



# Project Deliverable D: GROUP 5

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# INTRODUCTION

The objective of the CNL x uOttawa Design Challenge is to design a device capable of retrieving a metal sample from the interior of a 4.572 m (15 ft) long tube with an internal diameter of 101.6 mm (4 inches). The tube can be oriented either horizontally or vertically.





# PROBLEM STATEMENT

Design a modular, fail-safe samplings tool for CNL that can extract metal samples from pipelines under high radiation conditions while keeping the operator safe with industry regulation accuracy. Offer moderate feedback to confirm the operation of the tool and process status.



## **Anemone Retrieval and Sampling Tool by Orano**

Anemone has been designed to grip any solid element, whether for sampling purposes or more generally for recovery and removal.



## **Fusion QLD Uniprep Pipe Scraping Tool**

Works as a handheld scraping tool, able to scrape pipes from the full inner circumference.



## **Circumferential Wet Scraper Tool (CWEST)**

Enables monitoring of deuterium uptake in pressure tubes of CANDU reactors by collecting samples during shutdowns.

# Subsystem 1: Sample Collector and Mass Reader

## Concepts

- Open container with digital scale in it that can send feedback to user.
- Magnet to attract bits a scraped metal falling from the drill bit.
- Funnel to collect bits of metal and direct them to a narrow weight sensor.
- Rope that latches onto the container that collects the metal and runs through the whole system. This rope can be unlatched to remove the container.
- Rope system that the operator can pull to close the lid of the container without contact

# Subsystem 2: Scraper

## Concepts

- A two-point adjustable arm with drill bit attached to the end for scraping.
- Vibration sensor with Arduino to detect contact with wall.

# Subsystem 3: Failsafe

## Concepts

- Umbrella-like attachment at the front that drags any fallen objects out.
- Strong cord through the design to attach all parts in case of breaking.
- 5, 1-meter-long pipes attached with joints that are flexible in case of curvature in the tube length.



# Subsystem 4: Operator Control System

## Concepts

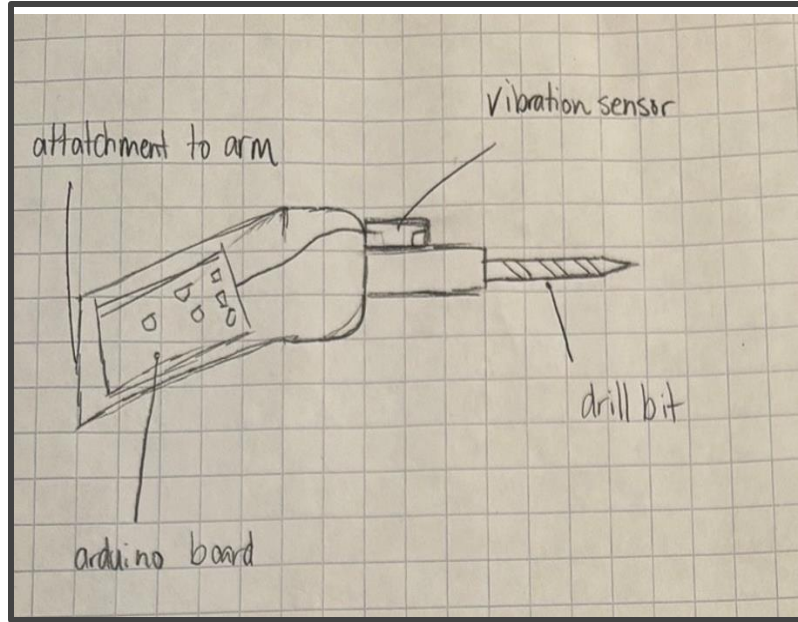
- This operator control system is mainly used to provide clear feedback to the staff.
- Corded console controller with coded controls for different functions.
- Green light for contact of scraper with the wall of the pipe.
- There is no contact, the controller will light up red.

