ARCHITECTURE AND DESIGN

Robot Arena

GROUP D1, CMPT370

Nico Dimaano, ned948

Niklaas Neijmeijer, nkn565

Kyle Seidenthal, kts135

Brendon Sterma, bws948

Jiawei Zang, jiz457

INTRODUCTION

Purpose

The purpose of this document is to outline the architecture and detailed design of the Robot Arena system. The Robot Arena system is a multiplayer turn based game that will feature online multiplayer and non-human players if desired.

Scope

This document describes the information needed to implement the Robot Arena system. It will contain a description of the architecture as well as a detailed level class design.

SYSTEM ARCHITECTURE

Chosen Architecture

The architecture we have chosen for this project is the "Model-View-Controller" architecture. This architecture works well with the concept of a game, and allows us to separate the interface from the game model. "Model-View-Controller" keeps the user interface separate from the game logic, which makes it easy to design, update, and maintain the interface to the game. By keeping the game logic in one place, any changes to the game logic itself are also easier to manage as they will not affect the controller or view. This architecture will also allow for easier testing, as each layer can be tested separately and can be guaranteed to work with any other layer through predefined interfaces. Overall the "Model-View-Controller" matches the system requirements more effectively than other architectures we have studied.

Other Considerations

We have studied into a few different options for the architecture of our system to ensure we maximize the efficiency of the system. The following section outlines the details of some of our options. The major architectures we considered were: “Data-Driven”, “Call and Return”, and “Pipes and Filters”.

