Overview

This application is a top-down, multiplayer game inspired by the iconic light-cycle battles from the Tron movie. Players face off in a fast-paced duel, controlling their motorcycles as they leave glowing light trails behind on the game board. The objective is simple but challenging: outmaneuver your opponent without crashing into walls, your own light trail, or the trail left by the other player.

Key Features:

1. Gameplay Mechanics:
   Each player's motorcycle moves continuously in the direction they set.
   - Players controls their motorcycle using the W, A, S, and D keys, or the arrow keys on the keyboard.
   - A player loses if they collide with:
     - The game board boundary.
     - Their own light trail.
     - The opponent's light trail.

2. Player Customization:
   - Before the game begins, players are prompted to enter their names.
   - Each player selects a custom color for their motorcycle's light trail, ensuring a unique and visually distinct experience.

3. Highscore System:
   - At the end of each match, the winner's score is incremented in a database.
   - If a player is new and not already in the database, their profile is automatically created, complete with their initial score.
   - A Highscore Table menu displays the top 10 players with the highest scores, fostering a competitive spirit among players.

4. Restart Option:
   - A Restart Game menu option allows players to quickly reset the game for another round of action.

Visual Style:

- The game features a clean and minimalistic design, with glowing trails in the players' chosen -colors.
- The top-down view provides a clear and strategic perspective for players to anticipate their moves and react to their opponent.

Analysis

Database

PlayerEntity:
Represents a player with their name, hashed password, and registration date. It includes methods to validate passwords and retrieve player details.

GameEntity:
Represents a game with its name and release date. It provides basic access to game properties.

HighScoreEntity:
Represents a player's score, linking a PlayerEntity with a score value.

HighScoreDB:
Manages database operations (CRUD) for high scores, players, and games, ensuring interactions like adding players, updating leaderboards, and retrieving scores.

Model

Tron:
Represents a player's "Tron" entity in the game. It manages the color, movement, score increment, bonus effects, and drawing logic for the Tron on the game board.

Player:
Represents a player by extending basic player data from PlayerEntity. It handles the score, a collection of Tron objects, and manages switching between active Trons during gameplay.

Movement:
Manages the movement logic for a player or object. It keeps track of position, direction, speed, and responds to key events to update movement accordingly.

Bonus:
Represents a bonus item on the game board. It ensures the bonus appears at random positions without overlapping with occupied areas and provides drawing logic for visualization.

GraphicsImages:
Loads and manages images used in the game, such as the scoreboard and logo, to be displayed on the UI.

Music:
Handles playing sound files in the game. It loads audio from a file and streams it for playback during gameplay.

Board:
The main game engine for the Tron Battle game, managing the game logic, rendering the game state, and handling player movements and collisions. It coordinates player actions, checks for deaths, handles bonuses, and manages the overall game loop using a timer and regular updates. It also interacts with other components like the Player, Bonus, Music, and GraphicsImages classes, and updates the user interface with BoardGUI. It supports key event handling for player movement and session saving to the high score database.

View

MenuGUI:
This class represents the main menu of the game, allowing players to start the game or exit the application. It initializes the UI components like buttons and handles their actions.

AuthenticationGUI:
It manages the player login and game setup, providing fields for username, password, and color selection. It ensures both players are authenticated and ready to play.

BoardGUI:
Displays the Tron game board, integrating the game logic with the visual interface and handling player key inputs during gameplay.

