High-Level Design Document Gobang

GROUP D3

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Content

I. INTRODUCTION

I.I PROJECT OVERVIEW

The Gobang project aims to create a comprehensive Gobang game that offers two game modes and various functionalities according to players' preferences. The game will have basic functions such as making moves, passing, retracting, and declaring the game over, and different player modes, including two-player and single-player against AI in different game difficulties. The game will have a user management system with sign-up, login/logout, game records, and admin features. In addition, the game will have extra configurations, such as early termination and a timer, and some optional rules, to add extra challenge and excitement and allow players to customize their experience. The ultimate goal is to provide an engaging and user-friendly gaming experience.

I.II SYSTEM FEATURE

Different player modes

In this Gobang program, there will be two modes of play: player vs. player and player vs. computer. When the user chooses to play against another player, the rules setting screen will appear. Players can adjust the fairness of the game according to their preferences, which will be explained later. When the user chooses to play against the computer, the previous rules will not take effect, only the basic rules will remain. Instead, the difficulty selection screen will appear.

Then the player can choose from three computer difficulties: **Random, Medium, and Master**.

Random: The computer will randomly place pieces until one side wins or the board is full.

Medium: The computer will try to prevent the player from winning by placing pieces.

For example, if the player has formed a live three (three consecutive pieces without an enemy piece on either end) or a dash four (four consecutive pieces without an enemy piece on one end), or a live four (four consecutive pieces without an enemy piece on either end), then the computer will place its own piece on one end. If none of these three situations occur, the computer will place its piece in the position where it can form a live three/punch four/live four. Otherwise, the computer will randomly place the piece around the pieces that already exist.

Master: Unbeatable computer AI, player can choose only white pieces, this part will use external source code.

User Management

Sign Up

After the game is opened, the user will see the Login page. If user does not have an account at

that moment, a new one can be created by using the sign-up function. After selecting “Sign up”, the user will be asked to enter an account name and password, which cannot be duplicated by other users. And data will be stored in the database.

Login/Logout

If the user already has an account, he can enter the account and password on the login page. If user successfully entered the account, he will be taken to a new page. It shows game history, enter the game and log out of his account. If there is wrong entered, a warning will be prompted to the user and request him to enter it again.

Game Records

The game records function will show the games played by the account, including start time, elapsed time, player names, winner, and final Goboard with stones.

List/Delete Users (for Admin only)

After successfully verifying that the account is the administrator, he can use the “List/Delete users” function. "List users" list all usernames of the game and "Delete users" allows the administrator to delete user accounts with a specific account name.

Game control

The game will provide the following functions once user enters the game, both in the 1-player and 2-players:

Choose color

In addition to the "master" difficulty of the game, users can choose the color of their own pieces to be white or black, and the game will start after the selection.

Make movement

User can place their pieces, and the game will go into the next turn after it is confirmed. Then, another player/computer can make their move.

Pass

If the user does not want to or cannot place a piece, he can select "pass" and it will be replaced by the next player.

Users can select "pass" function to pass the turn to the next player if they do not want to move in this turn.

Retract

If the user is not satisfied with the move, he is allowed to retract the previous move before placing the next piece. If the opponent agrees to the retraction, then both or one of the discs on the board are removed, and returning the game to the state it was in before the user placed the last disc.

Game over

The game ends when the game board is full or one of the players has 5 pieces either horizontally, vertically, or diagonally. The results of the game are saved in the database for the player to see.

Extra Configuration

Early Termination

Early termination refers to a situation where the game is ended before all the available moves have been made. This can occur if one player creates a "five in a row" pattern (also known as 雙活三 or 活四) that unlikely to be stopped by the other player. The game is then immediately ended and the player with the "five in a row" pattern is declared the winner. This rule is put in place to reduce the total number of moves needed to be made and to speed up the game.

Three-step Exchange (三手交換)

Three-step Exchange means the second-hand player, can choose to exchange the color exactly after the third move. This rule was made to increase the fairness of the game, given that Gobang is a first-hand advantage game. The exact pattern and moves involved in Three-step Exchange can vary depending on the specific game and the skill level of the players. It is often used by experienced players as a means to gain a strategic advantage over their opponents.