One of the architectures we studied was the “Data-Driven” architecture. This does not seem to be a necessary architecture for our system as there is no underlying data storage or lookup. All data used in the system is created and used during play and is not stored after the application has been terminated. The robot data from the librarian will travel through the system in JSON format, however it is unnecessary to store this information after a match has finished as it will be sent back to the librarian, which will manage it per its specifications. Thus, a data-driven architecture seems to have more overhead than is necessary for the system, and would ultimately be more costly than beneficial.

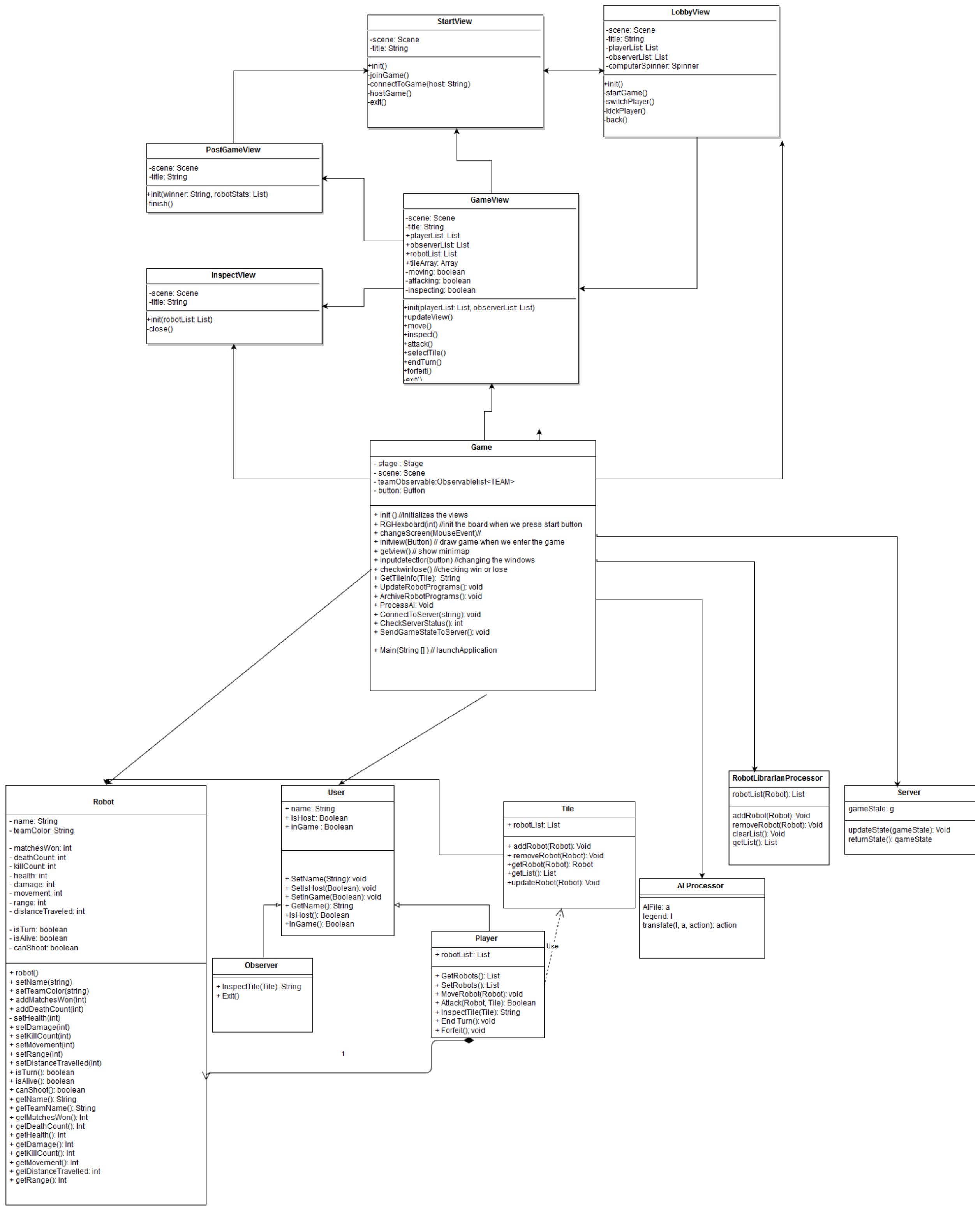
We also studied the “Call-and-Return” architecture. Some aspects of this architecture could be beneficial to the system, such as the ability to easily distribute across multiple machines or networks. Though this may make the networking pieces of the system easier, “Call-and-Return” has negative affects to keeping the game system simple and easy to manage. The hierarchical nature of this architecture would not allow us to abstract the input and output interfaces from the model of the game, and many objects would rely on each other, creating high coupling. This will ultimately impede our ability to manage game components separately from the user interface, making testing and implementation more work than is necessary. The “Call-and-Return” architecture does not fit well with the requirements for the system.

