

Camilo Artigas

Product Design | Robotics | Hardware

American Citizen and Aspiring Engineer
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SKILLS

Mechanical: Solidworks (CSWA), Ansys, GD&T, DFMA, FEA, 3D CAD, Rapid Prototyping, Assembly/Disassembly, Machining, Engineering Drawings, AutoCAD, Iterative Design, Root Cause Analysis, Tolerance Analysis, Actuators

Software: Python, C++, Arduino, MATLAB, Git, HTML, Automation, Web Scraping, NumPy, Matplotlib

Electrical: Altium, Circuit Analysis/Design, Electrical Troubleshooting, Serial, PWM, Stepper and Servo Motors

EXPERIENCE

Mechanical Design Intern

Sep. 2024 – Present

Sheartak Tools Ltd.

Waterloo, ON

- 3D modelled 10+ spiral cutterheads in SolidWorks, drafting technical drawings using GD&T and ensuring flawless manufacturing.
- Performed 6 cutterhead installations on planers and jointers in less than 7 hours, installing 50+ carbide blades per cutterhead while prioritizing safety at all times.
- Automated the migration of 500+ products to new website using Python, saving 30+ hours.
- Increased website engagement by 10% by launching an SEO campaign, optimizing 3000+ products' metadata.
- Earned the company 1000+ views by shooting and editing 4 installation videos, outlining best practices to customers.
- Optimized the installation time of 20+ customers by drafting 5 installation manuals.

Mechanical Designer & Project Manager

Aug. 2024 – Present

Waterloo Aerial Robotics Group

Waterloo, ON

- Lead the design of the drone's landing gear in SolidWorks for the 2025 competition, angling its legs to ensure concentricity with bucket for water retrieval; implementing depth limiters, anti-tipping bars and CF members.
- Optimized main drone assembly in PDM by implementing parametric modelling, allowing team members to change the parameters in real time, saving 10+ hours.
- Revamped an existing mount for an optical flow sensor, CV and IR camera, aligning them with the drone's direction of flight, saving weight and eliminating all vibrations.
- Manufactured aluminum 3+ parts for fixed-wing aircraft using mill and lathe, meeting all tolerances.

PROJECTS

Cycloidal Actuator | SolidWorks, 3D Printing, DFMA, Python, Stepper Motors, Iterative Design

July 2024 - Present

- Designed 130+ part assembly in SolidWorks, achieving a gear ratio of 23:1 with cycloidal speed reducer.
- Developed Python script that outputs instant visualization of the cycloid, reducing modelling time by 50%.
- 3D printed a backlash free functional prototype. Projected to machine all parts after testing torque.

3-DOF Robotic Arm | SolidWorks, 3D Printing, DFMA, Python, Arduino, Servo Motors

Apr. 2024 - July 2024

- 3D printed the robot with tight tolerances by iteratively designing it in SolidWorks and employing DFMA.
- Achieved smooth movement in the x, y and z axes by deriving the arm's inverse kinematics and implementing ramp libraries. This was facilitated by the use of 3 servo motors and 2 four-bar linkages.
- Established serial communication between Python GUI and Arduino IDE, achieving precise movement within workspace.

Autonomous Plant Watering Robot | SolidWorks, 3D Printing, C++, Sensors

May 2024 – Aug. 2024

- Reliably watered 6 plants in less than 1 minute by designing a 3D printed Peristaltic Pump with 20% occlusion.
- Converted rotational motion to linear by designing a 3D printed rack and pinion mechanism, lifting the hose.
- Achieved autonomy through the flawless integration of an ultrasonic sensor, motor encoders and C++ scripts.