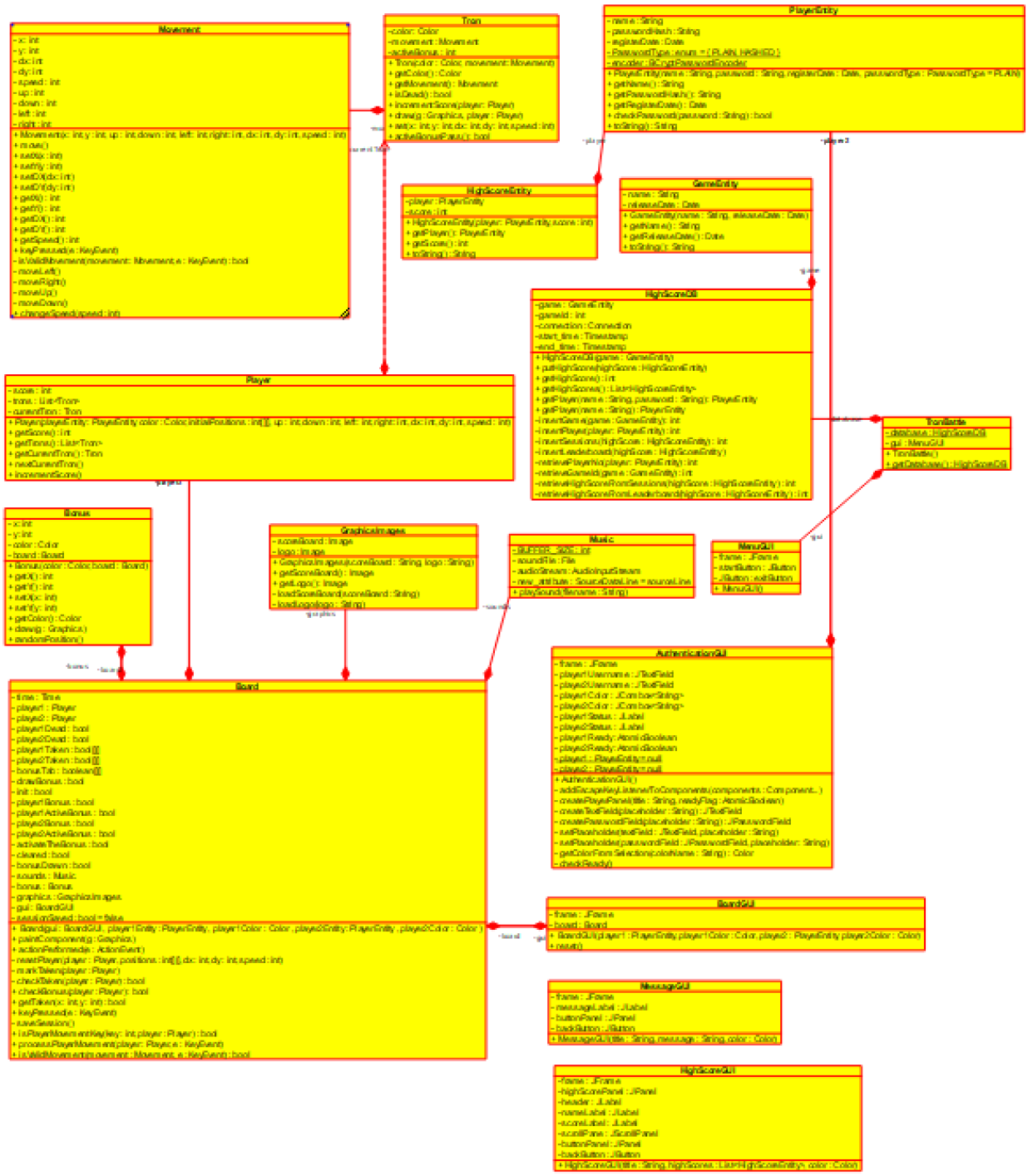
MessageGUI:
Displays informative or error messages with a back button that redirects players to the main menu.

HighScoreGUI:
Displays the list of high scores, presenting player names and their scores in a scrollable panel with a back button to return to the main menu.

Controller

TronBattle
The controller that initializes the game, sets up the database connection, and displays the main menu GUI. It manages the overall game flow, connecting to the high score database and providing access to it, while also launching the game with a default date for the game entity.

UML Class Diagram



Method Description

A short description on the methods used in each class. Getters and Setters are excluded.

Database

PlayerEntity	+ PlayerEntity(String name, String password, Date registerDate, PasswordType passwordType)	Constructs a PlayerEntity object with the specified name, password, registration date, and password type.
	+ getName(): String	Returns the player's name.
	+ getPasswordHash(): String	Returns the hashed password of the player.
	+ getRegisterDate(): Date	Returns the player's registration date.
	+ checkPassword(String password): boolean	Checks if the given plain password matches the stored hash password.
	+ toString(): String	Returns a string representation of the player.

GameEntity	+ GameEntity(String name, Date releaseDate)	Creates a GameEntity object with the specified name and release date.
	+ getName(): String	Returns the game's name.
	+ getReleaseDate(): Date	Returns the game's release date.
	+ toString(): String	Returns a string representation of the game.

HighScoreEntity	+ HighScoreEntity(PlayerEntity player, int score)	Creates a HighScoreEntity object with the specified player and score.
	+ getPlayer(): PlayerEntity	Returns the player associated with the score.
	+ getScore(): int	Returns the score of the player.
	+ toString(): String	Returns a string representation of the high score entry.