The “Pipes and Filters” architecture was the final architecture we considered. We found that this architecture would be useful for translating information from one state to another. It is not particularly useful for the overall game system, but may prove useful for specific pieces in the architecture. As an example, the robot librarian collects robot programs and gives them to the system. This data needs to be parsed out into a format that can be read by the system. Using “Pipes and Filters” would be useful in designing this piece of the system, but will not be effective for the overall game, where there is really no pipeline of commands being executed.

After exploring the above options, we feel we have adequately justified the use of the “Model-View-Controller” architecture for our system. It will allow us to separate the interfaces and maintain the system easily. All of the game logic will be kept in one place and will also allow for easy testing. As the system is meant to implement a game, the ability for the architecture to lower coupling for the user interface and game model makes “Model-View-Controller” an excellent choice.

DESIGN OVERVIEW

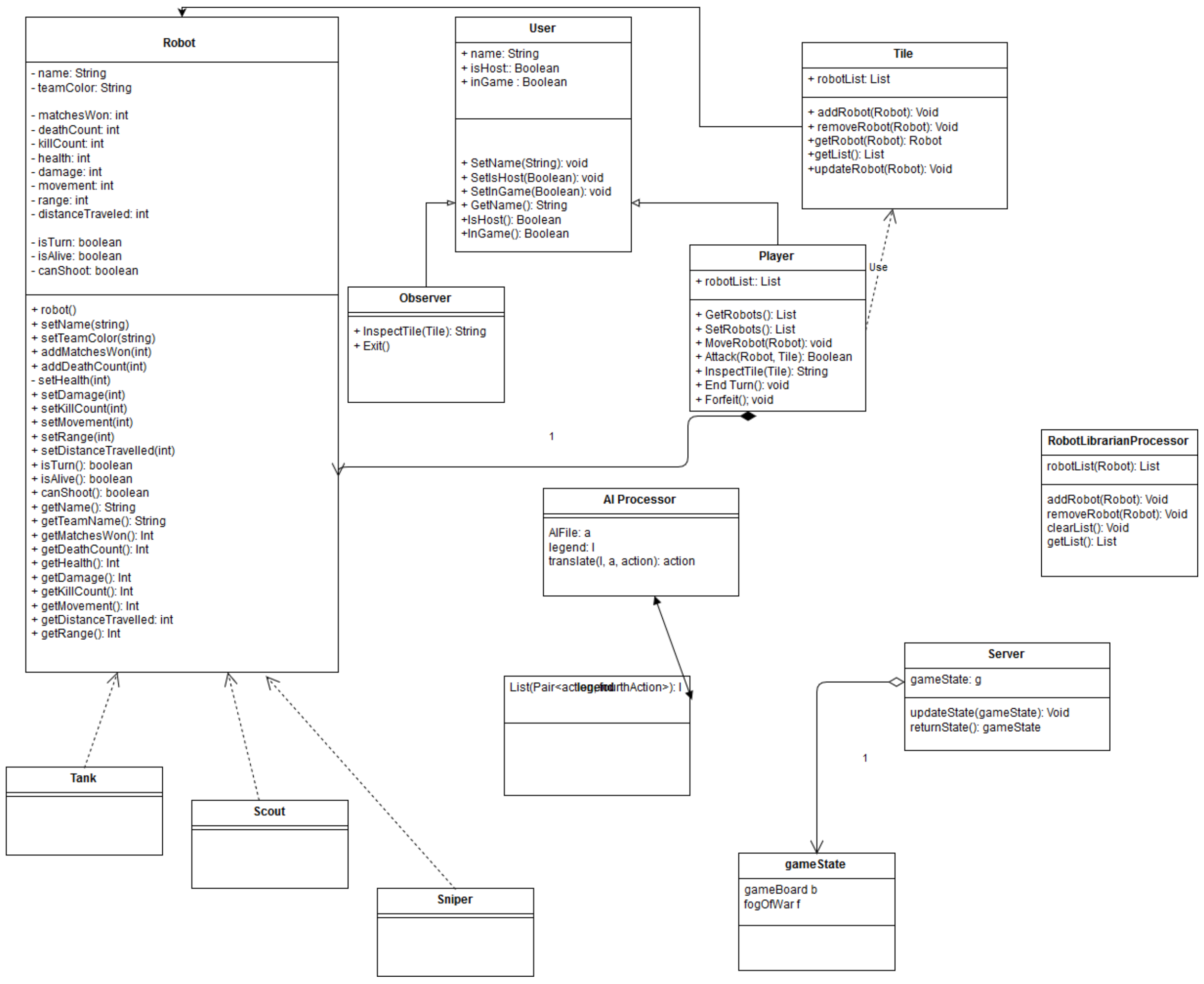
Overview of the System



The above figure shows an overall diagram of the system. It is divided into three layers, the View is the first layer, the Controller is in the center, and the Model is on the bottom. Some subclasses and other classes have been removed for readability.

The Model-View-Controller architecture allows the view to communicate with the model through the controller. This decreases coupling for the system. Each level of the system is described in detail below.

Model



The above figure shows the class relationships in the model. The robot and tile classes are interacted with by the user, while the controller acceses the server, librarian, and AI.

The AI Processor contains a copy of an AI File, a legend and a translate function. The legend consists of a list of Pairs. Each pair contains a Fourth function from the AI File and a java function that mimics the behavior in the java environment. The translate function finds a Pair in the legend that contains a desired java function. It then runs the co-responding action in the AI File, written in Fourth. The result is recorded and matched with another pair, executing the Java action associated with it.

Robot Librarian Processor contains a list of Robots and four functions for modifying them. The first is adding a robot to the list. This uses the list class's own adding functions as per choses implementation. The remove robot function also uses the list's functions to remove a specific robot from the list permanently. Clearing the list removes all robots from the list in an identical manner. The getList() function allows for the robot list to be returned as a full list to be manipulated by other exterior functions.