EDUCATION

University of Waterloo

Sep. 2023 – Present

Candidate for a Bachelor of Applied Science in Mechatronics Engineering

Waterloo, ON

Relevant Coursework: Dynamics, Mechanics II, Data Structures and Algorithms, Materials Science, Circuits I, Calculus II

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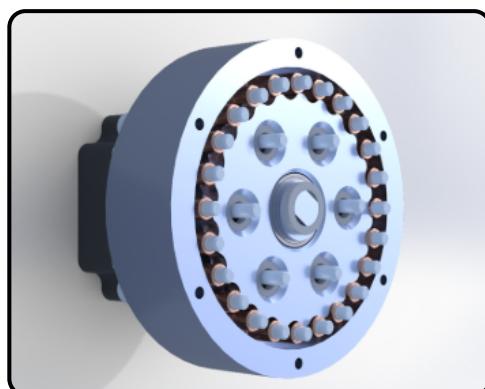
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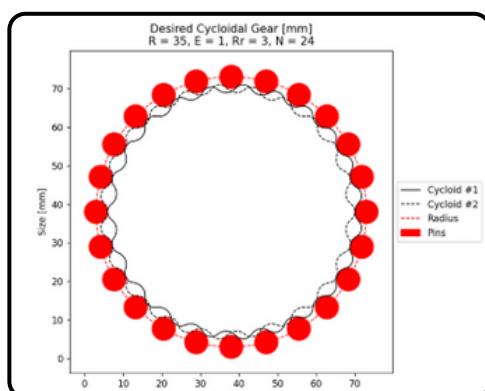
CYCLOIDAL ACTUATOR



WHAT?

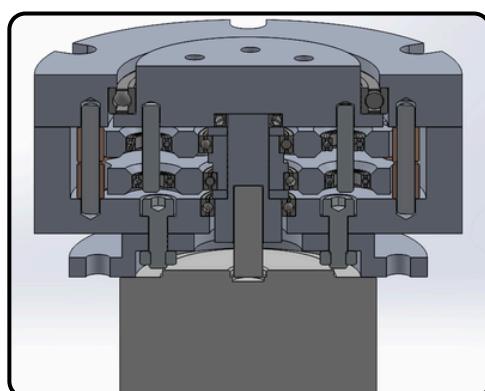
Design and manufacture a cycloidal actuator with the following goals:

- A reduction ratio (gear ratio) of 23:1.
- An efficiency above 85%.
- Ease integration with other systems.
- Robust and reliable design.
- Compact, light and compatible with a NEMA 23/17 motor.



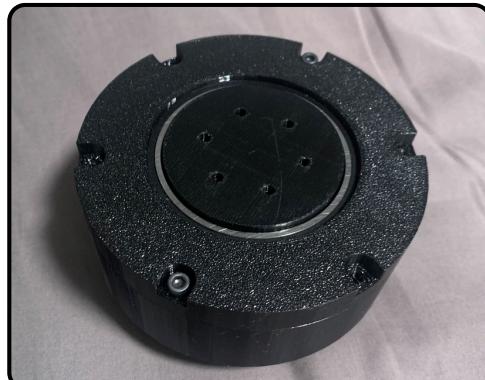
HOW?

- Used SolidWorks to draft parametric models of the drive, exploring different configurations in the process.
- Developed a Python Matplotlib script that outputs a visualization of desired cycloidal gear and its pins given geometric inputs.
- Implemented design decisions based on academic research focused on efficiency and stress concentrations.



WHY?

- I used SolidWorks' parametric design functionalities to be able to plug in parameters to get different designs. I explored designs where the torque is transmitted through an output disk or the casing.
- I used the Matplotlib script to create a quick visualization of a cycloidal disk of my choosing and parse the equations I would need in SolidWorks to generate the spline for the cycloidal gears. This made the process of settling on parameters easier and quicker.
- Decided to root decisions on proper research for better results.



RESULTS

- 3D printed a functional model after applying tolerance analysis, projected to machine all parts after testing its maximum torque and efficiency.
- Prototype showed no backlash and integrates with a NEMA 23 motor.

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ANGLED LANDING GEAR



WHAT?

