Project Report: Gomoku
Team 9

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1. Management process review

We used Agile development methodology for this project. The project was developed as a series of four two-week sprints. For each sprint a specific set of tasks were accomplished and a brief presentation and demonstration was presented to show incremental improvement and working functionality.

For the first sprint, the management process used was mostly unstructured. Since all the team members were new to Agile methodology and also to the Android environment, the goal was to familiarize everyone with the basics before stepping into the actual development. All the members set up github accounts to share and code together, and communicated via slack and regular meetings.

From the second sprint onwards, a more structured approach to assigning and tracking tasks was used. We used trello to first create a checklist of tasks for the sprint and then pull these tasks into 'in-progress' as they were being developed. At the end of the sprint, all completed tasks were pulled into 'completed' and the remaining tasks were assigned to the next sprint if they were still applicable.

The team met every week to assign new tasks and monitor the project's progress. The team collaborated well during the meetings and each member took up tasks voluntarily. Separate features of the application were developed by each team member and at the end of each sprint all different pieces of code were merged using git version control. The primary communication channels used were email and slack.

Each sprint saw adequate amount of functionality accomplished and bugs uncovered in the sprint were fixed early on. Overall, this was a very effective management style for this group. Individual contributors were motivated to contribute, and the project management overhead was minimal.

2. Required features completed

All required features were completed. The implemented features are:

- MAIN MENU: Players can select the game parameters from the main menu
- GAME TYPE: Standard or Freestyle
- GAME MODE: Offline, Online, AI
- BOARD SIZE: 10 x 10, 15 x 15, 20 x 20 (Players can select the size of the board before starting the game and the board is dynamically drawn according to the selection)
- PLACE STONE: Two players take turns, place stones correctly at non-empty corners in the board. Existing stones on the board cannot be moved.
- TIMER VIEW: Displays the remaining time of each player
- SCOREBOARD: Keeps track of number of matches won by each player
- OFFLINE GAME: Two players taking turns on the same device
- AI GAME: Player plays against computer
- ONLINE GAME: Two Players can connect via Bluetooth and play the game.
- WIN DETECTION: Determine if a player has won the game base on the game type mode
- STALEMATE: Two players tied if the board is fully covered with stones
- MULTIPLE ROUNDS: Players can restart a game at anytime and play multiple rounds

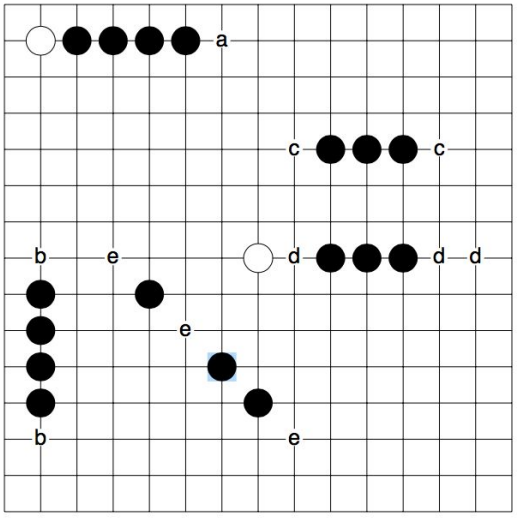
2.1 Game modes Implementation

- Offline Mode:
  - Two players play taking turns on the same device
  - Searches for 5 adjacent stones that are not blocked at both ends
  - In case of freestyle mode, also search for 6 adjacent stones
  - The algorithm is able to detect winner in all three directions
  - The algorithm can tell when there's a stalemate

- Online Mode:
  - Two players connect via Bluetooth to play the online game from their individual devices
  - The board is shared with both the players
  - The players take turns and one player waits while the other is playing
  - The state of the game is updated each time a player plays

- AI Mode:
  - Player plays against a computer algorithm opponent
  - AI uses the following logic to determine its next move in:
    1. Search for the Computer's Winning steps (Figure 1), if found, win the game.
    2. Search for threat sequences (Opponent's winning step). If found, the computer should block the threat sequences.
    3. If no threat sequences found, Computer will try to create its winning step.
    4. Else, it will place the stone next to the player's move.