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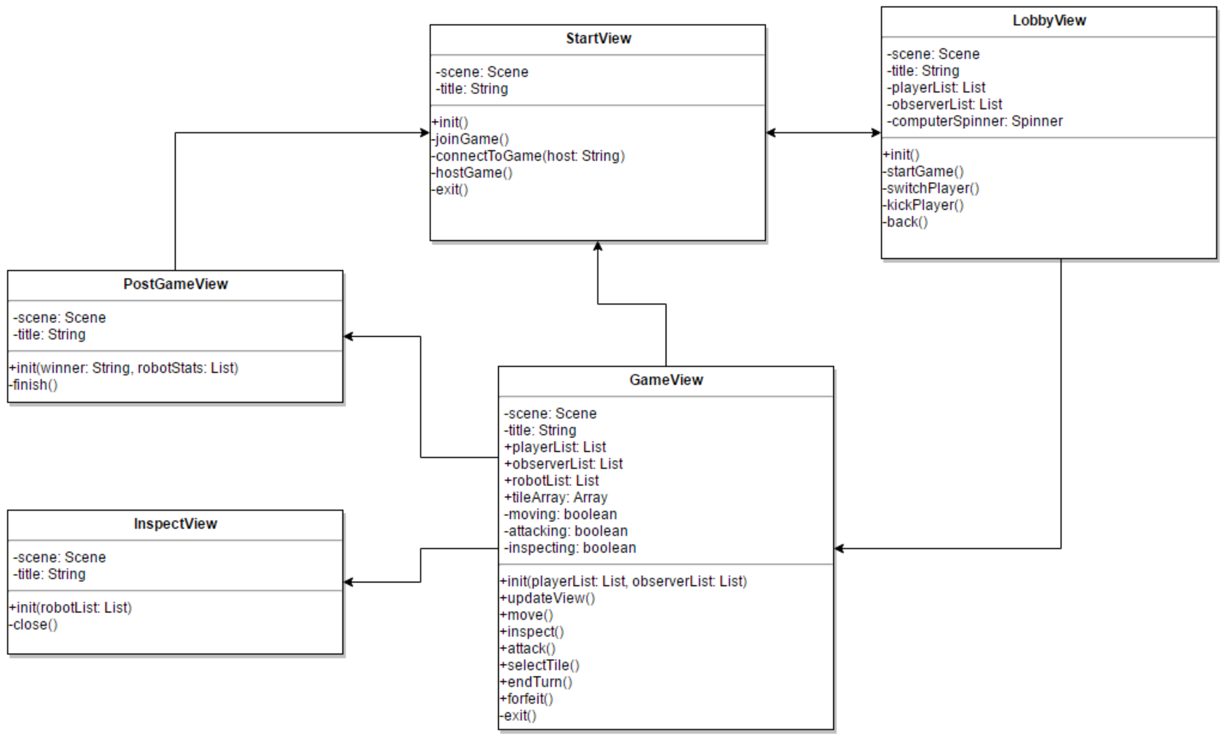
The tile class consists of a list of robots, and functions to manipulate them. A robot can be added to the list, a specific robot can be removed from the list, and a specific robot can be returned from the list for use by an external function. The entire list can also be returned in the same way. A specific robot can be updated by replacing that robot with an updated version.

The Robot class represents a robot in the game. Robots have many properties that allow them to be distinguished from one another, such as name, team, and their movement and attacking stats. Robots come in three types, Scout, Sniper, and Tank. These subclasses determine the stats for the robot. Robots can move between tiles, and can attack other robots through the respectively named functions.

The User class represents a human player for the game. The user has a Name conditions to determine whether they are the host of a match and if they are currently in a match. They have getters and setters for all of these properties. They have two subclasses. The first is the player, who can use the inspectTile() function to inspect a tile, the moveRobot() function to move robots, and the attack function to attack an enemy robot. They may also end their turn with the endTurn() function and forfeit the match with the forfeit() function. The player class has a list of their robots. The second subclass of User is Observer, which can use inspectTile() to look at any tile on the game board. This differs from the user's getTile() in that the user can only inspect tiles in their view. The observer can also leave the game.

View



The above figure shows the View level of the system.

The StartView class represents the screen shown to the user when the program begins. It has a title and a scene to display. The StartView is initialized via the init() method. It has three options represented by its methods: joinGame, which allows the user to specify the address of an active match, hostGame which allows the user to host a match, and exit which allows the user to exit the program.

