Logbook

November 10, 2024

Brainstorming Ideas

- Continued from last year's project: "Colonization of the Asteroid Belt."
- Explored ideas related to innovation and geothermal energy.
- Focused on Alberta's use of geothermal energy and its potential in powering robotics and drones.

November 12, 2024

Project Title: Colonization of the Asteroid Belt 3.0

Innovative Concepts:

1. Geothermal-Powered Charging Station:
    - Concept: Designed a model where a robot or drone charges at a geothermal-powered station.
    - Details: A small-scale geothermal power system (e.g., a heat pump) could power outdoor electronics in remote areas.
2. Temperature-Based Guidance or Mapping:
    - Concept: Robot detects and maps temperature variations in a simulated geothermal landscape.
    - Details: The robot uses sensors to identify geothermal hotspots and sends data to the drone to create a heat map, replicating real-life geothermal surveying.
3. Emergency Response Model with Geothermal Power:
    - Concept: Demonstrated how geothermal energy powers emergency equipment like lights, signals, and charging stations for robots and drones during natural disasters.
    - Details: The setup simulates geothermal power as an essential energy source in disaster scenarios.

November 15, 2024

Project Evolution: Phases 1–4

1. Phase 1: Colonizing Mars.
2. Phase 2: Mining valuable minerals from the asteroid belt and bringing them to Mars.
3. Phase 3:
    - Packed and shipped minerals from Mars to Earth.
    - Integrated geothermal energy extraction on Mars to power operations.
    - Drone detected temperatures for geothermal hotspots, while the robot verified conditions and dug for energy extraction.
    - Included a model explaining geothermal energy and its extraction.
4. Phase 4: Built a spaceship to send minerals to Earth.

December 11, 2024

New Idea Added:

- Drone detects geothermal hotspots while the robot digs to extract energy.
- Integrated a geothermal-powered charging

DEC 21

Final Idea: CCUS (Carbon Capture, Utilization, and Storage)

Dec 20th:

Concept:

- Use robots to demonstrate a CCUS system integrated with geothermal energy.
- **Process Flow:**
  - Drones survey areas to identify CO_2 emissions or geothermal hotspots.
  - Robots capture CO_2 and either store it underground or utilize it for power generation.
  - Demonstrate how captured CO_2 can enhance geothermal energy efficiency or be repurposed for other uses.

Dec 26:

Details:

1. **Capture Phase**: Robots equipped with sensors detect CO_2 in the environment and extract it.
2. **Utilization Phase**: Robots demonstrate the use of CO_2 in powering geothermal plants or creating useful byproducts.
3. **Storage Phase**: Robots inject CO_2 safely into underground reservoirs to reduce greenhouse gases in the atmosphere.

Integration:

- Show how AI allows the robots and drones to communicate efficiently in real-time.
- Display a small-scale model of how geothermal energy and CCUS work together for a sustainable future.

Jan1: Project Title

"Carbon Capture Utilization and Storage (CCUS) Via Solar-Powered Robots"

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1. Background Research (not done)

What is CCUS?

- CCUS stands for Carbon Capture, Utilization, and Storage.

- It is a set of technologies designed to capture carbon dioxide (CO2) emissions from industrial processes and power plants, preventing them from entering the atmosphere.
- Once captured, CO2 can either be:
    - Utilized: Transformed into useful products (like synthetic fuels, plastics, or concrete).
    - Stored: Injected into deep underground geological formations for long-term storage.

Why is CCUS Important?

- Global temperatures are rising due to greenhouse gas emissions, and CO2 is a major contributor.
- CCUS is critical to achieving climate goals, as it reduces emissions from industries that are hard to decarbonize, like oil and gas.

Why Alberta?

- Alberta's oil and gas industry is one of the largest contributors to Canada's CO2 emissions.
- The province has ideal geological formations for CO2 storage, like depleted oil and gas reservoirs.
- Existing projects, like the Quest Carbon Capture Project and the Alberta Carbon Trunk Line, have already demonstrated the feasibility of CCUS.
- Alberta is known to be the most successful province/city in CCUS.

JAN 9

Costs: (2021) suggests average standalone CCUS project cost in 2021 (US$125/tonne) will be reduced to (US$98/tonne) by 2050. Tonne is a metric ton. 1tonne = 1000KG
The government gives a 12% grant form the government, which make sit economically rich.

The Role of Technology

- Advanced technologies like drones, robots, and sensors can help:
    - Monitor CO2 storage sites for safety.
    - Detect pipeline leaks.
    - Analyze emissions in real-time.

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3. Research Objectives

1. Explore the role of CCUS in reducing Alberta's CO2 emissions.
2. Investigate how robots and drones can be integrated into CCUS projects for monitoring, analysis, and maintenance.
3. Develop a model to demonstrate the application of advanced technology in a CCUS facility.

Step 4: Analysis

- Evaluate how robotics and drones could solve specific challenges (e.g., detecting CO2 leaks faster or reducing human error).
- Assess the potential cost and environmental benefits of adopting these technologies in Alberta.

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5. Results and Analysis (Expected Outcomes)

1. Improved Monitoring:
    - Drones equipped with CO2 sensors can detect leaks faster than traditional manual inspections.
    - Robots can perform 24/7 monitoring in hazardous areas, ensuring safety and efficiency.
2. Reduced Costs:
    - Automating certain processes (like inspections) can lower labor costs over time.
    - Early detection of leaks reduces expensive emergency repairs.
3. Scalability:
    - Advanced technologies make it easier to scale CCUS operations to larger facilities.
4. Environmental Benefits:
    - Safer and more efficient operations mean fewer emissions escape into the atmosphere.

Jan 13th:

Drones are not part of the project anymore. Solar powered robots will take place.

7. Future Work

- Explore AI-powered robots for predictive maintenance in CCUS systems.
- Investigate how drones could work in harsh weather conditions (common in Alberta).
- Expand the concept to include other renewable technologies, like solar-powered CO2 capture systems.

JAN 20th

8.Statistics and Analyzation

Quest project.

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Injection amounts	0.371	1.11	1.138	1.066	1.128	0.941	1.055	0.970	

Alberta government: $745 million until 2025

Companies involved: Shell Canada Energy (project operator), Canadian Natural Upgrading Limited, Chevron Canada Oil Sands Partnership and 1745844 Alberta Ltd. (owners)

Alberta Carbon Trunk Line (ACTL) Project

Year	2020	2021	2022	2023	2024	2025
Injection amounts	0.933	1.24	1.034			

Alberta government: $495 million until 2025
Companies involved: Enhance Energy Inc., the North West Redwater Partnership and Wolf Carbon Solutions Inc.

https://www.alberta.ca/alberta-carbon-capture-incentive-program

Jan 29th: Researched about the economics of ccus. Also searched for types of it too.

Feb 2: Build the robots
Feb 3 and 4: finalize and edit