My Portfolio

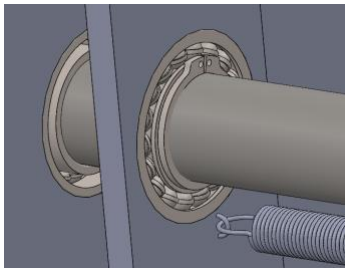
MECHANICAL ENGINEERING AT THE UNIVERSITY OF Ottawa —— Ahmed Yassine Ben Ayed

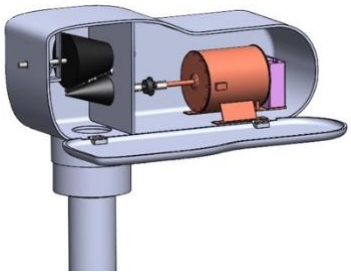
Summary

I am a 3rd-year Mechanical Engineering student at the University of Ottawa with strong interests in **automation systems (PLC, Arduino, embedded control)** and **CAD design**.
I enjoy working on engineering projects that combine **hands-on design with project leadership**, where I can contribute both technically and by guiding a team towards successful deliverables.

This portfolio highlights a selection of my most relevant **academic, professional, and personal projects**. Each project page follows a clear *What / How / Results* structure with visuals, and **all project titles are clickable links** to the corresponding GitHub repositories containing documentation, CAD models, and code.

Wind Turbine Nacelle





What?

- Designed a reliable nacelle for a horizontal-axis domestic wind turbine (client: Eole).
- Targeted Ontario's weather conditions and domestic energy needs.
- Delivered a complete report with CAD models, calculations, and assembly drawings.

How?

- Developed subsystems:
  - **CVT speed regulation system** for smooth adaptation of rotor speed to generator.
  - **Fail-safe braking system**
  - **Yaw control** with ring gear and pinions.
  - **50 kW permanent magnet generator** + **LiFePO4 battery** for storage.
- Integrated bearings, shafts, couplings, and optimized materials (fiberglass, steel).
- Modeled in SolidWorks, with detailed CAD and 2D drawings.

Results

- Produced a full design meeting client requirement for efficiency, durability, and maintainability.
- Optimized robustness and ease of assembly/maintenance with local materials.

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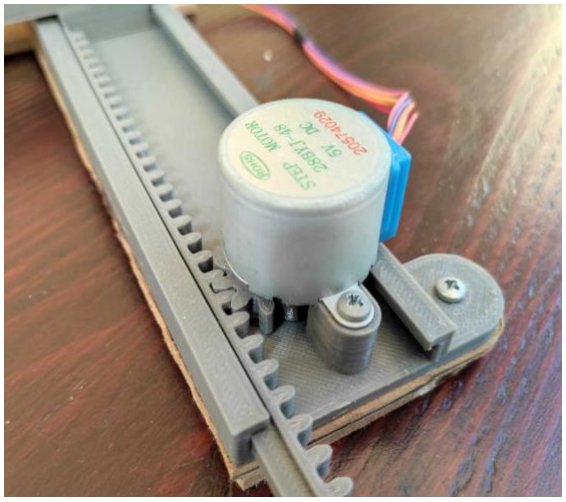
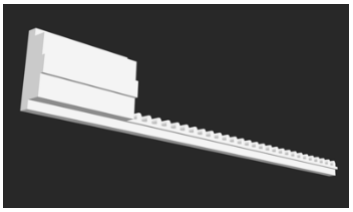
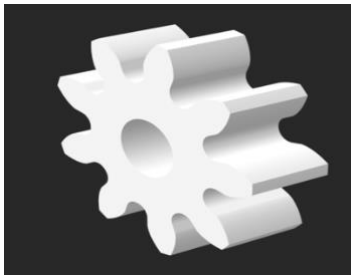
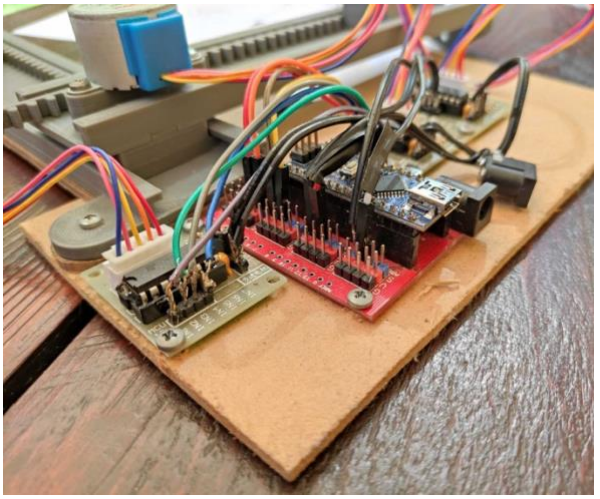
2D Mini Printer









What?

- Designed a prototype linear actuator using a 28BYJ-48 stepper motor, Arduino Nano and SolidWorks.
- Intended for precision motion applications (e.g., CNC mini-systems, automated mechanisms).

