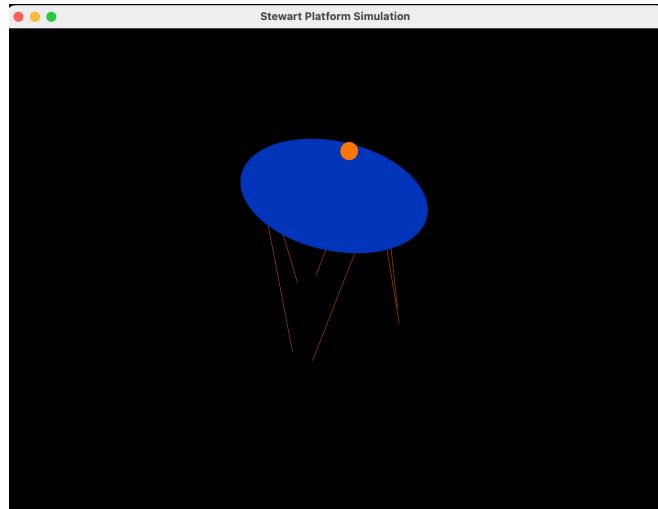


Project Portfolio

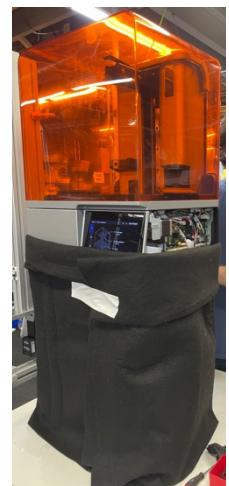
Shabd Gupta – Mechatronics Engineering at University of Waterloo

Ball Balancing Game



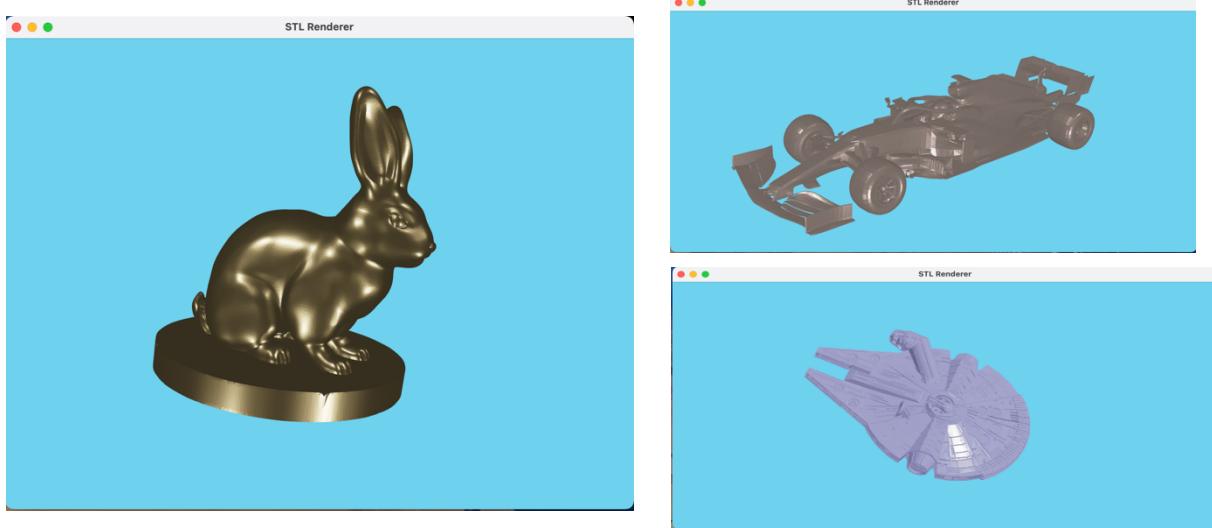
- Created a stewart platform simulation with kinematics for a ball and simplified contact physics.
- Used C++, OpenGL and GLSL for graphics, and GLFW for window management and user input.
- Challenge for the player to balance the ball as long as possible

Formlabs Hackathon



- Modified a Form 4 printer to experiment printing with novel resin formulation and print technique.
- Leveraged REST APIs to control a Vestaboard with live production data to display the number of printers manufactured.
- 3D printed 15+ with various materials on SLA/SLS printers.

