Project: Edmonton Global's Hydrogen Game

CMPT 2021: Algorithms - Fall 2024

Introduction

This assignment is worth 20% of your final grade in this course.

The goal of this assignment is to develop a fun video game application which simulates the 5000 Hydrogen Vehicle Challenge.

For this project, we will work with a local Edmonton organization, Edmonton Global. You will work in a group of FOUR students to learn about the goals of the client, plan an approach with your group, and then develop your own version of the game. You will have various opportunities to present your solution to the client for feedback and adjust.

The best game, as chosen by our clients, will be played by attendees of the Canadian Hydrogen Convention being hosted here in Edmonton on April 22-24, 2025.

Learning Outcomes

1. Apply the principles of object-oriented programming and algorithm design by using classes, attributes, and methods.
2. Practice testing and debugging methods for Python code.
3. Practice stakeholder engagement by listening to client needs, asking questions, prototyping solutions, and integrating feedback.

Assignment Instructions

Your team will develop a Hydrogen Car Simulation Game using Python libraries, such as Pygame. The game should be set in Edmonton Metropolitan Region, where players take on the role of creating a hydrogen-powered fleet, navigating the city's roads and highways. The player's mission is to help achieve the 5000 Hydrogen Vehicle Challenge by getting 5000 hydrogen-powered vehicles on roads. The game should allow players to collect hydrogen fuel cells, avoid obstacles, and contribute to the build-out of the region's hydrogen infrastructure.

The main goal is to generate and collect enough hydrogen fuel cells to fuel 5000 vehicles, while building out key economic corridors like the Calgary to Edmonton route. Players must strategically build hydrogen refueling stations along these corridors to ensure the fleet's success.

Your team should work to achieve the following goals:

- Provide an engaging and challenging gaming experience.
- Incorporate various game mechanics, such as obstacle avoidance and collectible items, to keep players interested.
- Develop intuitive controls for smooth navigation.
- Demonstrate consideration of the types of players and player environment (game will be played at a booth during a conference, players must be able to quickly learn the controls and will likely only engage for a few minutes at most).
- Implement responsive feedback through visuals and sound effects to enhance user experience.
- Communicate clearly and regularly with the client to ensure alignment with their expectations.

Your team should consider the following stages of the game:

1. **Start:** Players begin a single hydrogen-powered vehicle on the streets of Edmonton. They must collect hydrogen fuel cells scattered throughout the map to keep moving.

2. **Challenges:** As Players collect more fuel cells, they unlock new routes and face increasing challenges as they move further along and get more trucks on the road. Access to infrastructure and critical services (like maintenance and training) can be the driving force behind meeting your next destination and getting more trucks on the road. The more stations they build, the easier it becomes to refuel and continue the journey.

3. **Building Infrastructure:** Along the way, players can use the fuel cells they have collected to build and upgrade hydrogen refueling stations and other critical infrastructure and services. The more they build, the easier it becomes to refuel, grow, and continue the journey.

4. **Completion:** The game progresses through different levels, representing different stages of the 5000-hydrogen vehicle challenge. The ultimate goal is to successfully deploy 5000 hydrogen vehicles across the region, which is achieved by efficiently collecting fuel cells, building refueling and maintenance stations and avoiding obstacles.

Project Deliverables

This is a large project that you will work on throughout the term. The following stages and submissions will be required.

Date	Deliverable
September 12	Project introduction by instructor & team formation
September 19 **11AM – 12:30PM in 4-013**	Meet, greet, and project introduction by Edmonton Global team
September 26 **Project Plan DUE**	Project Plan Submission
October 25 **10AM – 1PM in 4-013** **DEMO 1**	Teams demonstrate initial game prototypes to Edmonton Global team and submit current application files to instructor
December 6 **10AM – 1PM in 4-013** **FINAL DEMO**	Teams demonstrate final game to Edmonton Global team, and submit all application files and documentation to instructor

ENGAGED LEARNING ASSESSMENTS (3 SUBMISSIONS)

1. You are required to prepare at least two questions to ask our clients, the Edmonton Global team, during the project introduction and meet and greet on September 19th. These questions need to be submitted on the Moodle forum by midnight the night before the presentation. Your questions should not duplicate those of other students, so post early!

