

# COVID-19 Autonomous Vaccine Preparation

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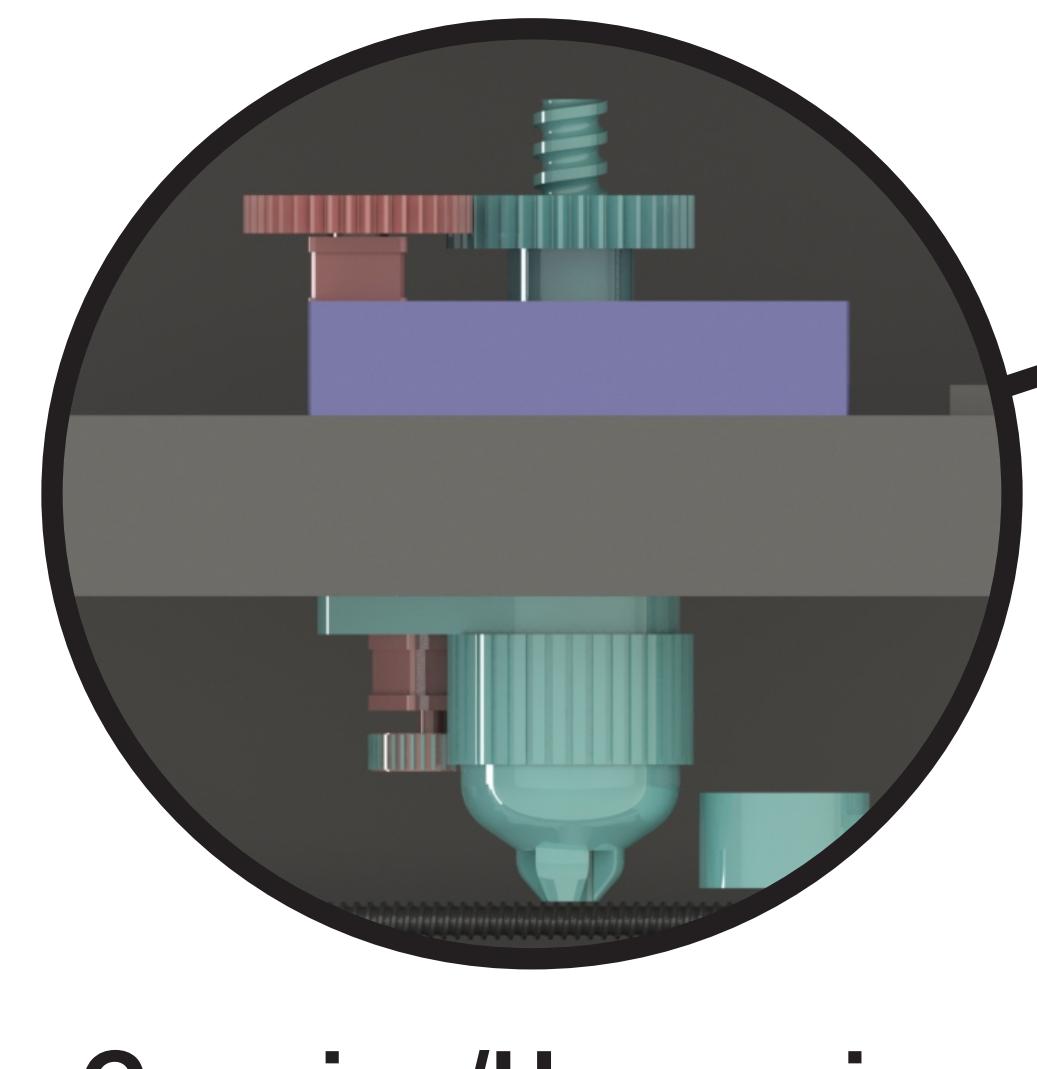
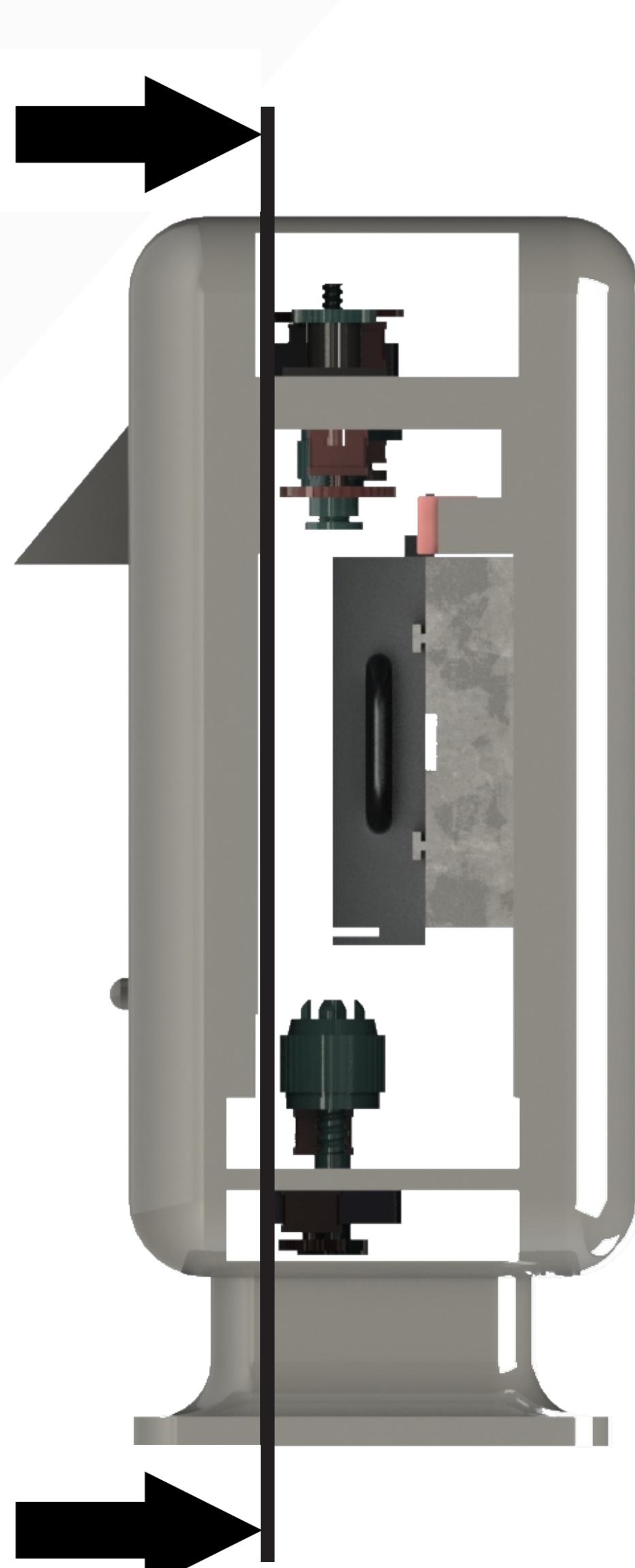
## Motivation

