MICHIGAN STATE UNIVERSITY **Project Plan Presentation** Machine Learning for Optimization of Carbon Removal The Capstone Experience Team Anthropocene Institute **Edie Haase** Jack Holscher Ishita Kokil

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From Students... ...to Professionals

Project Sponsor Overview

Sponsor Overview

- Founded by Carl Page in 2012.
- Mission is to make Earth sustainable by knowing and investing in the right technology.
- Partners with entrepreneurs, investors, governments, non-profits, and universities to achieve their goal.
- What they do:
 - Foster science
 - Influence policy
 - Back technology
 - Educate people about our options
 - Promote sustainable clean energy

Hu manity Needs Dreamers

for a resilient, equitable, and healthy future

Anthropocene Institute

Project Functional Specifications

Project Overview

- The removal of carbon dioxide is important to stabilize the Earth's climate.
- Create a web application (Carbon Mapp) that shows the best places to implement different carbon dioxide removal techniques.
- Carbon Mapp will display an interactive heat map of the United states for each chosen carbon dioxide removal techniques. The darker the color the better the location.

Project Design Specifications

- Web-app used by governmental agencies, private companies, entrepreneurs, and investors
- Information displayed in an interactive heat map
- Displays carbon removal efficiency, cost, and other relevant statistics.
- For people and organizations to become informed and help them make investment decisions.

Screen Mockup: Homepage



Screen Mockup: Algae Blooms Homepage Link

a carbonmapp.com

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Algae blooms hold significant potential for carbon removal and environmental restoration. These blooms, typically consisting of microalgae or cyanobacteria, are adept at photosynthesis, converting carbon dioxide (CO2) and sunlight into organic matter. By cultivating algae on a large scale in controlled environments such as bioreactors or open ponds, we can harness their natural ability to sequester carbon. As algae grow, they capture CO2 from the atmosphere, helping to mitigate climate change. Moreover, once harvested, algae biomass can be used in various applications, including biofuels, livestock feed, and even as a carbonnegative building material.

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Screen Mockup: Reforestation Homepage Link



Screen Mockup: Direct Air Capture Homepage Link



The Capstone Experience

Hemanth Yalamanchili

Screen Mockup: Algae Blooms Optimization Tool



Screen Mockup: Algae Blooms Optimization Tool (cont.)



Screen Mockup: Reforestation Optimization Tool (cont.)



Screen Mockup: Direct Air Capture Optimization Tool (cont.)



 Cost: \$100,000 Carbon Removed: 2 tons
 All Factors
 Cost
 Carbon Removed

Project Technical Specifications

- React.js Framework
- Flask Backend
- TensorFlow Machine Learning
- Python Data Scraping
- MongoDB Database
- Containerized using Docker

Project System Architecture



Project System Components

- Hardware Platforms
 - CSE Server / Anthropocene Institute Server
- Software Platforms / Technologies
 - VSCode/PyCharm: Development
 - Docker: Container
 - MongoDB: Database
 - React: JavaScript library for building web application
 - Flask: Python web framework
 - TensorFlow: Python machine learning library

Project Risks

Collecting Data for the Machine Learning Model

- Description: Sourcing sufficient and relevant data for the model is a challenge especially if expanding the granularity of the project.
- Mitigation: Heavily research government, non-profit sites with a focus on individual states, and consult Michigan State University's Environmental Sustainability professors.

Updating the web tool and the machine learning model periodically

- Description: Regular updates are necessary for the machine learning model and the web tool to keep
 pace with constantly changing data.
- Mitigation: Develop a web scraper script that will periodically get and preprocess the data for the machine learning model.

• Implementing the web tool to handle web scraping and updating of the website

- Description: Frequent backend execution may cause strain on the infrastructure and cause potential performance problems, server loads, and downtime.
- Mitigation: Optimize code and algorithms to be efficient and continuously test that the backend infrastructure can handle updates.

Expanding the scope of the project.

- Description: Expanding the tool from a US to global map needs uniform data that may not be available throughout.
- Mitigation: Ensure full functionality of the US heatmap with potential expansion to other countries as project extension following discussions with the client.

Questions?