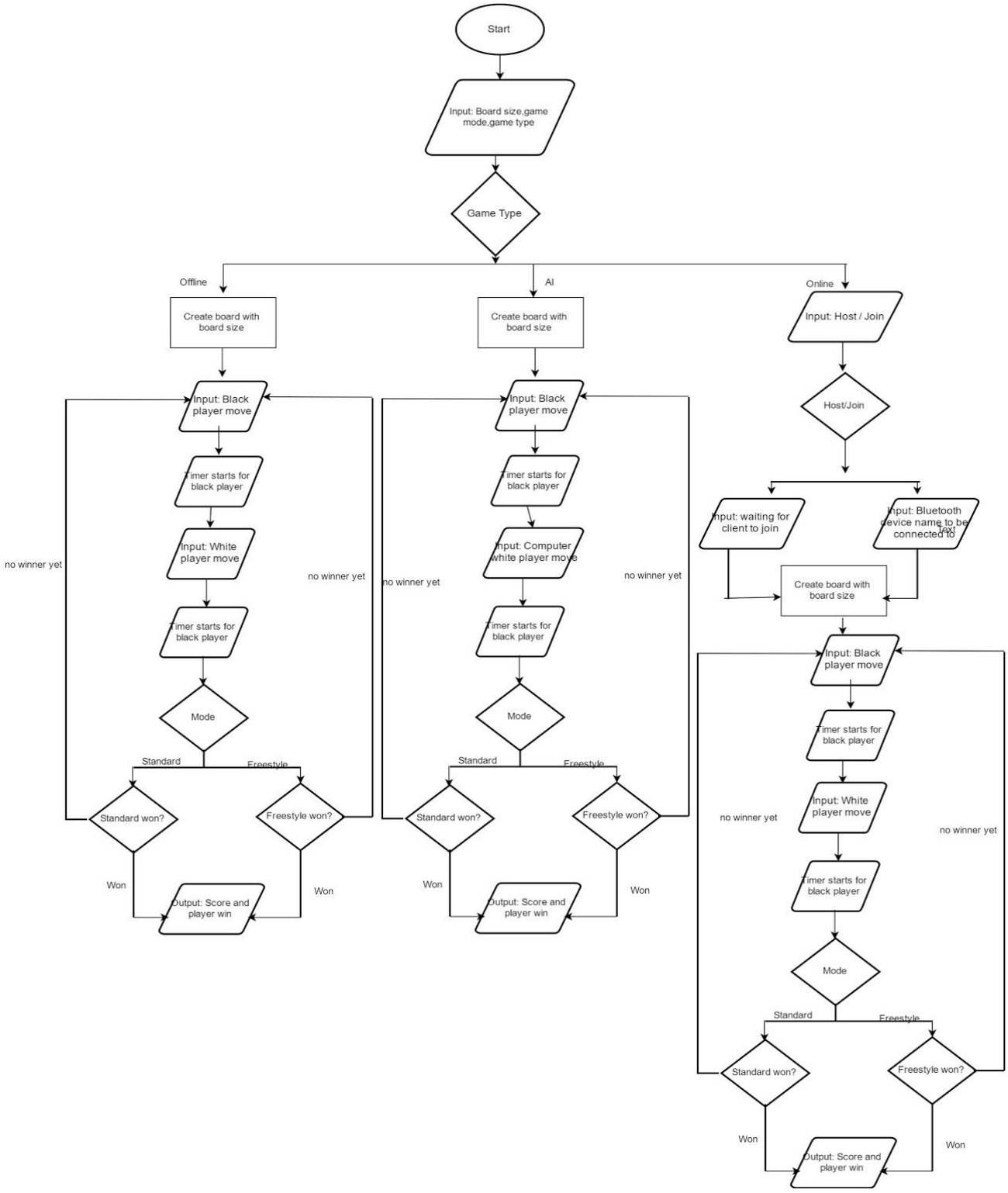
Figure 1: Winning steps



2.2 Game Type Implementation:

- Standard Mode:
  - The standard mode allows the player to win when there are **exactly 5** continuous pieces of same color in any direction (Horizontal, Vertical, Diagonal)
  - Player cannot win if blocked by the opponent color on both ends
  - Player cannot win if blocked by board edges
- Freestyle Mode:
  - The Freestyle mode lets the player win when there are 5 or more continuous pieces of same color in any direction (Horizontal, Vertical, Diagonal)

2.3. FLOW OF APPLICATION:



3. Extra Features:

- Added Player Names -- Players can enter their names, their scores are stored under their names respectively
- Scoreboard -- Players can choose to check their ranking from main menu
- Activity background

4. List of group member contributions

The team worked on many tasks. Only a handful of the largest tasks are listed below.
Individual 360 feedback will be provided separately from this document.

- Fan:
    - Set up the initial game board and stones
    - Timer for each player
    - Scoring system
    - Fix menu page bugs
    - Winner notification display
    - Project Report

- Melody:
    - User Interface - Menu Page
    - Bluetooth Connectivity for online game
    - Draw Board and share the game state for online mode
    - Online Game for two players
    - Project Report

- Cuong Ngo:
    - AI mode (Player vs Computer)
    - Offline Mode (Player vs Player)
    - Win detection function
    - FreeStyle Mode (Allows 6 in a row)
    - Standard Mode
    - Draw board with 3 sizes (10x10, 15x15, 20x20)
    - Placing stones
        - Alternating black and white
        - Stone position on valid position
    - Stalemate

- ❖ Sindhuja:
    - Menu Display bugs
    - Online Game bugs
    - Project Report

