PONG GAME REPORT

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Basic in Programming

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1. Introduction

This report describes the process of creating a Pong game in the Java-based programming language Processing. In this version of Pong game that closely recreates the classic one, two players can use keyboard inputs to control bats that resemble paddles in order to play against each other. The main objective is to keep the rally going by moving the bats to hit the ball back and forth across the screen. The game ends when one of the players fails to intercept the ball, resulting in the ball passing the player's bat and hitting the border.

This report includes three sections: an in-depth description of game, a detailed game design section outlining the basic features of the Pong game provided in the lecture and additional features implemented by me, and a link to the gameplay demo video.

2. Game Description

This version of the Pong game is inspired from a classic arcade-style video game. The game is a two-player game, and both players have to control their bats to keep the ball rallying and score as many points as possible until a player misses, terminating the game.

2.1 Objective

Throughout this variation of Pong game, the primary objective of the game is to score points by successfully hitting the ball with the bat and outscore opponent when the game ends. The game difficulty escalates progressively as the game unfolds. Players must carefully plan their bat motions and timing in order to keep the ball's trajectory within the boundaries of the playing field. The game ends when either player fails to intercept the ball and when the ball touches the right or left side of the game window.

2.2 Game Element

The game elements listed below work together to create the Pong gameplay experience with additional progressive and dynamic features. In the game, players control the bats to hit the ball, score points, and experience changes in bat length, ball speed, and ball color as they progress through the game.

1. Ball:
    The ball is the central object of the game. It moves continuously across the game area, and the objective is to hit it with the bat to prevent it from passing a player's side of the screen.

2. Bats:
    Bats are the player-controlled objects used to hit the ball back and forth. In this two-player Pong game, each player controls one bat, and the bats are usually located on opposite sides of the screen. The bats can move both vertically and horizontally within a certain area.

3. Score:
   Each player's score in the game is recorded. When the ball hits the player's bat, the player receives a point. When a player misses the ball and the ball hits either the left or right side of the wall, the game ends.

4. Levels:
   The game includes various levels that affect gameplay. There are three types of levels in this version of Pong:
   1) Bat Level: As a player reaches certain points, one's bat length shrinks.
   2) Speed Level: As the combined score of both players hits certain scoring milestones, the speed of the ball increases.
   3) Color Level: As the cumulative score of both players reaches predefined points, the ball's color becomes darker.

5. Game Console Style:
   The game screen is designed in a "game console" style, featuring a black background, a white dashed line in the middle of the screen to divide players' sides, and white text to show scores and levels. Both bats and ball are white as well.

6. Key Controls:
   Players can control the bats using keyboard inputs ('w','s', 'a', 'd', arrow keys).

7. Ball Behavior and Dynamics:
   The ball's movement includes collision detection and response with the bats and borders.

8. Game Initialization and Reset:
   When the game begins to run, the game state is initialized, a new ball is created, and the scores are reset.

2.3 User Manual

2.3.1   Bat Control

Players can control how their individual bats move in this version of Pong by pressing particular keyboard keys. These controls allow for both vertical and horizontal movement, enabling players to tactically place their bats for precise ball interception and responsive gameplay.

Player 1 Controls:
- 'w' Key: Move the bat upward.
- 's' Key: Move the bat downward.
- 'a' Key: Move the bat to the left.
- 'd' Key: Move the bat to the right.
*** The key must be in lowercase.

Player 2 Controls:
- 'Up' Arrow Key: Move the bat upward.
- 'Down' Arrow Key: Move the bat downward.
- 'Left' Arrow Key: Move the bat to the left.
- 'Right' Arrow Key: Move the bat to the right.

2.3.2   Game Termination

To exit the game at any point, press the 'ESC' key. This action will immediately terminate the ongoing game session and exit the application.

3.   Game Design

This section outlines the basic features presented in the lectures code and additional features implemented in this version of Pong.

3.1 Basic Features

1. *Ball Behavior and Dynamics:*
   The behavior of the ball in this game is fundamental to the overall gameplay experience.

   1.1   Ball Movement:
   The ball follows a continuous trajectory, moving horizontally and vertically within the game window.

   1.2   Collision Detection:
   The ball constantly checks for collisions with various game elements, including the bats and the top and bottom sides of the game window. Upon collision, the ball's behavior is changed to simulate a realistic bounce. There are two types of collision occurring during the game:

      1.2.1   Ball-Bat Collision:
      When the ball collides with a bat, its direction changes based on the angle at which it hits the bat.

      1.2.2   Border Collision:
      If the ball hits the top or bottom side of the game window, it changes its vertical direction so that it remains within the borders of the game window. If the ball touches one of the left or right edges, the game ends and the result is displayed.

2. *Player Interaction:*
   Players are given simple controls to manipulate their respective bats. Player 1 utilizes the keys 'w' and's' for vertical movement, while Player 2 uses the arrow keys 'Up' and 'Down', giving players full control over the bat's location and allowing for dynamic and responsive gameplay.

3.2 Additional Implemented Features

1. *Scoring Mechanism:*
   The game features a simple scoring system. A player receives one point for each successful hit of the ball with the bat. Both players' scores are prominently shown on the screen, keeping players informed of their progress.

2. *2D Bat Movement:*
   The bats can move in two dimensions in the game within a certain area. Players have control of the bat's vertical and horizontal movements, allowing for precise positioning and tactical movement to intercept the ball. In addition to bat's vertical movement, player 1 can use the keys 'a' and 'd' to move horizontally, while player 2 can use the arrow keys 'Left' and 'Right'.

3. *Progressive Ball Speed:*
   The game features a gradual increase in ball speed as players hit predefined scoring thresholds (5, 10, 30, 40 points). Hence, there are four levels in total regarding ball speed. This feature raises the thrill and difficulty level, keeping gaming interesting and dynamic. The speed's difficulty level for both players is displayed on the screen, keeping players informed of their current level.

4. *Bat Length Variation:*
   The game incorporates a dynamic change in bat length to intensify the game's competitive element. Players' individual bats gradually get shorter as they reach certain points (5, 10, 15 points). Thus, there are three levels in total regarding bat length. Players must adjust their gameplay to factor in the shrinking characteristics of their bats, making it a challenging game. The bat's difficulty level for each player is displayed on the screen, keeping players informed of their current level.

5. *Ball Color Change:*
   The game introduces a visual feature in the color of the ball. The color of the ball changes gradually from bright to darker shades as the combined score of both players crosses specific milestones (15, 20, and 25 points). Therefore, there are three levels in total regarding the ball's color. Since the ball is more difficult to see against a completely dark background, this feature not only adds a visual component to the game but also increases the level of difficulty. The color's difficulty level for both players is displayed on the screen, keeping players informed of their current level.

4. Gameplay Demo

The gameplay demo has been uploaded to YouTube.

The link to the video: https://youtu.be/i-fkch8TKfc