***Project Phase II***

***On­­­***

**3-D Multiplayer Game(Tic-Tac-Toe)**

**Submitted for the requirement of**

**Project course**

BACHELOR OF ENGINEERING

**COMPUTER SCIENCE & ENGINEERING**



**Submitted to: Priyanka Sharma(E6197) Submitted By: Sahul Kr. Parida(20BCS4919)**

**(Project Supervisor) Saksham Thakur(20BCS4970)**

**Sudhanshu Kumar(20BCS4953)**

**Co-Supervisor Signature**

**Archana Kumari (E13569)**

**DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

**CHANDIGARH UNIVERSITY, GHARUAN**

**November 2022**

**Table of Contents**

Literature Review and Problem Identification

[1: INTRODUCTION 3](#_Toc5146)

[2: LITERATURE REVIEW 3-3](#_Toc5148)

3: PROBLEM IDENTIFICATION 5

4: CONCLUSION 6

References 6

# **1: INTRODUCTION**

Tic-tac-toe also known as noughts and crosses is a paper and pencil game for two players, who take turns marking the spaces in a 3 x 3 grid traditionally. The player who succeeds in placing three of their marks in a horizontal, vertical or diagonal row wins the game. It is a zero-sum of perfect information game. This means that it is deterministic, with fully observable environments in which two agents act alternately and the utility values at the end of the game are always equal and opposite. Because of the simplicity of tic-tac-toe, it is often used as pedagogical tool in artificial intelligence to deal with searching of game trees. The optimal move for this game can be gained by using minimax algorithm, where the opposition between the utility functions makes the situation adversarial, hence requiring adversarial search supported by minimax algorithm with alpha beta pruning concept in artificial intelligence.

# **2: LITERATURE REVIEW**

# **2.1 Introduction**

A literature review discusses published information in a particular subject area, and sometimes information in a particular subject area within a certain time period. It can be just a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis. People can use it as a guideline or a sample to upgrade or to develop a new better system compared to the old one.

The main objective of literature review is:

* It presents the literature in an organize way.
* It surveys the literature in your chosen area of study.
* It synthesis the information in that literature into a summary.
* It critically analyses the information gathered by identifying gaps in current knowledge; by showing limitations of theories and points of view; and by formulating areas for further research and reviewing areas of controversy.

# **2.2 Literature Review (based on game concept)**

There are a few categories on developing game concept. The following sections deal with each of the categories in detail.

**2.2.1 Video Games and Interactive Storytelling**

Interactive storytelling is a topic tightly related to this thesis, because every quest needs a story, and interactive storytelling can be the instrument to produce them. The core of this concept is the ability of the player to influence the narrative by his actions, and the two main kinds of interactive storytelling are based on who, or what, creates the narrative– either the virtual characters in the game, or the story itself.

**2.2.2 Character–Driven Storytelling**

In the character-driven subtype of storytelling, the story is not controlled or enforced in any way, but instead is generated by the characters being in the situations and taking actions based on their motivations and subsequent decisions. The possibility to alter the characters’ decisions by altering the environment or giving them advice was presented, with the result of changing the action the character takes, ultimately leading to a change in the ending of the story.

**2.2.3 Story–Driven Storytelling**

In the story-driven storytelling, the story is seen as a sequence of actions controlled by another entity. When the user makes a difference in the world, either by interaction or the lack of it, the controller takes notice and adjusts the story and its actions, and that ultimately leads to a change of the narrative course.

# **3: PROBLEM IDENTIFICATION**

Tic tac toe game has 16 cells for a 4x4 grid. The two players with their respective marks as ‘X’ and ‘O’ are required to place their marks in their turns one by one. Once the cell is occupied by a mark it cannot be used again. The game is won if the agent is able to make a row or column or a diagonal occupied completely with their respective marks. The game terminates once the winning situation is gained or the cells are fully occupied. The problem specification for this game is given below:

Problem: Given a 4x4 grid, the agents has to find the optimal cell to fill with respective marks.

Goals: To find the optimal cell to fill with respective marks and in order to win the game, the cell must be filled such that one of the following criteria is satisfied:

1. A row is completely filled by a mark ‘X’ or ‘O’.
2. A diagonal is completely filled by a mark ‘X’ or ‘O’.
3. A column is completely filled by a mark ‘X’ or ‘O’.

If these criteria are not satisfied by both the agents, the game is terminated with a tie situation.

Constraints:

1. Once the cell is occupied by a mark, it cannot be reused.
2. Agents place the mark alternatively. So, consecutive moves from any agent is not allowed.

# **4: CONCLUSION**

With the basis of minimax algorithm for mathematical analysis alongside speeding up the computation by alpha beta pruning concept and optimizing the utility function using heuristic function, the 4x4 tic tac toe game was developed. We explored that a 4x4 tic tac toe, an adversary search technique game in artificial intelligence, can be developed using these techniques. Increasing the size of this game would create a huge time complexity issue with the same algorithm and techniques, for which other logics must be further researched.

**References**

1. K. Kask. [Online]. Available: https://www.ics.uci.edu/~kkask/Fall2016%20CS271/slides/04-games.pdf. [Accessed 02 01 2020].
2. G. Surma. [Online]. Available: https://towardsdatascience.com/tic-tac-toe-creatingunbeatable-ai-with-minimax-algorithm-8af9e52c1e7d. [Accessed 20 12 2019].
3. P. G. ,. P. S. P. Sunil Karamchandani, "A Simple Algorithm For Designing An Artificial Intelligence Based Tic Tac Toe Game".
4. 12 09 2019. [Online]. Available: https://www.edureka.co/blog/alpha-beta-pruning-in-ai.

[Accessed 20 11 2019].