HighScoreDB	+ HighScoreDB(GameEntity game) throws SQLException	Initializes the database connection and game-related information.
	+ putHighScore(HighScoreEntity highScore): void	Adds a high score for a player.
	+ getHighScore(HighScoreEntity highScore): int	Retrieves the current high score of a player.
	+ getHighScores(): List<HighScoreEntity>	Retrieves the list of all high scores for the game.
	+ getPlayer(String name, String password): PlayerEntity	Retrieves a player by name and password.
	+ getPlayer(String name): PlayerEntity	Retrieves a player by name.
	- insertGame(GameEntity game): int	Inserts a new game into the database if it does not already exist.
	- insertPlayer(PlayerEntity player): int	Inserts a new player into the database if it does not already exist.
	- insertSessions(HighScoreEntity highScore): int	Inserts a new session into the database for a player.
	- insertLeaderboard(HighScoreEntity highScore): void	Inserts or updates the leaderboard with the player's high score for the game.
	- retrievePlayerNo(PlayerEntity player): int	Retrieves the player number (id) based on the player's game and password hash.
	- retrieveGameId(GameEntity game): int	Retrieves the game id based on the game's name.
	- retrieveHighScoreFromSessions(HighScoreEntity highScore): int	Retrieves the high score from the sessions for a specific player and game.
	- retrieveHighScoreFromLeaderboard(HighScoreEntity highScore): int	Retrieves the high score from the leaderboard for a specific player and game.

Model

Tron	+Tron(Color color, Movement movement)	Constructor that initializes the Tron player with a specific color and movement behavior.
	+ getColor(): Color	Returns the color of the Tron player.
	+ getMovement(): Movement	Returns the Movement object associated with the Tron player.
	+ isDead(): boolean	Checks if the player has gone out of bounds. Stops movement if out of bounds.

	+ incementScore(Player player)	Increments the score of the specified player.
	+ draw(Graphics g, Player player)	Draws the Tron player on the screen based on its movement and position.
	+ set(int x, int y, int dx, int dy, int speed)	Sets the position, direction, and speed of the Tron player.
	+ activeBonusPass(): boolean	Decrements the active bonus counter and increases player speed if the bonus expires.

Player	+ Player(PlayerEntity playerEntity, Color color, int[][] initialPositions, int up, int down, int left, int right, int dx, int dy, int speed)	Constructor that initializes a player with a list of Trons, score, and movement keys.
	+ getScore(): int	Returns the player's current score.
	+ getTrons(): List<Tron>	Returns the list of Trons associated with the player.
	+ getCurrentTron(): Tron	Returns the currently active Tron for the player.
	+ nextCurrentTron()	Switches to the next Tron in the list, looping back to the first if needed.
	+ incrementScore()	Increments the player's score by one.

Movement	+ Movement(int x, int y, int up, int down, int left, int right, int dx, int dy, int speed)	Constructor that initializes the position, direction, speed, and movement keys.
	+ move()	Moves the object based on the current direction and speed.
	+ setX(int x)	Sets the x-coordinate position.
	+ setY(int y)	Sets the y-coordinate position.
	+ setDX(int dx)	Sets the horizontal direction (dx) of movement.
	+ setDY(int dy)	Sets the vertical direction (dy) of movement.
	+ getX(): int	Returns the x-coordinate position.
	+ getY(): int	Returns the y-coordinate position.
	+ getDX(): int	Returns the horizontal direction (dx) of movement.
	+ getDY(): int	Returns the vertical direction (dy) of movement.

	+ getSpeed(): int	Returns the movement speed.
	+ keyPressed(KeyEvent e)	Handles key press events to change movement direction.
	-isValidMovement(Movement movement, KeyEvent e): Boolean	Checks if the current key press results in a valid movement based on the player's current direction.
	- moveLeft()	Updates movement to go left.
	- moveRight()	Updates movement to go right.
	- moveUp()	Updates movement to go up.
	- moveDown()	Updates movement to go down.
	+ changeSpeed(int speed)	Changes the speed and adjusts position accordingly.

Bonus	+ Bonus(Color color, Board board)	Constructor that initializes a player with a list of Trons, score, and movement keys.
	+ getX(): int	Returns the player's current score.
	+ getY(): int	Returns the list of Trons associated with the player.
	+ setX(int x)	Returns the currently active Tron for the player.
	+ setY(int y)	Switches to the next Tron in the list, looping back to the first if needed.
	+ getColor(): Color	Returns the color of the bonus.
	+ draw(Graphics g)	Draws the bonus on the board at a random valid position.
	+ randomPosition()	Randomly assigns a position on the board where no area is already taken.