2. Each member of your team is required to submit a reflection **after Demo 1 AND after the Final Demo** about how the demo went and what changes your group will implement based on client feedback. The reflection should include the answers to the following four questions:

   a. What did the client really like about your game so far?

   b. What did you misunderstand or do differently than the client expected?

   c. What changes are you going to make to your project based on the feedback from the client?

   d. Describe two components other groups had in their games that you thought were creative and different than your own.

PROJECT PLAN (4%)– DUE SEP 26, 2024

After the project introduction, your team will meet to discuss how you want to approach the project. You should start by organizing yourselves for success- introduce yourselves to each other and discuss the best way to communicate as a group. You can use a group chat, email, and set regular in-person meeting times.

Your project plan should have the following components:

1. A team name.
2. All group member names and contact information.
3. Your communication method and meeting times for the entire term.
4. An outline of the milestones for the project- both those set by your instructor, but also those you want to meet as a team (such as practicing together before a client demo).
5. A description of how you want to design your game. This should include some rough drawings of what your game will look like and how it will work. If you have some ideas of other games, it will be similar to or tools you would like to use, please include those details as well. The more information you can give us, the more we can help guide you to get a good start.

Deliverables

Write all the above information in a professionally formatted document and submit it to the Moodle drop-box before the deadline. As this is a group submission, only one group member is required to submit. **All group members are responsible for the content of the submission.**

Grading

Criteria	Exemplary (9-10 Points)	Proficient (7-8 Points)	Basic (5-6 Points)	Needs Improvement (1-4 Points)
Group Organization	A creative team name and all group members details are included. Content demonstrates collaboration and thought, and planning has gone into team formation and on-going communication.	Group name lacks creativity and/or group member details are missing. Team formation is started, and some planning done, lacking details for communication planning.	Group lacks cohesive naming and details. Team formation is disjointed, and no solid communication plan is included.	Team details and plans are minimal to non-existent.
Timeline and Milestones	Provides a detailed and realistic timeline with clearly defined milestones that go above and beyond those provided by the instructor.	Provides a timeline with milestones, including some outside of those set by the instructor. Some details may be lacking or slightly unrealistic.	Provides a basic timeline with milestones as defined by the instructor, lacking details and may not be realistic.	Timeline and milestones are unclear, incomplete, or missing.
Game Development Plan	Plan includes details which cover all relevant components set by the client- game environment, in game components and game play details are described and depicted clearly using examples of existing games, drawings and specific tools have been researched and named.	Plan includes details covering all relevant components set by the client. Some parts are unclear or missing details such as examples and drawings.	Plan is high-level and missing one or more major components. Lacking details necessary to move from plan to game development.	Plan is high-level and lacks detail. No examples or drawings have been included and no execution can begin based on this plan.
Clarity and Organization	The project plan is exceptionally clear, well-organized, and easy to follow. Sections are logically structured with a strong flow	The project plan is clear and well-organized with minor issues in flow or structure.	The project plan is somewhat organized but may lack clarity or have disjointed sections.	The project plan is unclear or poorly organized, making it difficult to follow.
Total Points				/40 points

DEMO 1 (7%) – DUE OCT 25, 2024

Application development requires an iterative, prototyping process to be most successful. The client communicates expectations and goals to your group, you interpret them and present an initial solution. Then the client provides feedback on what you have created, and you get to know if you are heading in the right direction. If there is a misalignment between your interpretation and their expectations, you adjust. **This is an expected process.** Often clients don't have full picture of what they want, and their expectations and goals may change as they see it through your solutions. Your job is to continue to communicate back and forth and adjust until you reach a satisfactory solution for everyone. Misunderstandings and adjustments should not be viewed as failure. These are learnings and being able to receive feedback and adjust is an important skill in this field.