Graphics Rendering Engine using OpenGL



- Developed a primitive graphics engine to render STL files with accurate lighting with various material properties.
- Leveraged GLSL to create a graphics pipeline to implement Physically Based Lighting and Blinn-Phong.
- Implemented user-input controls to provide drag rotation, zoom-in and material change using GLFW.

<https://github.com/Shabd034/StlRenderer>

Toyota Innovation Challenge (Autonomous Sticker Detector)

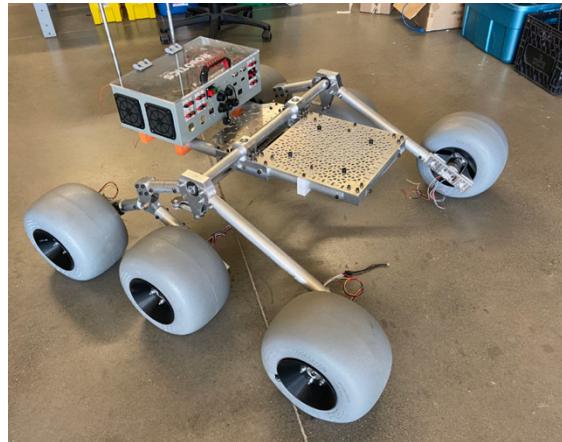


Different colors represent stickers and holes

- Detected and classified holes and stickers on an aluminum extrusion using **OpenCV** and a **CNN**, with 98% accuracy.
- Built a data collection and processing pipeline with **Canny edge** and **blob detection** to locate holes and stickers.
- Interfaced and overlayed results from the processed data pipeline in real time on a live camera feed.

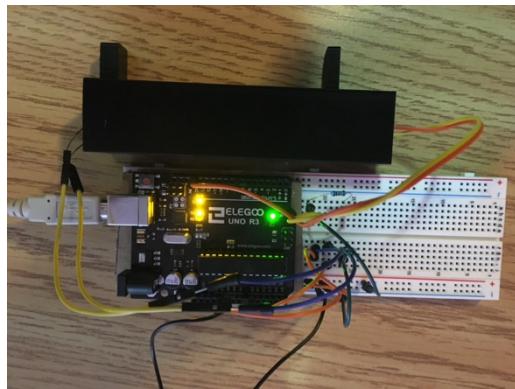
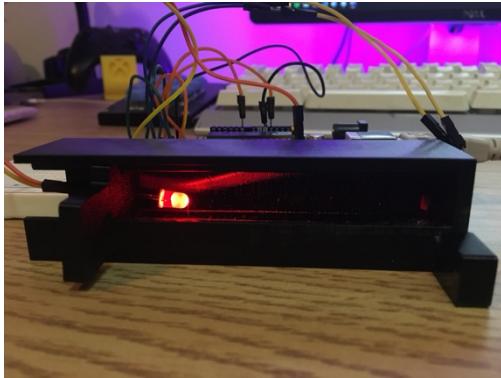
<https://github.com/owenmoogk/toyota-stickers>

UW Robotics Design team



- Designing, building, and programming a Mars rover to compete in the University Rover Challenge.
- Redesigned rover chassis using skeletal modelling principles to implement use of carbon fibre tubes.
- Prototyped and machined parts using **CAD**, machine shop tools and 3D printing. Assembled and tested PCBs.
- Gained proficiency in **PCB** design using **Altium**. Assisted in designing a buck convertor using a buck controller IC.