- Designed the drone's landing gear for the 2025 competition in SolidWorks, angling its legs to ensure concentricity with a bucket for water retrieval.
- The design was parametric and modular to allow for two different payload configurations.
- It integrated with already existing/machined components for cost and time efficiency.



HOW?

- Used SolidWorks to create parametric models that can be accessed/modified by anyone in the team, promoting and ensuring collaboration.
- Key features include: angled top and bottom portions, carbon fiber members, anti-tipping bars and depth-limiters.
- Performed hand calculations to validate angles, structural strength and integrity.



WHY?

- Using parametric modelling and collaborative platforms (PDM) is essential for a dynamic environment - such as WARG - to fully flesh out ideas and concepts.
- The angled landing gear forms concentricity between the drone and the bucket, the carbon fiber gives a stiff and reliable frame, the anti-tipping bars are for the drone to be able to "right" itself to its home position despite disturbances and the depth-limiters were implemented due to bucket measurements being vague.



RESULTS

The landing gear has been fully manufactured, these are the results:

- It's sturdy without much tip at an angle of 20 deg with the vertical.
- Concentricity with the bucket is achieved by the angle. However, landing on the barrel was limited by the drone's PID tuning.
- The depth limiters function, they support the drone on the barrel.
- The anti-tipping bars saved the drone from tipping in 3/4 flights.

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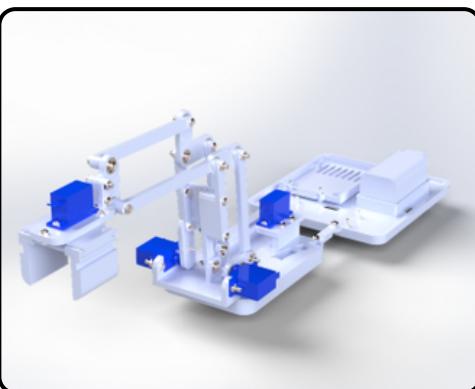
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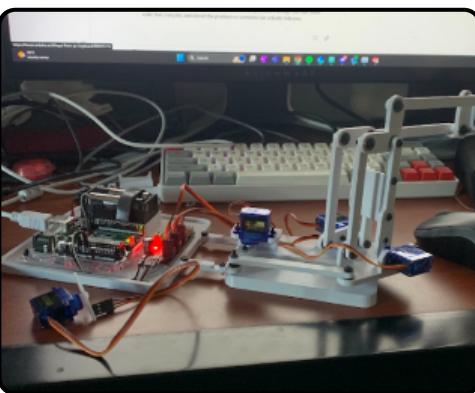
3-DOF ROBOTIC ARM



WHAT?

Design, manufacture and program a 3 DOF Robotic Arm that can perform a variety of tasks and meet the following requirements:

- Move its end effector in straight lines in the x, y and z axes.
- Be easy to control.
- Grip and move objects within its workspace.
- Keep its end effector parallel with the ground.



HOW?

- Designed the robot and the base for the electronics in SolidWorks, which were 3D printed with tight tolerances.
- Employed servo motors and a servo motor driver for the motion of the robot, which were powered by a 6V battery.
- Used an Arduino board, which with a combination of inverse kinematics, C++ scripts and a Python GUI to control the robot.
- Ensured the parallelism of the end effector with the ground with four-bar linkages.



WHY?

- I cadged the model in SolidWorks due to its use in the industry and versatility. I chose 3D printing due to its prototyping speed.
- I selected servo motors due to their straight forward position control and decided to drive them with a servo driver for consistent results.
- I decided to go with Arduino due to its vast documentation and I employed a Python GUI due to its modularity.
- I used four-bar linkages due to their ease of integration and effectiveness.



RESULTS

- Due to GUI control, the robot was able to move in smooth straight lines to any point within its workspace and grip objects.
- With the four-bar linkages, the end effector remained parallel to the ground, facilitating object pick up.
- Demonstrated consistent and reliable results across the board.