This demonstration is your group's first opportunity to show the client the direction you have started in and get to know if it aligns with their desired outcomes. It should be a two-way conversation between your group and the client, you should ask questions and clarify any areas of confusion. The goal is to leave the demo with a better understanding of what you will work on next. **The goal of the demo is NOT to present your work and walk off the stage.**

Anytime you do a presentation, you should keep your audience in mind. What do they already know? No need to repeat that. Do they know how to read code? Does the code matter to them? Let's leave out back-end details. What are they most interested in? Let's focus on that. What do we need to know from the client? Let's focus on that.

Each group will have 10 minutes with the client. Your group should use this 10 minutes wisely. Remember that you want to hear from the client as well. Show them what you have so far, and what you are thinking about doing next. Ask them what they think about it and if they have any concerns. Clarify details where your group had disagreements or got stuck. Ask them what they want to see next and what their priorities are. You have limited time to complete this project, so focusing on the **minimal viable product (MVP)** will be a key to your success.

You are required to observe all other groups presentations.

Deliverables

For this submission, your group should submit the following files in Moodle:

1. Python code with thorough documentation,
2. Executable game file to easily run and play the game.
3. Additional instructions on how to play the game, mockups, and plans for next steps.
4. Presentation files from client demo.
5. Reflection in Moodle to be completed by each individual student.

Grading

Your demo will be graded on the following criteria:

Criteria	Exemplary (9-10 Points)	Proficient (7-8 Points)	Basic (5-6 Points)	Needs Improvement (1-4 Points)
Project Completion	The application shows significant time invested. It demonstrates functionality of the most important components highlighted by the client, as well as many additional features and functions that go above and beyond the MVP.	The application shows time invested. It demonstrates functionality of the most important components highlighted by the client, as well as several some features and functions that go above and beyond the MVP.	The application shows minimal time invested. It demonstrates functionality of some important components highlighted by the client. Some features may be missing or not working. No additional functionality completed.	The application has significant deficits. There is no working features or functions. The application is either minimal, non-existent, or focused on too many pieces, making it complex and inoperable.
Project Quality	The application shows attention to detail and understanding of the goals. Shows commitment to creating a quality product that aligns with client expectations. Code is well designed; graphical and game design choices are creative and well thought out.	The application shows attention to detail and understanding of the goals. Shows commitment to creating a quality product that aligns with client expectations. Code is well designed; graphical and game design choices are simple and minimally creative.	The application lacks attention to detail and/or understanding of the goals. Demonstrates alignment with client expectations. Code is well designed; graphical and game design choices could be more creative.	The application lacks attention to detail and/or understanding of the goals. There is misalignment with client expectations. Code and game design needs improvement or is non-existent.
Documentation	Documentation in code is thorough, well -formatted and easy to follow. The instruction manual is complete and accurate. The application state and usage are easy to discern based on the documentation.	Documentation in code is minimal, but well-formatted and easy to follow. The instruction manual contains minor omissions or inaccuracies. The application state and usage are easy to discern based on the documentation.	Documentation in code is minimal and/or hard to follow. The instruction manual contains major omissions or inaccuracies. The application state and usage are difficult to discern based on the documentation.	Documentation in code is non-existent and/or hard to follow. The instruction manual is missing or minimal. The application state and usage are impossible to discern based on the documentation.
Presentation Content	Content focus is on complete and operational features and functions.	Content focus is on complete and operational features and functions. Areas of future	Content focus was on incomplete or inoperable functions. Minimal or no future	Content focus was on code details and not application use. No

