SENG 465
Artificial Intelligence in Game Programming

Project Report

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Knowledge-Based Agent

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1. Summary

We have created a game called “Who is the Murderer?” using knowledge-based agent. Logic of the game is simple. There are many people in the town such as a murderer, a detective, and people from different professions. Town people are very strict about their professions to outsiders because of that detective must examine the professions of each town people by himself. Detective is our Artificial Intelligence in the game that comes from outside of the town. While user as a murderer kill people every day except detective, AI (detective) searches the murderer every night. However, AI can receive only one unique feature of a town people per a day. According to the properties, detective determines professions of people in the town. When the game ends names and professions that are determined from AI are printed on the screen.

2. Previous work in the literature

In the literature our AI can be related with knowledge-based agent. Knowledge based agent have a clear representation of knowledge that can be justified [1]. As an example, Wumpus world’s agent has the same logic with our agent. Hunter in the Wumpus world takes logical actions based on collected knowledge. Stench and breeze warn the agent if there is a pit or Wumpus in adjacent squares [2]. Similarly, our agent collects knowledge as well such as profession of a person. Furthermore, the agent decides whether it continues to examine same person or next person in the town based on safe professions until the agent finds specific properties that are unique for Murderer.

3. Description on the project

The game simulates two players playing each other. One of them is murderer and the other one is detective. In this game detective is being played by AI. Chance factor is playing a great role in this game. Detective can choose murderer or somebody else to examine. There is an important point in this examining. Every town people have one to three unique properties. Two of the important roles, the doctor, and the butcher, have two same features with murderer. This situation causes the detective to waste time while murderer is killing people.

Detective collects some information about town people includes murderer per a day. AI keeps that information in the knowledge base. Finally, detective makes logical assumptions. For instance, a farmer has farmer hat and harrow and the time the detective finds farmer hat, he should look for harrow next day. If detective finds both farmer hat and harrow, he makes inference that the person he is looking for is a farmer. After finding out which profession that person has, agent saves persons' data into knowledge base and starts to examine for another person. At the end of the game, if there is only one person left in the area except the murderer, the murderer (user) wins the game. Oppositely, if the detective finds the murderer by the last 1 person left, the user will lose the game. Therefore, it may be too late before the detective finds the murderer.

3.1 Implementation

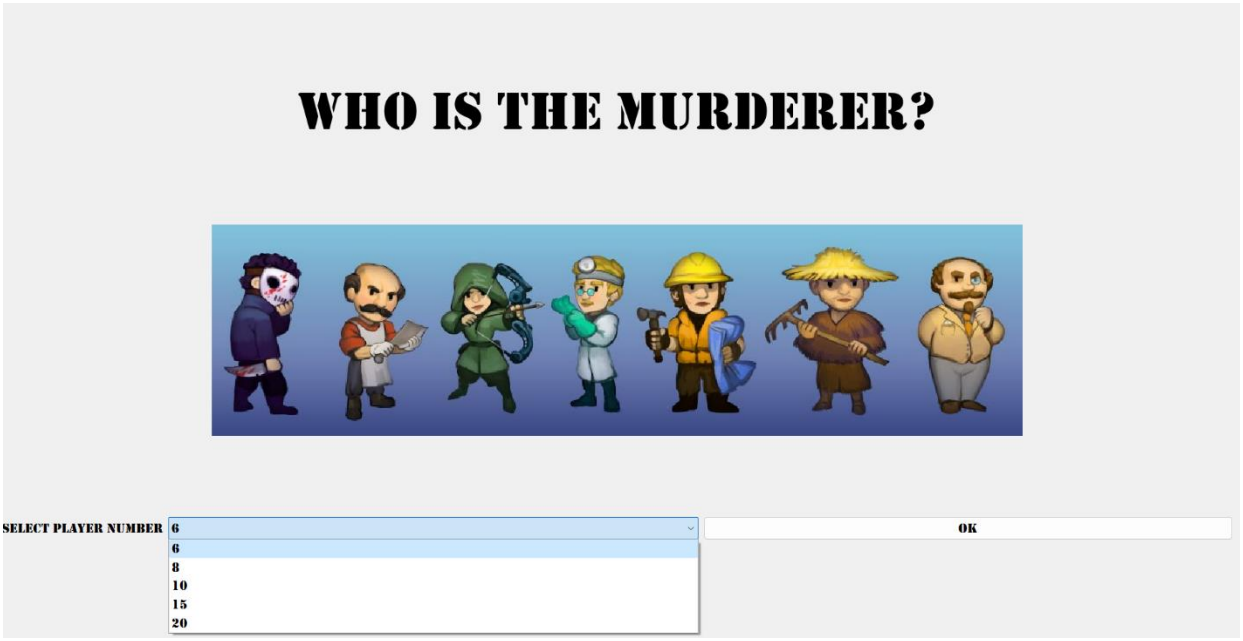
This project has been written with C++ via Qt framework. Project has several classes and objects like agent, professions, and properties. There are several classes exist. These are "Properties" "Murderer" "Builder" "Doctor" "Butcher" "Farmer" "Mayor" and "Hunter". Professions classes are derived from Properties. Objects are created with Properties type and allocated with professions' type, so polymorphism is involved. Town people objects have both label and radio button classes [3]. Agent class has two functions namely examine and conclude. AI is used here. In addition, properties class has many Boolean variables that provides logical inferences to AI. Furthermore, In the professions class, properties have been set as "true" according to professions. Moreover, classes have point that is an integer. At run time point variables are changing according to acts of murderer and detective. While user's choices for killing decreases this points to -100, the examination time of detective makes these points either -100 or 10 to 30. If a point equal 30 it means the murderer has been found. Names that are examined from AI are printed on a new window for user.