# Subsystem 5: Mobility System

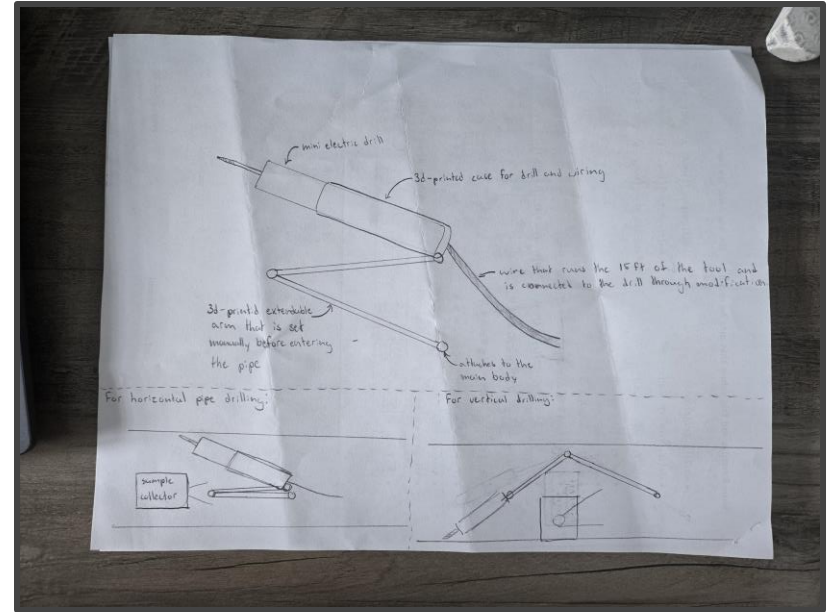
## Concepts

- Remote RC car/robot with attachments put together on top.
- It incorporates cameras for the navigation.
- Wheels that are attached to the main structure of the scraper and are the diameter of the tube to center the main body of the scraper system.

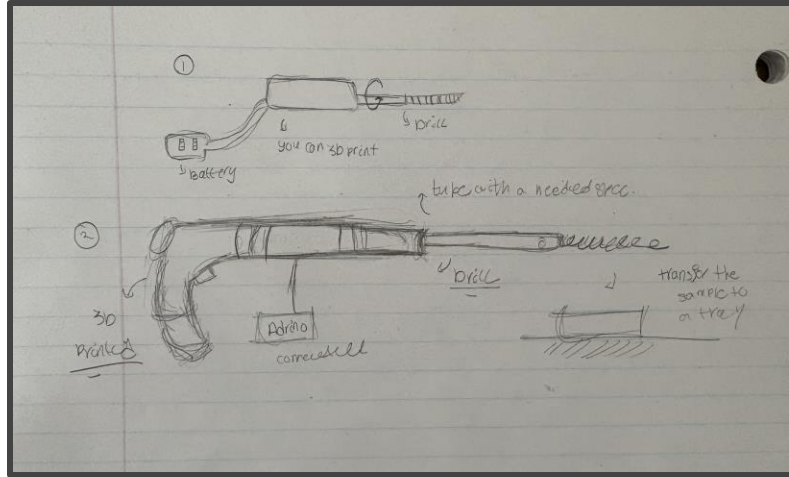
# Concept Designs : Drill Bit with Vibration Sensor