	Areas of future improvement are thoughtful. Content demonstrates an understanding of the audience and was displayed in a professional, well-organized manner.	improvement are thoughtful. Content demonstrated minor misunderstandings of the audience, but was displayed in a professional, organized manner.	improvements mentioned. Content demonstrated major misunderstandings of the audience, and/or was disorganized, inconsistent, or hard to follow.	space was made for client feedback. Content was disorganized, inconsistent, or hard to follow.
Presentation Delivery	Group members were all well-prepared and spoke clearly and concisely. Members engaged the client. The group completed their presentation within the given time slot.	Most group members were well-prepared and spoke clearly and concisely. Members engaged the client. The group completed their presentation within the given time slot or within +/-2 mins.	One or two group members were well-prepared and/or some spoke quietly or caused confusion. Members engaged minimally with the client. The group had to be stopped at time or was less than 5 mins.	Group was unprepared and spoke quietly or caused confusion. The client was not included in the conversation.
Group Synergy	All group members attended and engaged. Members worked together to complete the presentation and ask and answer questions.	The majority of group members attended and engaged. Members worked together to complete the presentation and ask and answer questions.	One or two group members attended and engaged. Other members were absent or did not participate in asking and answering questions.	The group members demonstrated disorganization and tension. Lack of team communication and synergy was apparent.
Client Engagement	Group members discussed the project with the client in a professional manner. There is evidence of client relationships and incorporating feedback and adjustments since the first demonstration.	Group members discussed the project with the client in a professional manner. There is minimal evidence of client relationships and minor missing areas where feedback and adjustments could have been made since the first demonstration.	Group members minimally discussed the project with the client or lacked professionalism. No evidence of client relationships and minor missing areas where feedback and adjustments could have been made since the first demonstration.	Group members did not discuss with the client and simply put forward their own ideas and decisions. No adjustments were made based on client feedback since the first demonstration.
Submission	All files are submitted in an organized and easy to understand format. File names are relevant to the content.	All files are submitted in a mostly organized and easy to understand format. Some file names are irrelevant to the content.	All files are submitted in a disorganized and difficult to understand format. Some file names are irrelevant to the content.	Files are missing and disorganized. File names are irrelevant to content.
Reflection	All group members completed the demo	The majority of group members completed the demo reflection	One to two group members completed the demo reflection	Reflections not completed or completed

	reflection in Moodle. Reflections demonstrated commitment to the iterative learning approach. They highlighted key areas of strength and deficient as well as a clear path forward.	in Moodle. Reflections demonstrated commitment to the iterative learning approach. They highlighted key areas of strength and deficient as well as a clear path forward.	in Moodle. Reflections lacked commitment to the iterative learning approach. Missing key areas of strength and deficient or a clear path forward.	hastily without demonstrating commitment to understanding and learning.
Total Points			**/90 points**	

FINAL DEMO (9%)– DUE DEC 06, 2024

This is your last opportunity to demonstrate your game to the client. Many of the considerations from the first demonstration still apply. However, in this demo, you may want to focus on the highlights of your game and what is working well. You should also outline any bugs or shortfalls (features or functions you weren't able to complete), so the client can fully understand the usability of the game, if they choose to implement it at the convention. Continue to consider your audience and focus on what is important to them (for example, the team likely has little to no desire to see your code directly).

Your team will again have 10 minutes with the client. Plan well and use this time wisely!

You are required to observe all other groups presentations.

Deliverables:

For this submission, your group should submit the following files in Moodle:

1. Python code with thorough documentation,
2. Executable game file to easily run and play the game.
3. An instruction manual on how to play the game, mockups, and plans for next steps.
4. Presentation files from client demo.
5. Reflection in Moodle to be completed by each individual student.

Grading

Your submission will be graded on the following criteria:

