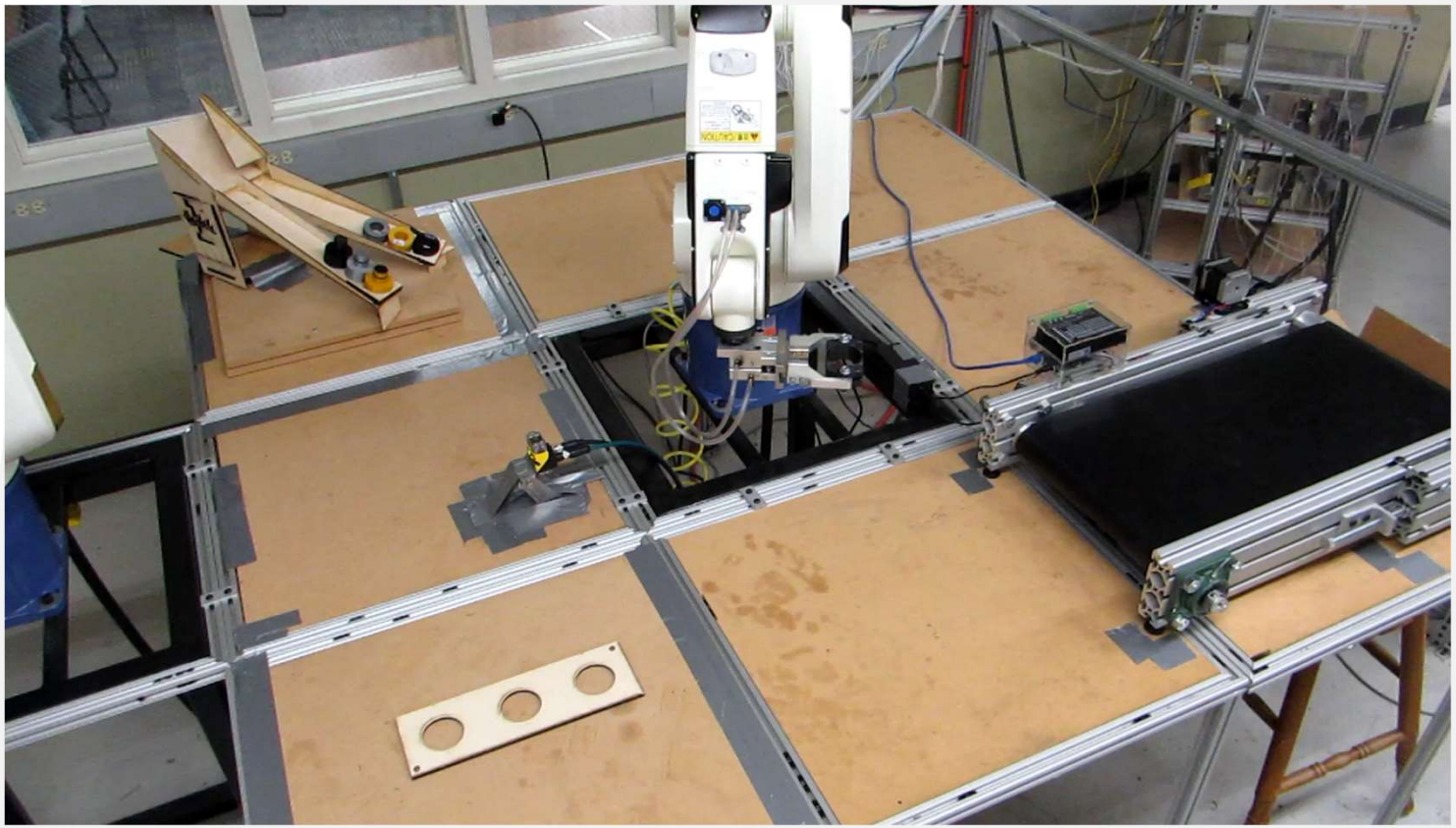
Mentor
Andre Corpus

Questions?



Future Potential

- Mechanical Material Handling System
- Adding sensors to each robot so they can run simultaneously
- More powerful conveyor
- Using pneumatic end effectors on both robots

Constraints

- Robotic arm should not hold more than 5-7 kg
- Due to limitations on Robot 2, the negative x-axis must not exceed a length of 762 mm
- In order to be picked up, the parts must have a max diameter of 2”
- The conveyor belt has a maximum running tension of 5.26 lbs.
- The power supply for the Arduino must be between 7-12V. The power supply for the controller must be between 20-50V.
- Speed of conveyor is variable, but max speed is dependent on both the belt tension and the torque.
- Estimation of reading distance range for scanner: 55-135mm above the scanner.