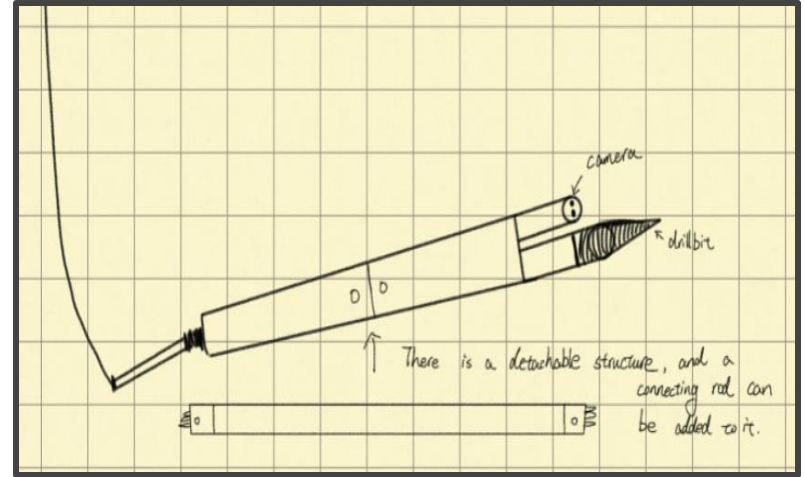
Sam



Owen

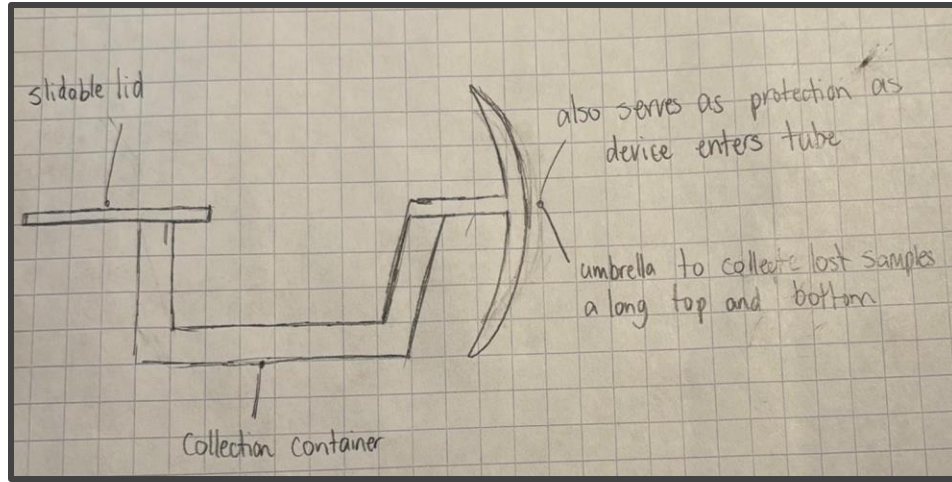


Aidin

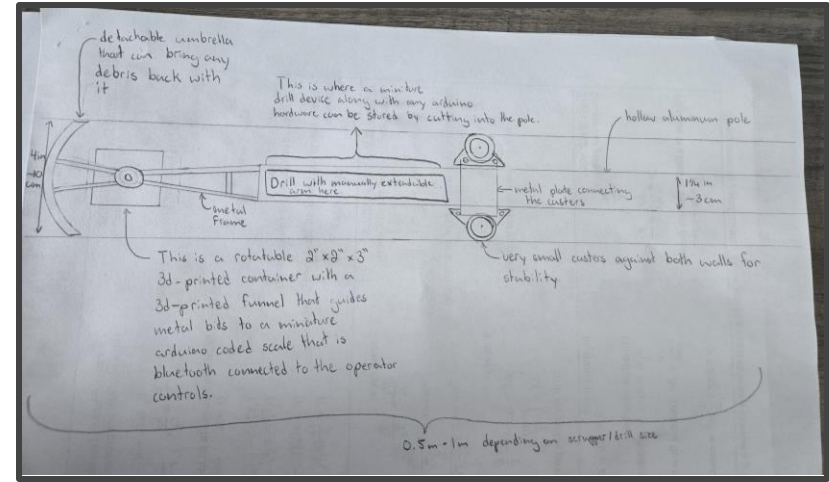


Ziyi

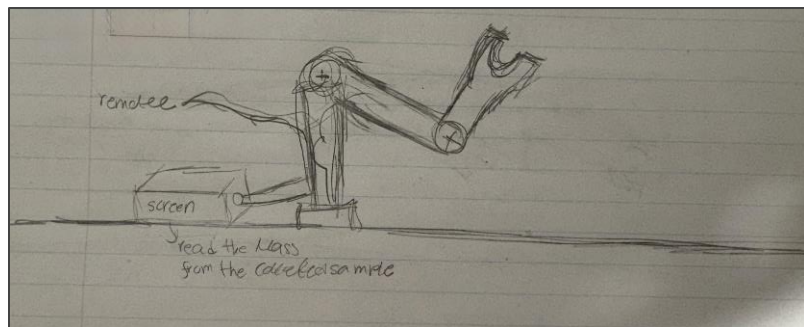
# Concept Designs : Precision Balance System