GraphicsImages	+ GraphicsImages(String scoreBoard, String logo)	Constructor that loads the scoreboard and logo images from the provided file paths.
	+ getScoreBoard(): Image	Returns the scoreboard image.
	+ getLogo(): Image	Returns the logo image.
	- loadScoreBoard(String scoreBoard)	Loads the scoreboard image from the specified file path.
	- loadLogo(String logo)	Loads the logo image from the specified file path.

Music	+ playSound(String filename)	Plays an audio file specified by the file path using a buffered audio stream.

Board	+Board(BoardGUI gui, PlayerEntity player1Entity, Color player1Color, PlayerEntity player2Entity, Color player2Color)	Initializes the game board, players, bonus system, and other components needed for the Tron Battle game.
	+paintComponent(Graphics g): void	Renders the game board, including players, score, bonus items, and highlights.
	+actionPerformed(ActionEvent e): void	Updates the game state by moving players, checking collisions, and handling bonuses.
	-resetPlayer(Player player, int[][] positions, int dx, int dy, int speed): void	Resets a player's state (position, speed) after a death or game restart.
	-markTaken(Player player): void	Marks the areas occupied by the player's trail on the game grid.
	-checkTaken(Player player): boolean	Checks if the player has collided with a wall or another player's trail.
	-checkBonus(Player player): boolean	Checks if the player has collected a bonus item.
	+getTaken(int x, int y): Boolean	Checks if the given coordinates (x, y) are occupied by either player's trail.
	+keyPressed(KeyEvent e): void	Handles key press events for player movement and saving the session.
	-saveSession(): void	Saves the current game session to the high scores database.
	-isPlayerMovementKey(int key, Player player): Boolean	Determines if a key press corresponds to a valid movement for the specified player.
	-processPlayerMovement(Player player, KeyEvent e): void	Processes the movement of a player based on the key press event.
	-isValidMovement(Movement movement, KeyEvent e): Boolean	Checks if the current key press results in a valid movement based on the player's current direction.

MenuGUI	+ MenuGUI()	Constructs and initializes the main menu with Start and Exit buttons.

AuthenticationGUI	+ AuthenticationGUI()	Constructs and initializes the authentication window for player setup.
	- addEscapeKeyListenerToComponents(Component... components): void	Adds an Escape key listener to components to return to the main menu.
	- createPlayerPanel(String title, AtomicBoolean readyFlag): JPanel	Creates and configures an authentication panel for a player, including fields and buttons.
	- createTextField(String placeholder): JTextField	Creates a text field with a placeholder for user input.
	- createPasswordField(String placeholder): JPasswordField	Creates a password field with a placeholder for user input.
	- setPlaceholder(JTextField textField, String placeholder): void	Adds placeholder text functionality to a text field.
	- setPlaceholder(JPasswordField passwordField, String placeholder): void	Adds placeholder text functionality to a password field.
	- getColorFromSelection(String colorName): Color	Converts a color name string into a corresponding Color object.
	- checkReady(): void	Checks if both players are ready, and starts the game if true.

BoardGUI	+ BoardGUI(PlayerEntity player1, Color player1Color, PlayerEntity player2, Color player2Color)	Initializes the game board GUI and assigns player colors.
	+ reset(): void	Disposes of the current game board frame and resets it.

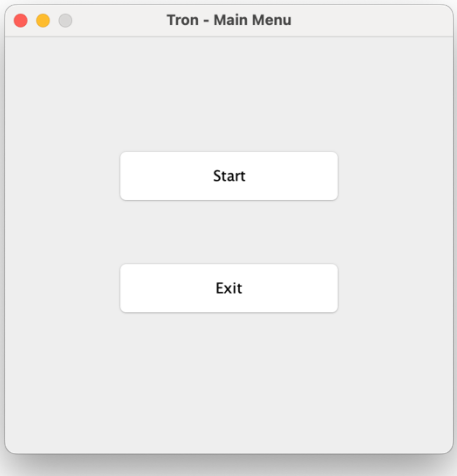
MessageGUI	+ MessageGUI(String title, String message, Color color)	Displays a message window with a back button to return to the main menu.