**Problem:** The highly infectious COVID-19 virus has resulted in a staggering number of Canadian infection cases and there is an enormous labour initiative required to vaccinate the population of Ontario.

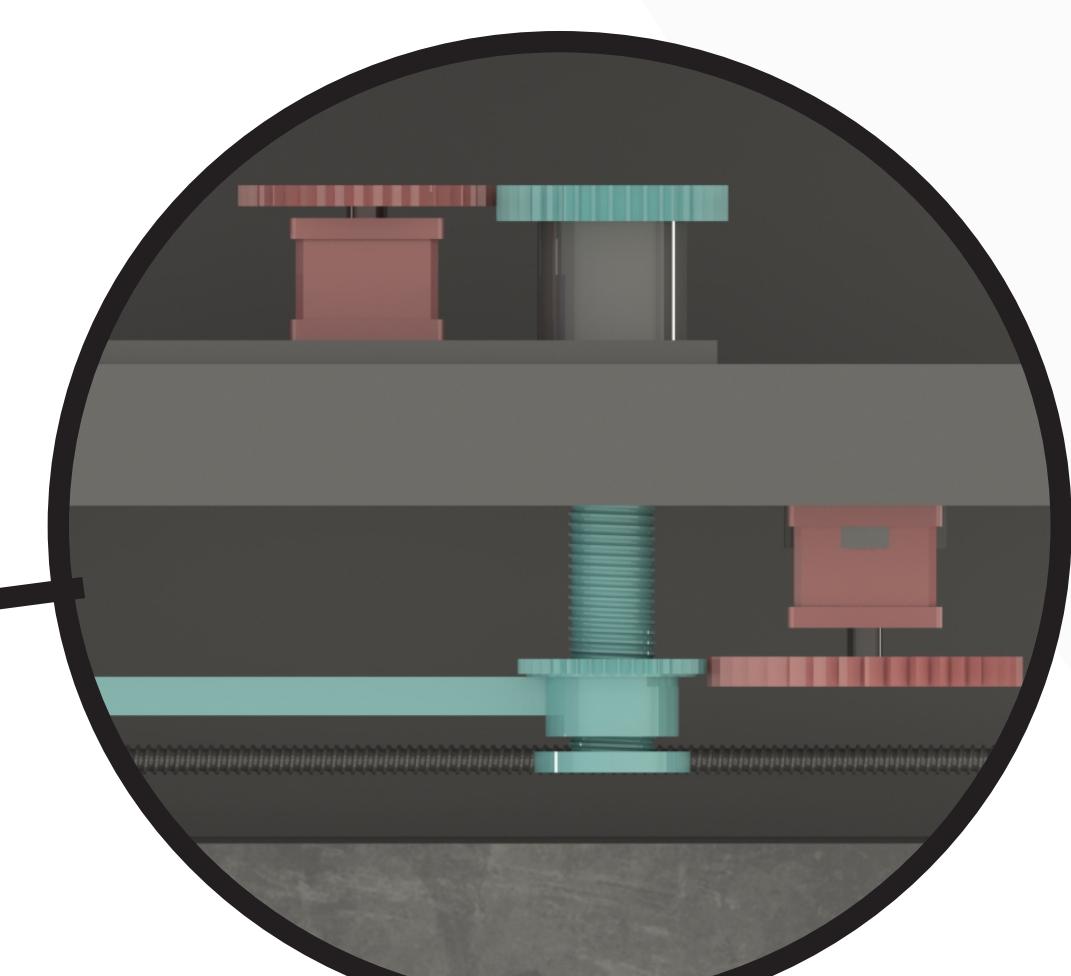
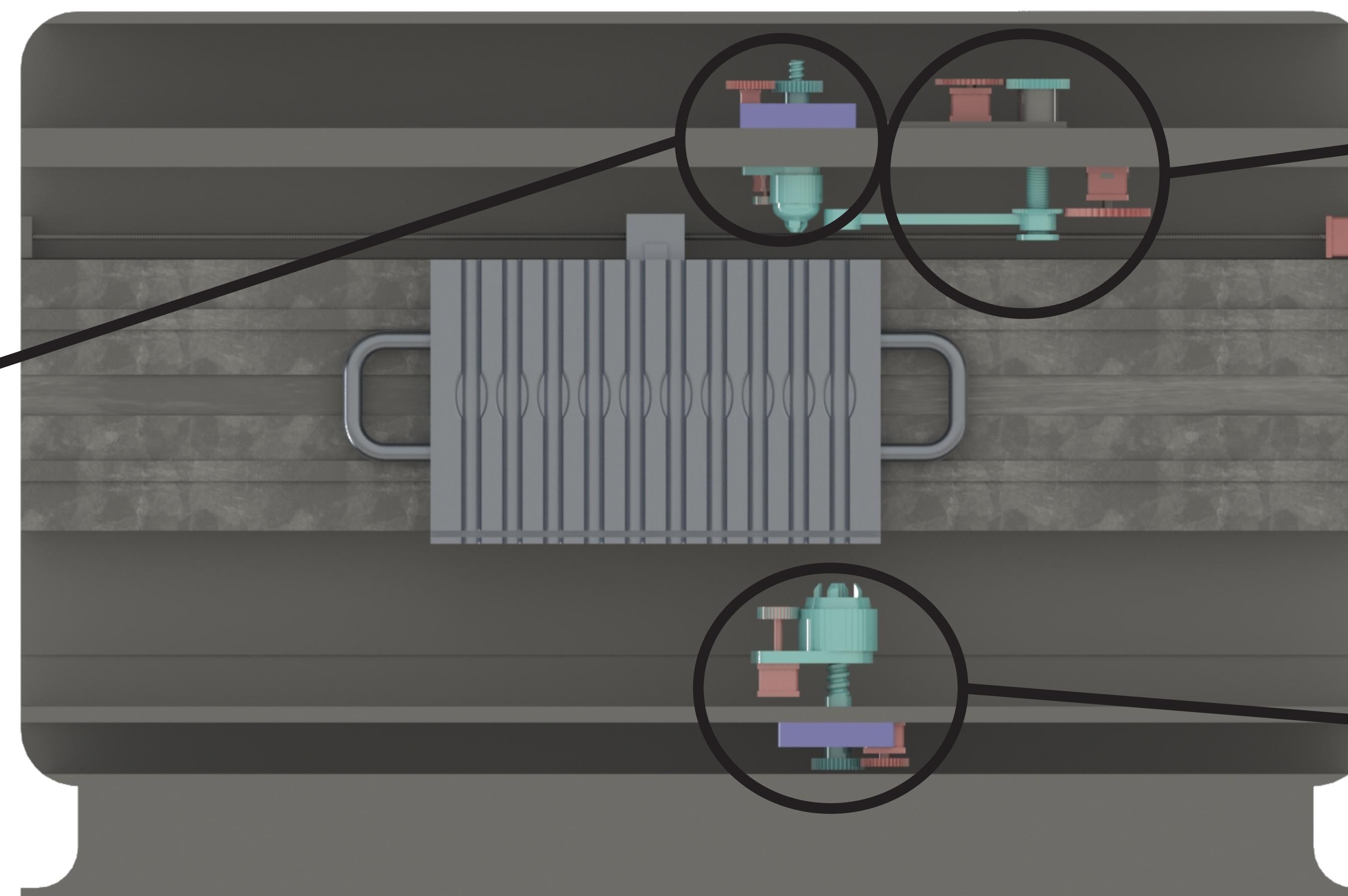
1. Ontario needs to vaccinate 8.5 million people by the end of July 2021.
2. The Ford government will spend \$52.5 million to add 3,700 workers at its hospitals and long-term care homes.
3. Automate the process of vaccine preparation to:
  - a) To promote social distancing in immunization clinics.
  - b) Prepare vaccines more efficiently than a Registered Nurse.