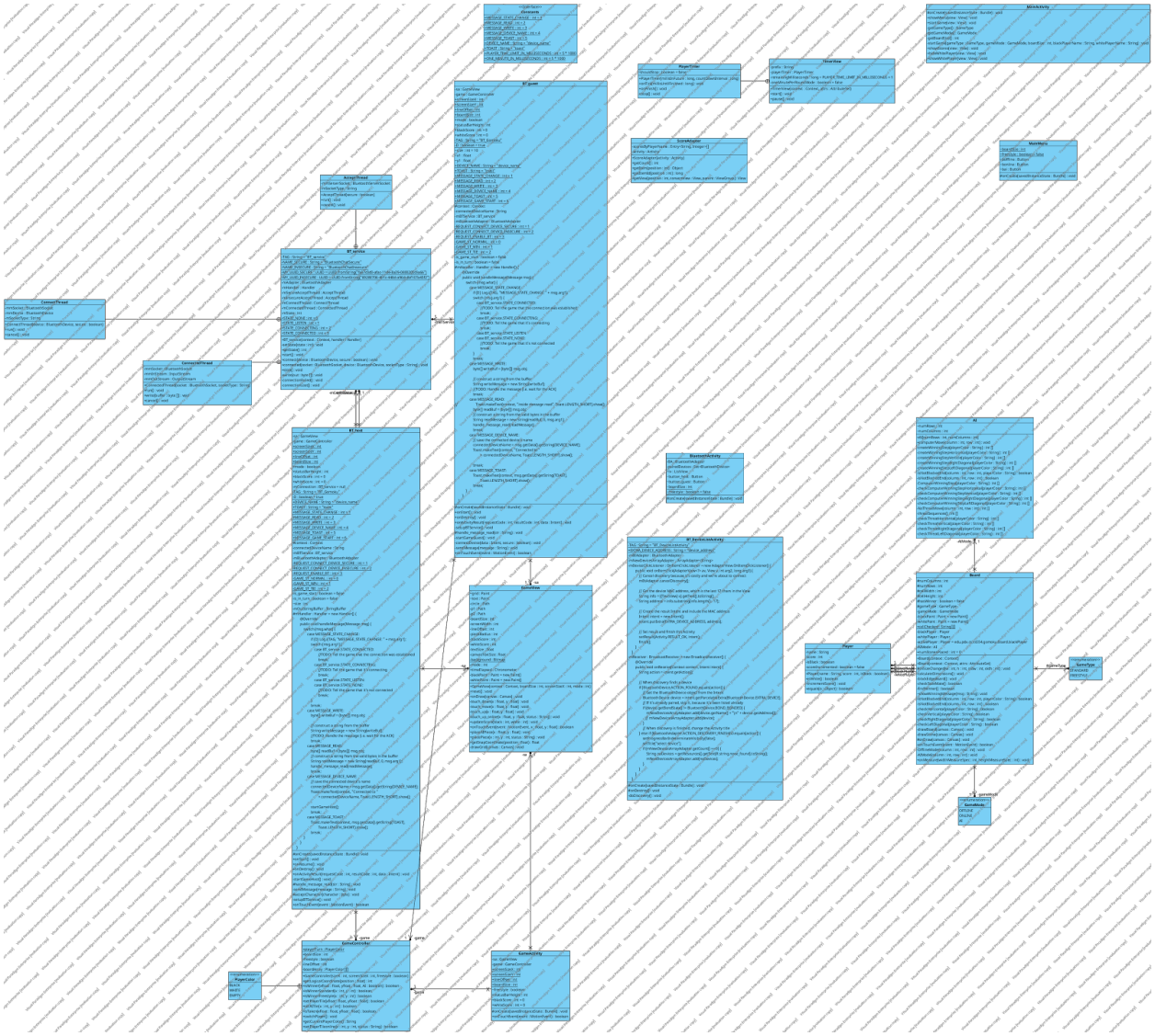
5. Instructions for downloading, compiling, and running

5.1 Describe high level design of your application to fulfill the requirements

Please refer to the class diagram for application design:

To enlarge below diagram, please click below link:

https://raw.githubusercontent.com/Team9-Gomoku/GomokuV2/master/Class%20Diagram1.png



5.2 Instructions to compile, deploy and run your application

1. Clone the git repo from github:

    git clone https://github.com/Team9-Gomoku/GomokuV2.git

2. Open Android Studio and choose "Import project". In the dialog select the "Gomoku" directory inside the "GomokuV2" directory created in the last step. Select "Import project from external model - Gradle".

3. In the Project window, right-click on "MainActivity" and then "Run MainActivity.

4. Select an Android device or Virtual Android Device. You may need to create a new virtual device if one isn't present.

5. Note that Online Mode can only run on two physical devices since virtual ones do not support Bluetooth.