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Information technology

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Pong

Arcade Game

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1 Project goal

The goal was to program a version of the classic arcade game Pong where players control a paddle to deflect a ball at his enemy. The goal was also to understand the workings of JFrames and JPanels and how to utilize them effectively. The game can in two player mode where both control paddle on different sides of the board, or alone where player plays against a computer.

2 Software

The game was made in IntelliJ IDEA 2023.2.2 (Ultimate Edition), using Java SE Development Kit 16.0.2. To open a jar file in Windows, you need to have the Java Runtime Environment installed. No external libraries were used.

3 Game description

This game is about player-controlled paddles deflecting ball. The game runs in a window or full-screen if player chooses the option to make it run that way.

3.1 Mechanics

```
/**
 * Draws the title screen with menu options.
 *
 * @param g2 The Graphics2D object.
 */
private void drawTitleScreen(Graphics2D g2) { 1 usage  ⬆ oleg +2
    String text = "PONG";
    drawTitle(text, g2);
    g2.setFont(g2.getFont().deriveFont(Font.BOLD, size: 24f));
    text = "Player vs Player";
    int line = 0;
    if (commandNum == line) {
        drawChoice(text, g2, commandNum);
    }
    line = drawMenu(text, g2, line);
    text = "Player vs Computer";
    if (commandNum == line) {
        drawChoice(text, g2, commandNum);
    }
    line = drawMenu(text, g2, line);
    text = "Settings";
    if (commandNum == line) {
        drawChoice(text, g2, commandNum);
    }
    line = drawMenu(text, g2, line);
    text = "Quit";
    drawMenu(text, g2, line);
    if (commandNum == line) {
        drawChoice(text, g2, commandNum);
    }
}
```

Figure 1: drawTitleScreen method in UI

This menu has 4 choices leading into other menus. Other menus are built on the same principle.

```
/**
 * Updates the computer paddle's position based on the ball's position.
 * The paddle moves towards the ball's Y-coordinate at ySpeed and if the ball is 25 pixels or further then it moves at yMaxSpeed + ySpeed.
 */
@Override 8 usages 1 Oleg
public void update() {
    directions = Directions.NONE;
    if (y + height / 2 - 25 > gp.getBally() + gp.getBallHeight() / 2) {
        if (y >= 0) {
            y -= yMaxSpeed;
            directions = Directions.UP;
        }
    } else if (y + height / 2 > gp.getBally() + gp.getBallHeight() / 2) {
        if (y >= 0) {
            y -= ySpeed;
            directions = Directions.UP;
        }
    }
    if (y + height / 2 + 25 < gp.getBally() + gp.getBallHeight() / 2) {
        if (y <= gp.getScreenHeight() - height) {
            y += yMaxSpeed;
            directions = Directions.DOWN;
        }
    } else if (y + height / 2 < gp.getBally() + gp.getBallHeight() / 2) {
        if (y <= gp.getScreenHeight() - height) {
            y += ySpeed;
            directions = Directions.DOWN;
        }
    }
}
```

Figure 2: update method in Computer

Method used for updating position of paddle controlled by computer.

```
/**
 * Handles key press events in the play state.
 *
 * @param code the key code of the pressed key
 */
private void playState(int code) { 1 usage 1 Oleg +1
    switch (code) {
        case KeyEvent.VK_W -> leftPlayerUpPressed = true;
        case KeyEvent.VK_S -> leftPlayerDownPressed = true;
        case KeyEvent.VK_UP -> rightPlayerUpPressed = true;
        case KeyEvent.VK_DOWN -> rightPlayerDownPressed = true;
        case KeyEvent.VK_P -> gp.setGameState(GameState.PAUSE_STATE);
        case KeyEvent.VK_ESCAPE -> gp.setGameState(GameState.MENU_STATE);
    }
}
```

Figure 3: playState method in KeyHandler

This method checks if player is pressing any buttons affecting the game.

```

/**
 * Main game loop runs at the specified FPS.
 * Updates and renders the game state.
 */
@Override
public void run() {
    double drawInterval = 1000000000.0 / FPS;
    double delta = 0;
    long lastTime = System.nanoTime();
    long currentTime;
    long timer = 0;
    while (gameThread.isAlive()) {
        currentTime = System.nanoTime();
        delta += (currentTime - lastTime) / drawInterval;
        timer += currentTime - lastTime;
        lastTime = currentTime;
        if (delta >= 1) {
            update();
            drawToTempScreen(); // Draw everything to the buffered image
            drawToScreen(); // Draw the buffered image to the screen
            delta--;
        }
        if (timer >= 1000000000) {
            timer = 0;
        }
    }
}

```

Figure 4: run method in GamePanel (Game loop)

This method checks how much time has passed, divides that by drawInterval and adds that to delta. If delta is bigger or equal to 1 then the game updates and repaints, delta has 1 removed from it and loop repeats.

```

/**
 * Adjusts the Y-speed of the ball based on the direction of the paddle's movement.
 *
 * @param paddle the Paddle object to check direction
 * @return the adjustment to the Y-speed
 */
private int addYSpeed(Paddle paddle) { 1 usage  ▲ Oleg
    int speedToAdd = 0;
    if (paddle.directions.equals(Directions.UP)) {
        speedToAdd = -paddle.ySpeed / 4;
    }
    if (paddle.directions.equals(Directions.DOWN)) {
        speedToAdd = paddle.ySpeed / 4;
    }
    return speedToAdd;
}

```

Figure 5: Method to add ySpeed to ball depending on direction paddle is heading in.

The method above adds one fourth of players speed to the paddle in the direction the paddle was moving at the time of collision.

4 Manual

If game is started in two player mode where the players play against each other. The player on the left side of the board can control the left paddle with keys "W" and "S", and player on the right controls his paddle with arrow up "↑" and arrow down "↓", players can go in menu by pressing "ESC". The same buttons are used along with "Enter" to navigate in the menu. Game can be paused anytime while in game by pressing "P". The game can also be played in player vs computer mode in which only left player can control his paddle, the other one is controlled by a CPU.

5 Conclusion

The development of this project was smoother than I expected. I managed to implement most of functions that I wanted my game to include.

6 Sources

Font used in game: <https://www.fontspace.com/press-start-font-f5841>