

Desktop Pick & Place Machine - Project Portfolio

Project Overview

This project was completed as part of a second-year engineering design course (MIE243) at the University of Toronto. Our team was tasked with designing a desktop-sized, automatic Pick and Place (PnP) machine for educational use, optimized for versatility, affordability, and mechanical precision. Unlike industrial-scale SMT machines, this PnP machine is compact, designed for lab or classroom demonstration purposes, and supports a range of PCB component sizes.

The machine was designed using SolidWorks, featuring a gantry-style X-Y motion system and a custom Z-axis motion module based on a rack-and-pinion mechanism. Component reels are placed on the sides and advanced automatically, while the nozzles pick and place electronic components onto PCB boards using air suction, guided by 5MP cameras.

My Contributions

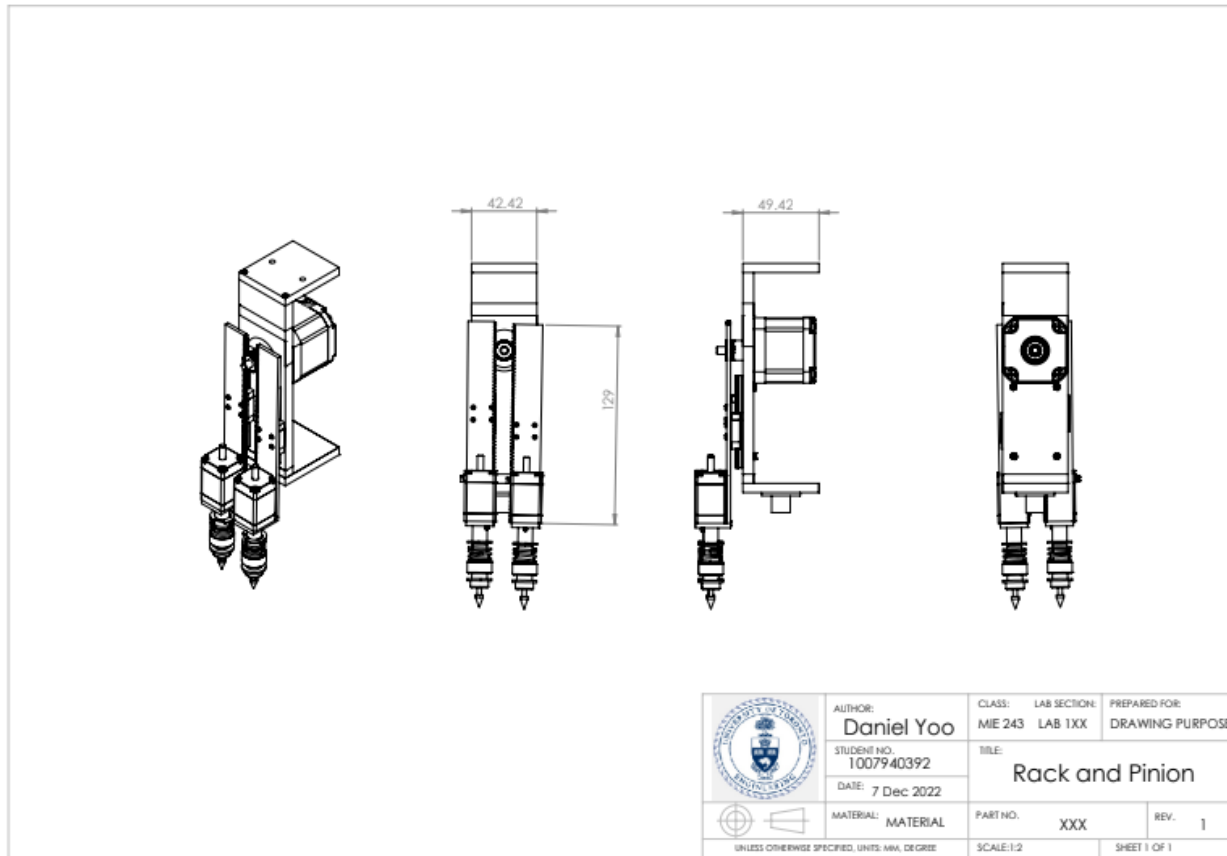
I designed the entire Rack and Pinion Z-axis module from scratch in SolidWorks. This included:

- Developing a dual-nozzle structure with individual vertical actuation
- Modeling and dimensioning gear interactions for controlled vertical motion
- Creating 2D engineering drawings and exploded views for documentation and manufacturing
- Ensuring compatibility with the main gantry and feeder system by adjusting frame clearances
- Collaborating with teammates to integrate the rack and pinion with the base assembly

The Rack and Pinion module was evaluated as the optimal design based on our weighted decision matrix, balancing precision, mechanical complexity, cost, and ease of fabrication.