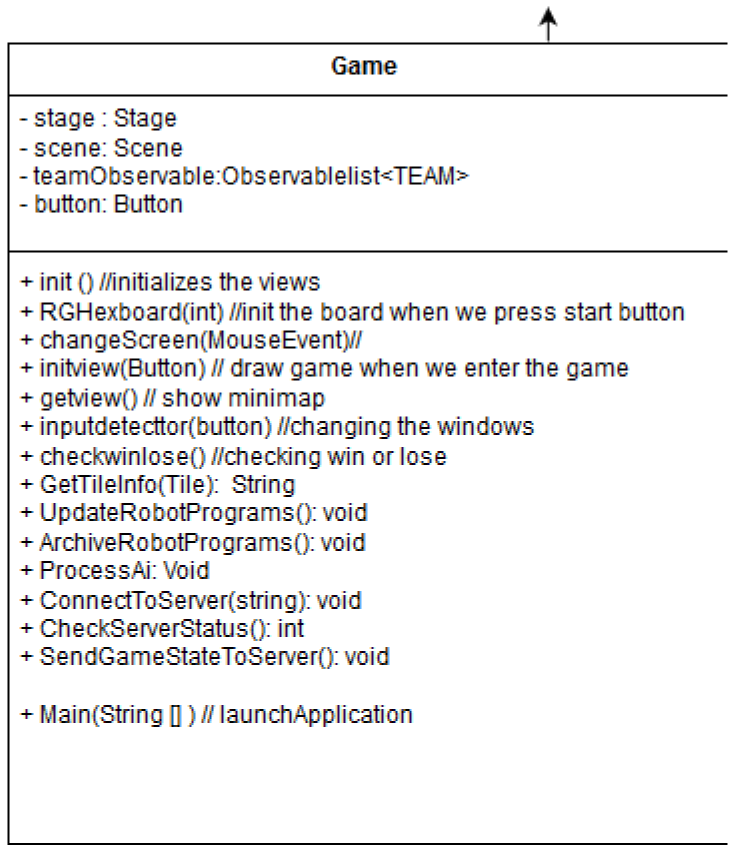
The LobbyView displays the game lobby to the user once the user has joined the match. The view has a title, a list of players, and a list of observers. The startGame() method starts the game and starts the GameView. There is a switchPlayer method that allows a user to become an observer, or an observer to become a player. There is also the kickPlayer() method, which removes the desired player from the match.

The gameView displays the current ongoing game. It has a list of players, observers, tiles, and robots in the game. The game view has methods to communicate with the controller to move robots, attack other robots, inspect tiles, end turns, and forfeit games.

The InspectView has a title and a scene to start the view. It is initialized with a list of robots to display to the player. It is closed with the close function.

The PostGameView displays a screen to the player that shows the results of the match. It has a scene to start the view and a title. It is initialized with the winning player and a list of robots. The finish method finishes the match.

Controller



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Game

- stage : Stage
- scene: Scene
- teamObservable:Observablelist<TEAM>
- button: Button

+ init () //initializes the views
+ RGHexboard(int) //init the board when we press start button
+ changeScreen(MouseEvent)//
+ initview(Button) // draw game when we enter the game
+ getview() // show minimap
+ inputdetecttor(button) //changing the windows
+ checkwinlose() //checking win or lose
+ GetTileInfo(Tile):  String
+ UpdateRobotPrograms(): void
+ ArchiveRobotPrograms(): void
+ ProcessAi: Void
+ ConnectToServer(string): void
+ CheckServerStatus(): int
+ SendGameStateToServer(): void

+ Main(String [] ) // launchApplication
```

The Contril

Game:

this is class will mainly initialize the game, and handle the user input which will contain functions such as:

init

which will initializes the views

RGHexboard

initializes the board when we press start button

changeScreen(MouseEvent)

change the screen when we press button

initview

draw game when we enter the game

getview

show minimap

inputdetecttor(button)

changing the windows, which we getting hit

checkwinlose

checking win or lose, if lose or win it will shows the windows which is winloss windows view

Main(String [])

launchApplication

REQUIREMENTS TRACEABILITY

We have decided to make minimal changes to our requirements. We have made the robot librarian an external system to our own, and added a win lose screen to our view.

Version History:

- **23/10/2016 – Initial DESIGN version – V1.1**