# My Portfolio

MECHANICAL ENGINEERING AT THE UNIVERSITY OF Ottawa

Ahmed Yassine Ben Ayed

# **Summary**

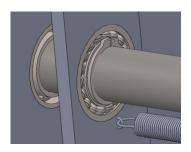
I am a 3rd-year Mechanical Engineering student at the University of Ottawa with strong interests in automation systems (PLC, Arduino, embedded control) and CAD design.

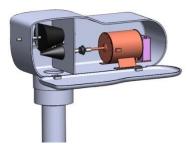
I enjoy working on engineering projects that combine hands-on design with project leadership, where I can contribute both technically and by guiding a team towards successful deliverables.

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.

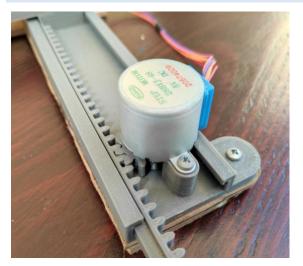
### Results

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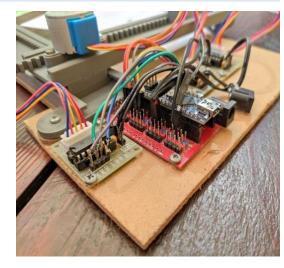
MECHANICAL ENGINEERING AT THE UNIVERSITY OF Ottawa ——— Ahmed Yassine Ben Ayed

# 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).

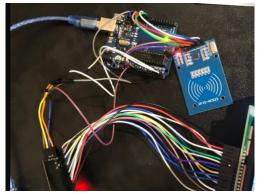
#### How?

- 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.

#### Planned Improvements

- 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**



- 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.



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#### How?

- Built using Arduino UNO, RC522 RFID reader, tags, LEDs, and buzzer for realtime 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.

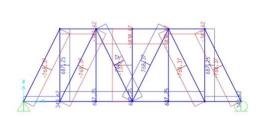
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# Pennsylvania Truss Bridge





#### 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?

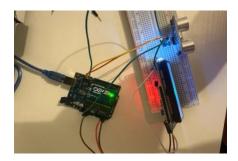
- Performed manual calculations (static equilibrium, joint method, buckling/stress checks).
- Modeled and validated the bridge using SAP2000 simulations under applied
- Optimized cross-sections for stability and material efficiency.
- Constructed the bridge using balsa wood, based on calculated results.



#### Results

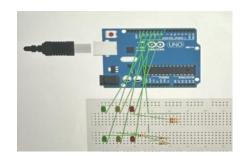
- Final bridge weight: 200 g.
- Load resisted: 940 N.
- Achieved a load-to-selfweight ratio of ~234x.
- Successfully demonstrated a balance between theoretical design and practical construction.

# **Arduino**



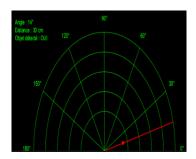
#### What?

 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.