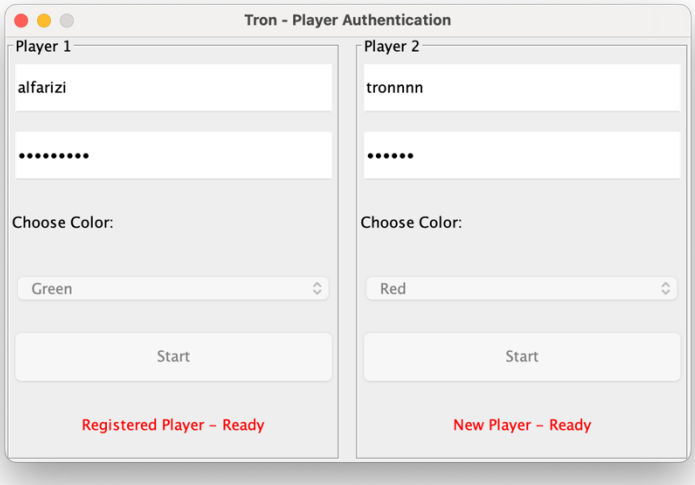
HighScoreGUI	+ HighScoreGUI(String title, List<HighScoreEntity> highScores, Color color)	Constructs a window displaying a list of high scores with a back button.

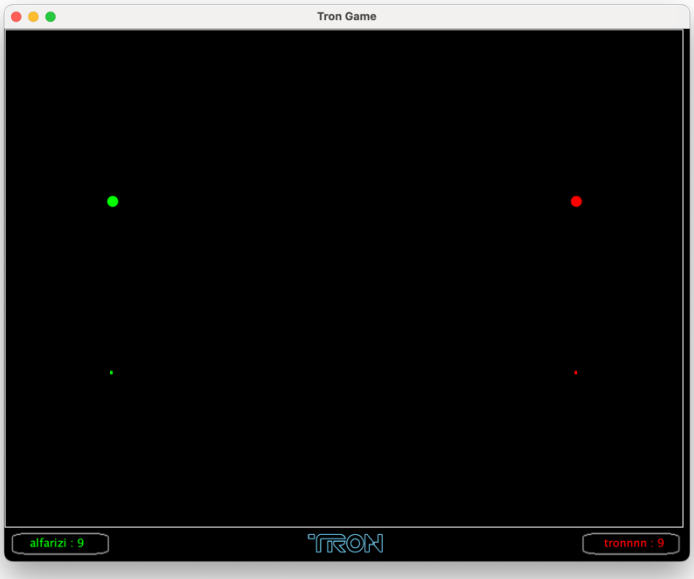
Controller

TronBattle	+ TronBattle()	Constructs the TronBattle game, initializes the database, and displays the main menu GUI
	+ getDatabase(): HighScoreDB	Returns the HighScoreDB instance for accessing high scores. Throws an exception if the database is not initialized.

Screenshots







Testing

Test Player Movement
As a player
I want to control my Tron using keyboard keys
Given the game is running and my Tron is visible
When I press the assigned movement keys (W/A/S/D or Arrow keys)
Then my Tron should move in the corresponding direction without any delays

Test Collision Detection
As a player
I want to lose the game if I collide with my trail, the opponent's trail, or the game boundary
Given my Tron is moving
When my Tron collides with a trail or boundary
Then the game should register my Tron as "dead" and increment the opponent's score

Test Bonus Pickup
As a player
I want to collect bonuses to gain temporary advantages
Given a bonus is visible on the board
When my Tron passes over the bonus
Then the bonus effect should activate (e.g., speed increase) and the bonus should disappear

Test Score Update
As a player
I want to see my score updated when my opponent loses
Given the opponent's Tron collides with a trail or the boundary
When the opponent is registered as "dead,"
Then my score should increment and be displayed on the scoreboard.

Test Game Reset After Death
As a player
I want to restart the game after one player dies
Given one player has lost the round
When the game resets
Then both players' Trons should return to their starting positions, and the board should reset without trails or active bonuses.

Test High Score Saving
As a player
I want to save my game session high scores
Given I press the spacebar to save the session
When the game session ends
Then my score should be stored in the high score database and displayed in the high score GUI.

Test Menu Navigation
As a user
I want to access the main menu to start the game
Given the game is launched
When I interact with the menu options
Then I should be able to start the game or view the high scores.

Test Bonus Effects Duration
As a player
I want bonuses to have temporary effects
Given I pick up a speed bonus
When the bonus duration ends
Then my Tron's speed should return to its original state

Test Multiple Bonuses
As a player
I want to pick up bonuses without conflicting effects
Given there are multiple bonuses on the board
When I collect one bonus
Then only one effect should activate, and the others should remain visible for collection

Test Database Connection Failure
As a developer,
I want to ensure the game handles database errors gracefully,
Given the database connection fails during initialization,
When the game attempts to access the high score database,
Then the game should display an error message and continue running without crashing.