Criteria	Exemplary (9-10 Points)	Proficient (7-8 Points)	Basic (5-6 Points)	Needs Improvement (1-4 Points)
Project Progress	The current state of the application shows time invested. Current progress is aligned with the project plan and on track to have a working application by end of term.	The current state of the application shows time invested. Current progress is minorly off track with the project plan and group commitment will be required to get back on track.	The current state of the application is below expected. Current progress is significantly off track with the project plan and group commitment will be required to get back on track.	The current state of the application is unacceptable Current progress is minimal or non-existent. Group at high risk to not complete the project by end of term.
Project Quality	The current state of the application shows attention to detail and understanding of the goals. Shows commitment to creating a quality product that aligns with client expectations. Code is well designed; graphical and game design choices are creative and well thought out.	The current state of the application shows attention to detail and understanding of the goals. Shows commitment to creating a quality product that aligns with client expectations. Code is well designed; graphical and game design choices are simple and minimally creative.	The current state of the application lacks attention to detail and/or understanding of the goals. Demonstrates alignment with client expectations. Code is well designed; graphical and game design choices could be more creative.	The current state of the application lacks attention to detail and/or understanding of the goals. There is misalignment with client expectations. Code and game design needs improvement or is non-existent.
Documentation	Documentation in code is thorough, well -formatted and easy to follow. The instruction manual is complete and accurate. The application state and usage are easy to discern based on the documentation.	Documentation in code is minimal, but well-formatted and easy to follow. The instruction manual contains minor omissions or inaccuracies. The application state and usage are easy to discern based on the documentation.	Documentation in code is minimal and/or hard to follow. The instruction manual contains major omissions or inaccuracies. The application state and usage are difficult to discern based on the documentation.	Documentation in code is non-existent and/or hard to follow. The instruction manual is missing or minimal. The application state and usage are impossible to discern based on the documentation.
Presentation Content	Content focus is on current progress and plan. Areas of confusion were highlighted for client feedback. Content	Content focus is mostly on current progress and plan. Areas of confusion were highlighted for client feedback.	Content focus is mostly on current progress and plan. No space was made for client feedback. Content	Content focus was on code details and not client interaction. No space was made for

	demonstrated an understanding of the audience and was displayed in a professional, well-organized manner.	Content demonstrated minor misunderstandings of the audience, but was displayed in a professional, organized manner.	demonstrated major misunderstandings of the audience, and/or was disorganized, inconsistent, or hard to follow.	client feedback. Content was disorganized, inconsistent, or hard to follow.
Presentation Delivery	Group members were all well-prepared and spoke clearly and concisely. Members engaged the client with questions. The group completed their conversation within the given time slot.	Most group members were well-prepared and spoke clearly and concisely. Members engaged the client with questions. The group completed their conversation within the given time slot or within +/-2 mins.	One or two group members were well-prepared and/or some spoke quietly or caused confusion. Members engaged minimally with the client. The group had to be stopped at time or was less than 5 mins.	Group was unprepared and spoke quietly or caused confusion. The client was not included in the conversation.
Group Synergy	All group members attended and engaged. Members worked together to complete the presentation and ask and answer questions.	The majority of group members attended and engaged. Members worked together to complete the presentation and ask and answer questions.	One or two group members attended and engaged. Other members were absent or did not participate in asking and answering questions.	The group members demonstrated disorganization and tension. Lack of team communication and synergy was apparent.
Client Engagement	Group members discussed the project with the client in a professional manner. They demonstrated a desire to learn from and understand the client goals and took notes on areas of change or focus.	Group members discussed the project with the client in a professional manner. They demonstrated a desire to learn from and understand the client goals. They did not note down changes during the discussion.	Group members discussed the project with the client but focused on their own goals instead of listening. They did not note down changes during the discussion.	Group members did not discuss with the client and simply put forward their own ideas and decisions.
Submission	All files are submitted in an organized and easy to understand format. File names are relevant to the content.	All files are submitted in a mostly organized and easy to understand format. Some file names are irrelevant to the content.	All files are submitted in a disorganized and difficult to understand format. Some file names are irrelevant to the content.	Files are missing and disorganized. File names are irrelevant to content.
Reflection	All group members completed the demo reflection in Moodle. Reflections demonstrated commitment to the iterative learning approach. They	The majority of group members completed the demo reflection in Moodle. Reflections demonstrated commitment to the iterative learning approach. They highlighted key areas of	One to two group members completed the demo reflection in Moodle. Reflections lacked commitment to the iterative learning approach. Missing	Reflections not completed or completed hastily without demonstrating commitment to

	highlighted key areas of strength and deficient as well as a clear path forward.	strength and deficient as well as a clear path forward.	key areas of strength and deficient or a clear path forward.	understanding and learning.
Total Points				**/90 points**