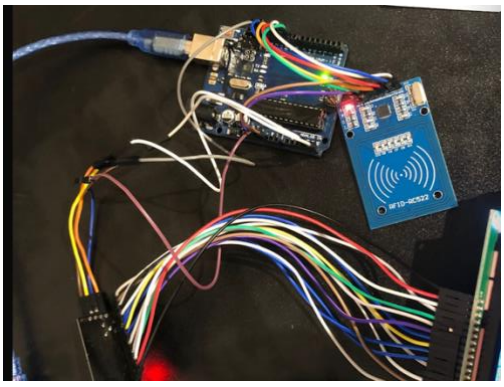
How?

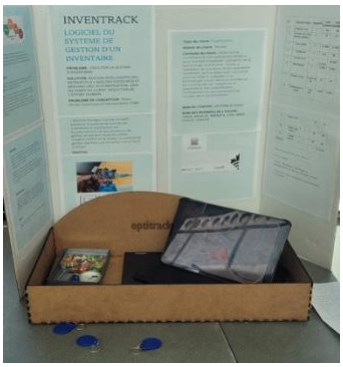
- Built with 3D-printed components (rack, pinion, sliding rail, holders) on a wood/MDF baseplate.
- Controlled via Arduino + ULN2003 driver, enabling step control and calibration routines.

Next Step

- Prototype partially functional; identified issues in **smoothness**.
- Next iterations will integrate **end-stop detection**, improved 3D-printed tolerances, and optimized Arduino code for smoother motion.

Inventory Management System - Inventrack





What?

- Designed and implemented an **RFID-based inventory system** to automate check-ins and check-outs.
- Developed as part of a university project with **Shared Services Canada** as client.

How?

- Built using Arduino UNO, RC522 RFID reader, tags, LEDs, and buzzer for real-time feedback.RC522 RFID reader.
- Integrated with **Excel via PLX-DAQ** for live data logging (date, time, UID) and visualization.

Results

- Fully functional demo presented with **poster + live system**.
- Improved **traceability** and reduced **manual errors** in inventory management.
- Reduced project costs by **55%** through optimization strategies.

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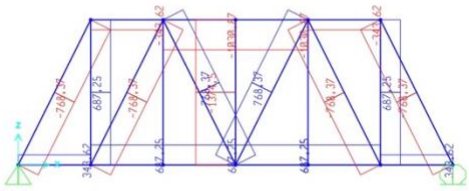
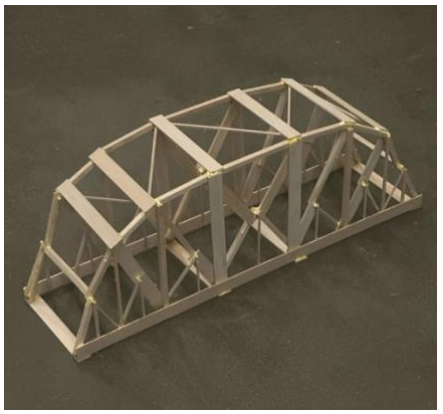
Pennsylvania Truss Bridge





What?

- Designed, analyzed, and physically built a **Pennsylvania truss bridge** as part of the Mechanics of Materials course.
- Compared two truss types (**Pratt vs. Pennsylvania**) and selected the Pennsylvania truss for its superior rigidity and load capacity.

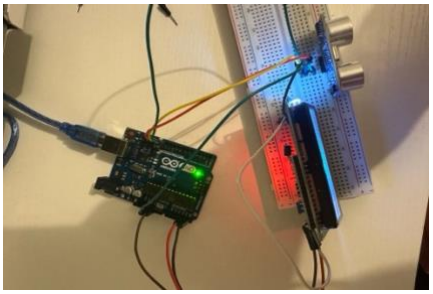
How?

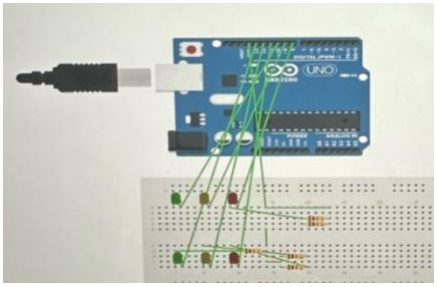
- Performed **manual calculations** (static equilibrium, joint method, buckling/stress checks).
- Modeled and validated the bridge using **SAP2000 simulations** under applied loads.
- Optimized cross-sections for stability and material efficiency.
- Constructed the bridge using **balsa wood**, based on calculated results.

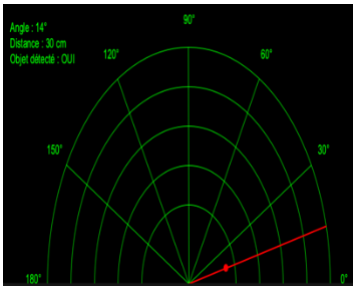
Results

- Final bridge weight: **200 g**.
- Load resisted: **940 N**.
- Achieved a **load-to-self-weight ratio of ~234x**.
- Successfully demonstrated a balance between theoretical design and practical construction.

Arduino







What?

- Developed several prototypes using **Arduino microcontrollers** for automation and data acquisition.

How?

- Integrated various sensors (RFID, motion, environmental, distance) with Arduino and Processing/Excel for real-time monitoring and control.

Results

- Gained strong hands-on experience in embedded systems and rapid prototyping, with functional demos presented in academic settings.