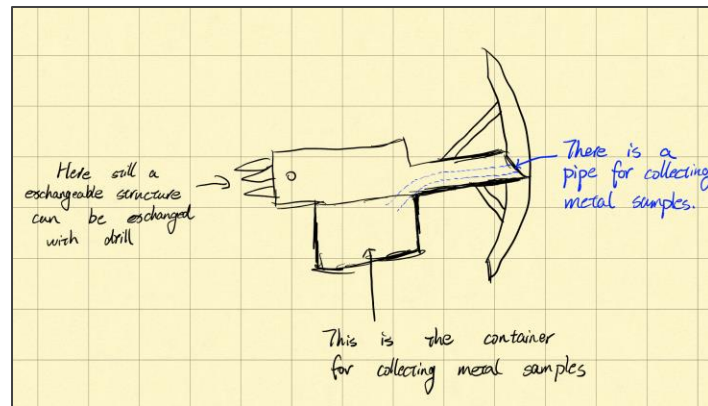
Sam



Owen

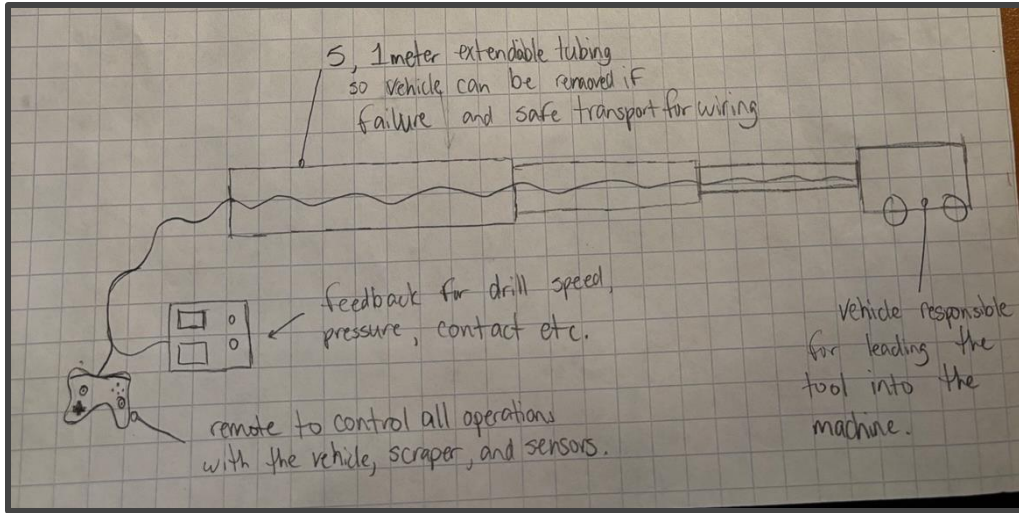


**Aidin**

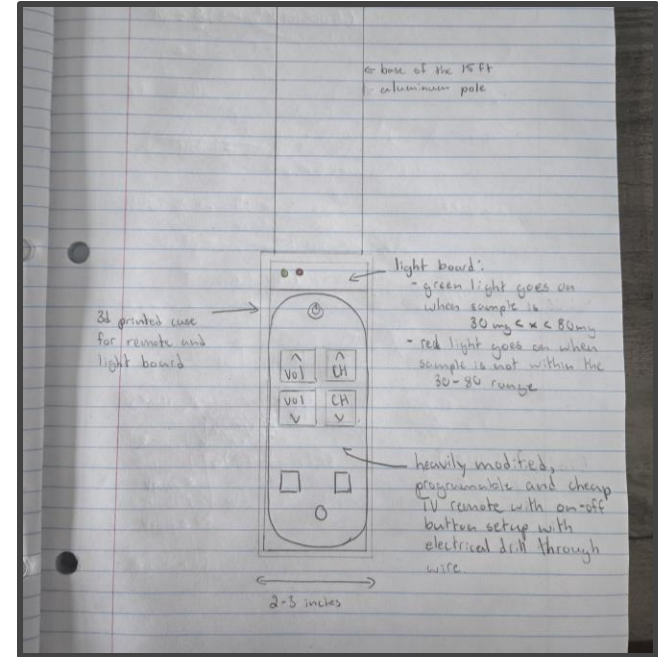


**Ziyi**

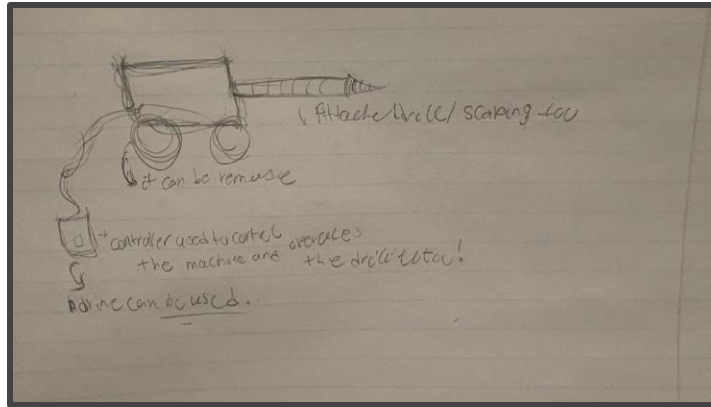
# Concept Designs : Control System



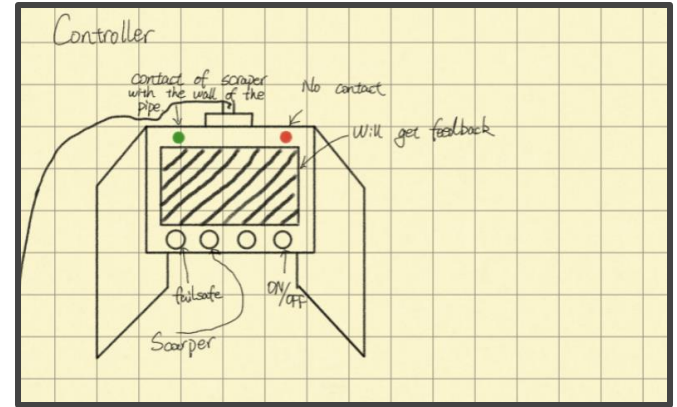
Sam



Owen



**Aidin**



**Ziyi**



**Questions?**

# Conclusion

All feedback is much appreciated and will be used to better our design in the prototype phase!