3.2 Difficulties Encountered

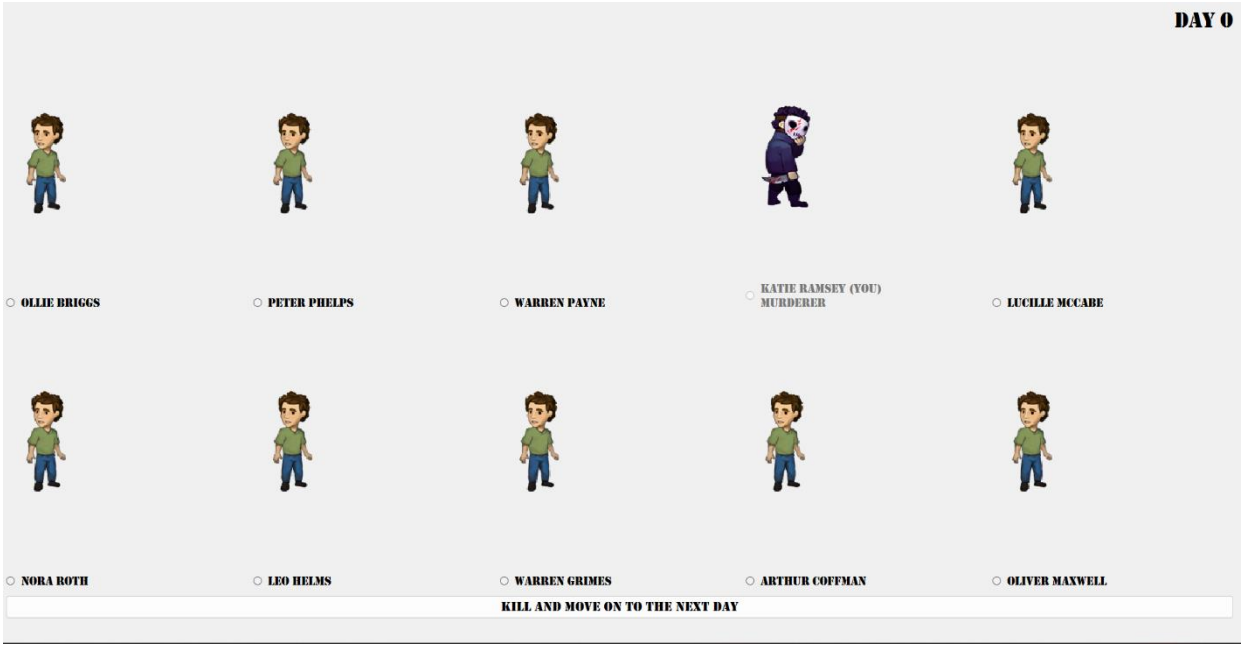
We have designed ourselves the game, so we have encountered difficulties at the beginning of the project. While we write classes and their variables, we need to think about it for a while. We have written a text file and have read from the text file to use names and professions. In Qt, it's a little bit complicated, we have dealt with it. In addition, there are some challenges from the Qt such as adding images or radio buttons to user interface, designing user interface and thinking about logic of the knowledge base.

4. User Interface

4.1 Run-time Screenshot



Picture 1



Picture 2

Picture 3

Picture 4

4.2 Final Comments on the Project

In this project artificial intelligent and user interface are cared more than gameplay or graphic quality. Inferences making by AI reveals safe roles and murderer. Having more than 15 player can be a big handicap for user to win. Most of the time when player number is equal to 20, AI wins. While 10 and numbers less than 10 have higher win rates to user, 15 players can be more balancing.

5. References

[1] GeeksforGeeks, “Knowledge Based Agents in AI”, 2021. [Online]. Available: https://www.geeksforgeeks.org/knowledge-based-agents-in-ai/

[2] Javatpoint, “The Wumpus World in Artificial Intelligence”, 2011-2021. [Online]. Available: https://www.javatpoint.com/the-wumpus-world-in-artificial-intelligence

[3] Qt Documentation, “QRadioButtonClass”, 2022. [Online]. Available: https://doc.qt.io/qt-6/qradiobutton.html

[4] Çankaya Üniversitesi, “Term Project Description”, 2022. [Online]. Available: https://webonline.cankaya.edu.tr/pluginfile.php/413457/mod_resource/content/1/SENG%20465%20Term%20Project%20description.pdf