Five-Step Three Strikes(五手三打)

Five-step three strikes is also a rule to improve the balance of the game. It means that the first-hand player must provide three positions for the fifth move, and let the second-hand player chooses exactly one place to keep it. This rule reduces first-hand advantage effectively.

Timer

The timer helps to prevent slow play, adds pressure to the game, and makes it more exciting. If a player takes too long to make a move, they may forfeit their turns, or the game could be terminated, and their opponent became the winner. The total time of the timer can be set before each game.

II. SYSTEM ARCHITECTURE

II.I TECHNOLOGIES

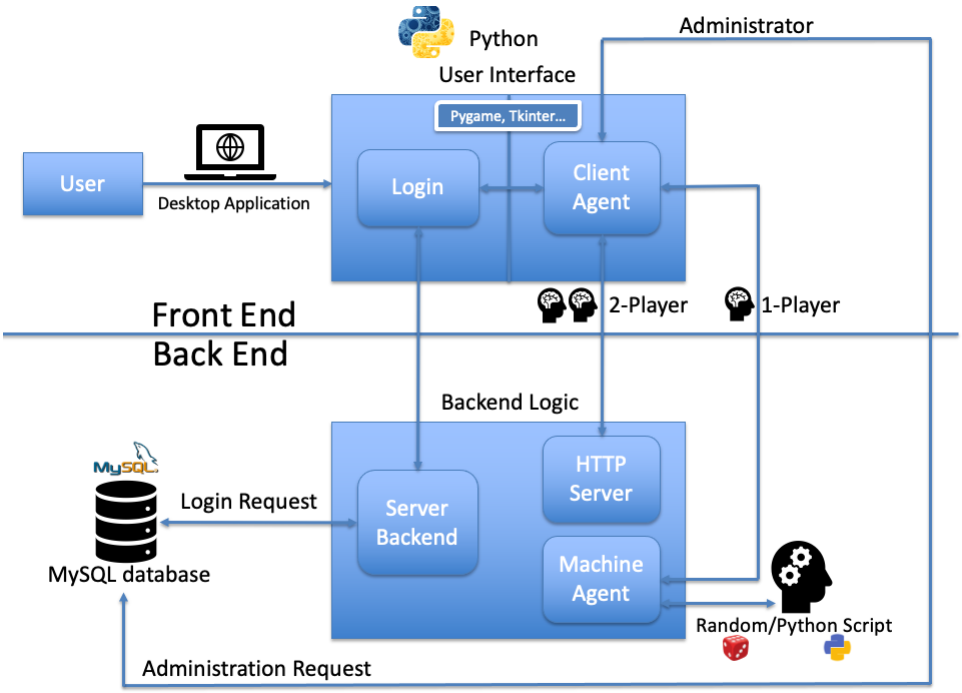
Database: To store important game data such as player information, game history, and high scores, we have chosen to use the powerful and widely-used MySQL database system.

Programming Language: Python will be the primary programming language utilized in our Gobang project. Being a high-level language that is easy to understand and has a broad range of available modules and tools, it makes Python an excellent option for game development,

providing both versatility and efficiency to our project. The programming of our various AI modes is also carried out using Python.

User Interface: We will utilize GUI libraries in Python such as Tkinter, PyQt, and wxPython, or Unity, depending on our specific needs. We will ensure that players have enjoyable gaming experience.

II.II ARCHITECTURE DIAGRAM



II.III SYSTEM COMPONENTS

Frontend

User Interface

For the interface, Pygame and Tkinter will be used. Pygame is a cross-platform set of Python modules designed for writing games and allows developers to structure the game through a high-level programming language. Tkinter is a standard graphic user interface (GUI) library for Python, which provides an object-oriented approach to developers in UI design. All interfaces of Gobang, including the user login interface and game interface, are based in Python.

Backend

Database

To store the data of Gobang, MySQL will be used. MySQL allows developers to organize their data and uses it with other programs to access tasks. In Gobang, data from the game, like all

users' login accounts and the gaming record, can be stored and well-organized by using MySQL. Moreover, user authentication and analytics of Gobang also will be handled by MySQL.

Server

In order to set up a development environment, Django is used to run the real-time web game. Django is a fully featured server-side web framework to allow developers to handle the logic of the project. It mainly provides the function to receive, process, and respond to HTTP requests from its server. To achieve the interaction between players.