Design Images

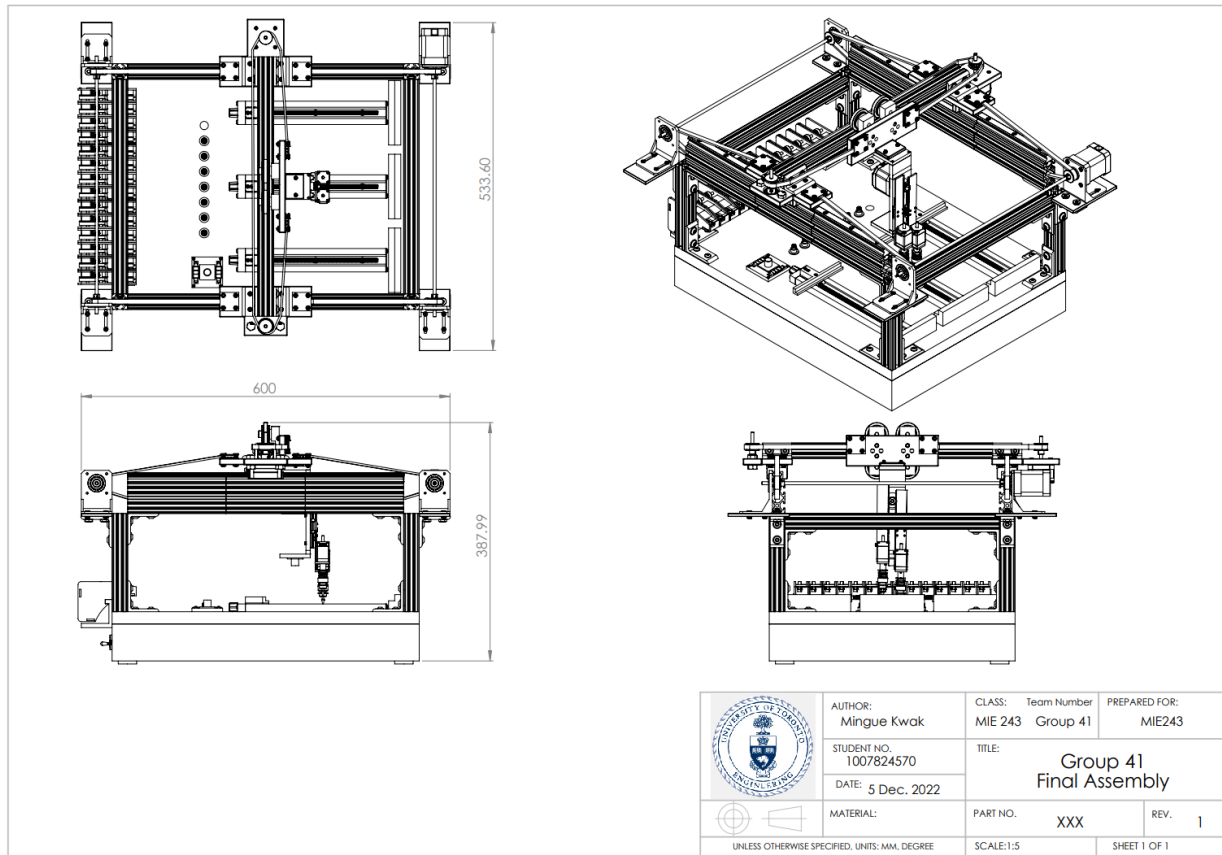
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SOLIDWORKS Educational Product. For Instructional Use Only.

Figure 1. Rack & Pinion Z-Axis Module (Designed by Daniel Yoo)

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Figure 2. Full Machine Assembly (Team Design)