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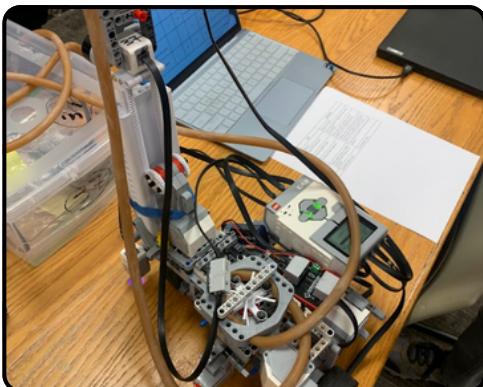
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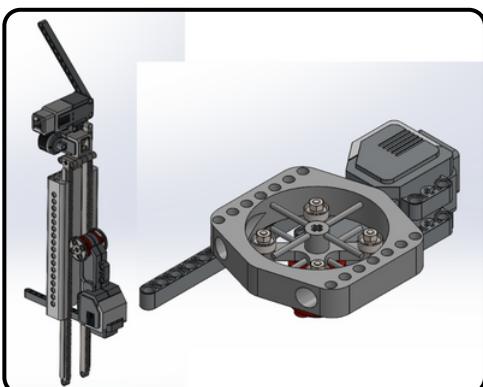
AUTONOMOUS PLANT WATERING ROBOT



WHAT?

For our programming course, we were tasked to create an autonomous lego EV3 system that would meet engineering specifications set by ourselves, we came up with the following:

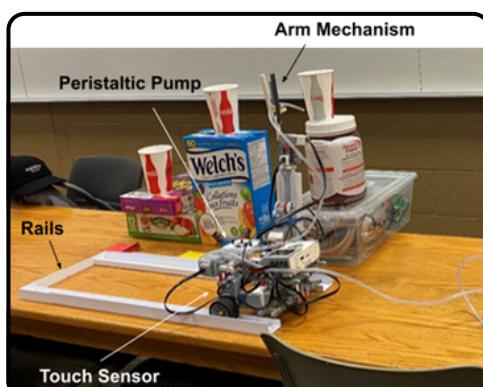
- Be able to reach plant pots that are more than 30 cm in height.
- Must deliver the right amount of water to 6 plants in a row.
- Must be able to detect height correctly with an ultrasonic sensor.



HOW?

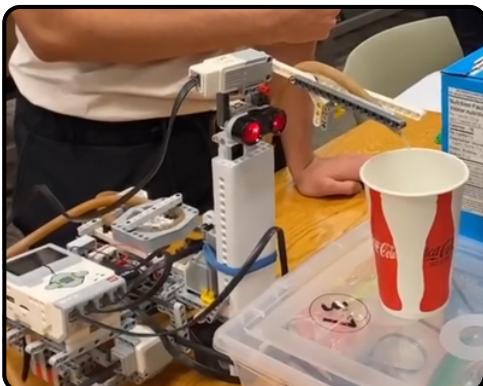
My duty was to find the mechanical solutions to the specifications, I implemented the following by using SolidWorks and 3D printing:

- A peristaltic pump with 20% occlusion, effectively squeezing the tubing to deliver water to each plant.
- A rack and pinion mechanism to lift and lower the ultrasonic sensor, which would also implemented a rotating arm for when the sensor reached the desired height.



WHY?

- I decided on a peristaltic pump due to its reliability and ease of prototyping. I ended up going through 4 prototypes before getting reliable flow. The 20% occlusion rate was critical, as it provided a steady and powerful flow which was made possibly by our flexible and soft tubing.
- I used a rack and pinion mechanism due to its ease of integration to the EV3 environment.



RESULTS

- The pump was able to consistently supply water to 3 different plants twice (6 times) and the rack and pinion mechanism was able to reliably elevate/lower the ultrasonic sensor throughout.
- The mechanical systems were able to properly respond to C++ scripts, in turn fully integrating with the sensors and encoders. This allowed the system to be fully autonomous.