Assignment - Research

Introduction

In this research assignment, you are invited to explore the concept of Behavior Trees (BTs), a powerful and highly adaptable framework used for managing complex behaviors in artificial intelligence and robotics systems. This assignment will be split into two parts: a research component and a practical application design. Your task will be to not only understand but also apply the principles of Behavior Trees to a theoretical scenario.

Part 1: Research Component

Objective: Conduct a comprehensive investigation into Behavior Trees.

1. Definition and Structure

- Present the foundational elements of Behavior Trees, including their nodes and operational flows.
- Discuss how they compare to other decision-making architectures such as finite state machines. (A plus would be to find BT libraries in Python & C++)

2. Applications:

- Identify and describe specific use cases where Behavior Trees have been effectively implemented. Focus on areas such as robotics, video games, software automation... (mainly robotics[🙂])

Deliverable:

- Prepare a detailed report that encapsulates your research findings. This document should include diagrams or other illustrative materials to aid in the explanation of key concepts.

Part 2: THEORETICAL Application Design

Objective:

- Design a Behavior Tree for a selected scenario.

Task:

Choose any scenario and develop a Behavior Tree to manage its dynamics. You can choose but NOT limited to the following:

- Smart Vacuum Cleaner Operations: Design a BT that enables a vacuum cleaner to navigate a living space efficiently, manage its power, and avoid obstacles.
- Theme Park Service Robot Construct a BT for a robot tasked with interacting with guests, guiding them through attractions, and handling emergencies like first aid or lost children.

- Automated Coffee Machine: Develop a Behavior Tree for an automated coffee machine that manages different coffee making processes, handles user inputs, and performs cleaning cycles.
- Intelligent Vending Machine: Create a BT for a vending machine that includes interactions such as selecting products, processing payments, handling stock levels, and managing error states like product jams or payment failures.
- Home Automation System: Design a Behavior Tree to control a smart home system that manages lighting, temperature, security alarms, and entertainment systems based on user presence and preferences.

Guidelines

- Your Behavior Tree should include a comprehensive set of nodes, each clearly labeled and logically connected.
- Provide a narrative explaining the purpose of each node and the rationale behind your structural choices.

Deliverable:

- Submit a diagram of your Behavior Tree along with a succinct explanation of its mechanics and design rationale.

OPTIONAL Challenge: Implementation

If you wish, implement your Behavior Tree in a suitable programming environment or simulation tool. This practical exercise is optional but recommended to enhance your understanding of BTs in action.

Submission Guidelines

GitHub Repository Creation

- Create a new GitHub repository named Name-BehaviorTrees.
- Initialize the repository with a README.md file that briefly describes the project and its objectives.
- Ensure the repository is public so that it can be accessed for evaluation.

Code and Documentation

- Ensure all code is well-commented, and each file has appropriate documentation describing its functionality.
- Include comments in your code explaining any unique approaches.

Submission Deadline

- Deadline: Submit your GitHub repository link by Thursday.
- This assignment is to be completed individually. Each student should work on it on their own!!!