## Objectives

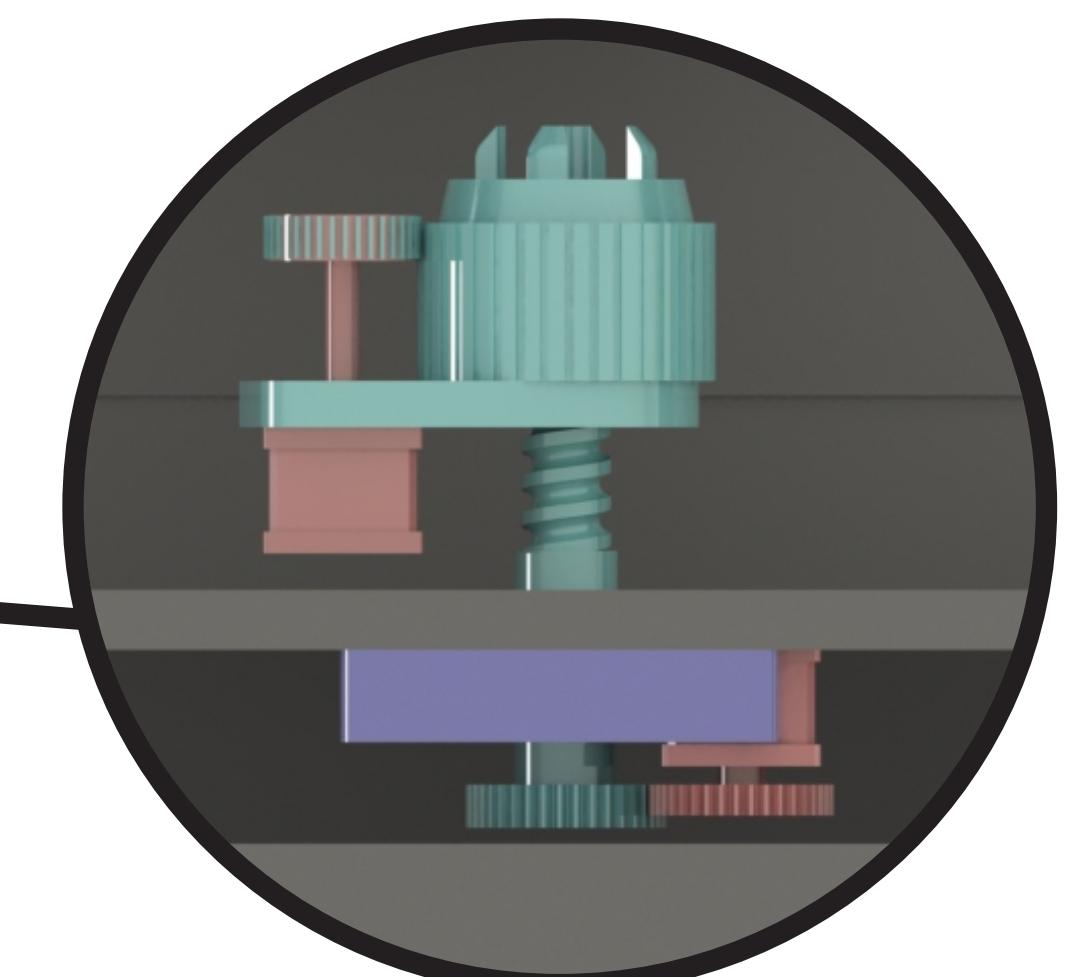
1. The device must fill the syringe with 0.5mL of vaccine with a +/- 1% error.
2. The device must have the capacity to prepare 100 syringes per hour.
3. The cost to produce one unit of the device must not exceed \$10,000.



Capping/Uncapping Unit



Vial Handling Unit



Extraction Unit

## Conclusions & Recommendations

The final cost of manufacturing one unit was well below the objective outlined at the beginning of the project.

The device is capable of a final throughput of 80 syringes per hour.

The device is adaptable for different syringe sizes and can be used with various COVID-19 vaccines.

The device was designed to be compact and portable, and is therefore suitable for use in various environments.

Testing and evaluation of a physical prototype.

## Critical Calculations

Description	Value
Acceleration of the Tray	2.31 cm/s <sup>2</sup>
Velocity of the Tray	1.21 cm/s
Positional Accuracy of the Tray	0.125 mm
Lift Force	2.52 N, 7.7245 N
Torque Required	0.0126 N·m, 0.386 N·m
Shaft Diameters	1.24 mm, 1.79 mm
Maximum Pixel Size	28.07 µm
Total Cycle Time	7.52 minutes
Power Consumption	151.56 kWh

## Cost (CAD)

**Total Cost Per Unit:** \$1,852.85

**Electronics:** \$318.34

**Sourced Parts:** \$422.57

**Custom 3D Printing:** \$1,111.94

**Cost of Mass Production (559 Units):** \$1,035,743.15