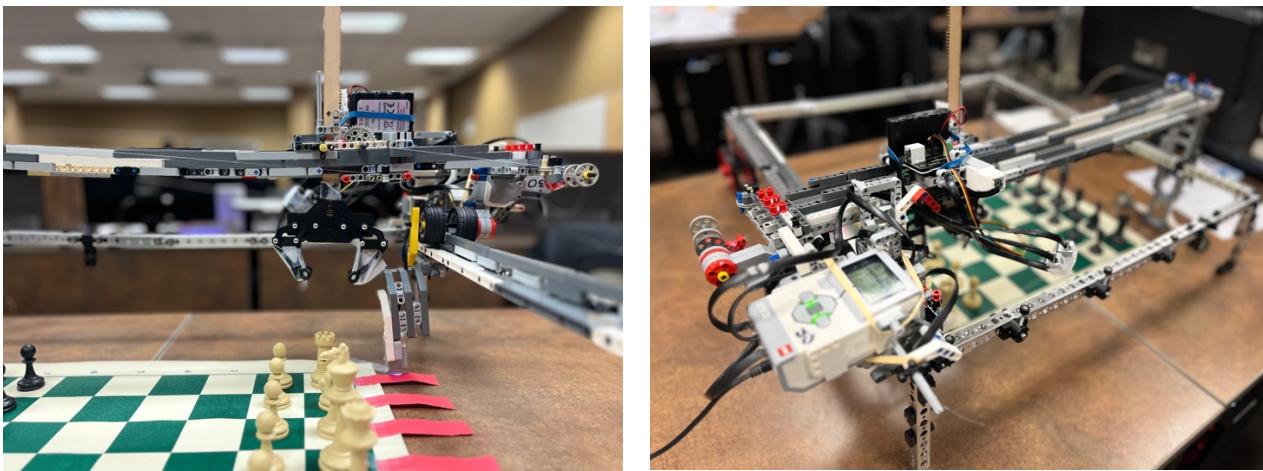
Light Calipers (University Project)



- Created a caliper to use photoresistor and LED to calculate length of an object. Made for a statistics course to learn about calibration and random error.

<https://github.com/owenmoogk/light-calipers>

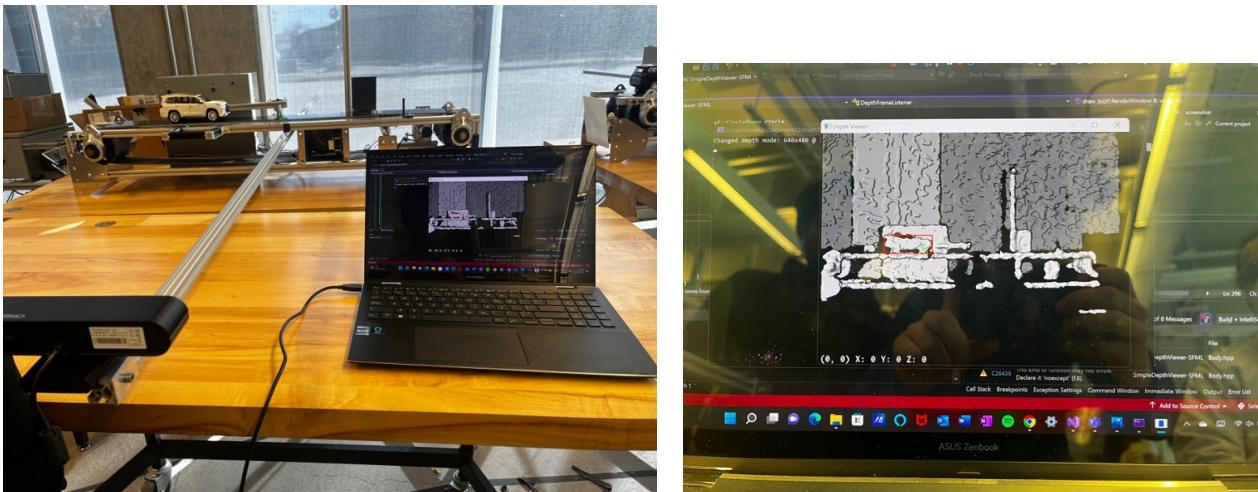
Robotic Chess Player at the University of Waterloo



- Designed and assembled a chess playing robot which moves on two-axes, using a pulley system and a rail mechanism to precisely pick up and place pieces
- Implemented agile development techniques with robust error handling using RobotC, ensuring precise movements based on inputs from motor encoders, touch sensors, and colour sensors

<https://github.com/EidanErlich/CarlBot>

Toyota Innovation Challenge at the University of Waterloo



- Led a team to develop an autonomous machine vision algorithm within a simulated manufacturing environment
- Tracked a 1:24 scale model car and its wheels using a depth camera and C++ on an assembly line
- Recorded the real time position of the car with an event trigger at a predetermined location

<https://github.com/EidanErlich/Autonomous-Machine-Vision-Algorithm>

Game Development

- Led a team in developing a single player dinosaur game using Object-Oriented Programming in Java
- Employed breakdown problem solving techniques and OOP methodology in Java to create a Pong game with both single player and two player modes, a player-vs-player mode and a player-vs-computer mode