Project Report: Rock-Paper-Scissors using Hand Gesture Recognition

# Objective

To develop an interactive game where a user plays Rock-Paper-Scissors using hand gestures, and the computer randomly selects its move. The system detects hand signs using real-time webcam feed.

# Tools & Technologies Used

• Programming Language: Python

• Libraries:

- cv2 (OpenCV) – for webcam feed and image processing

- mediapipe – for hand landmark detection

- random – to randomly choose computer's move

- time – to add delay between rounds

# Working Methodology

1. Hand Detection:  
 - MediaPipe Hands is used to detect 21 landmarks on the hand in real-time.  
 - OpenCV reads the webcam feed and sends frames to MediaPipe for processing.  
  
2. Gesture Recognition:  
 - Rock: Only thumb is slightly inward, and all other fingers are folded.  
 - Paper: All fingers are open (extended).  
 - Scissor: Only index and middle fingers are open.  
 - Logical comparisons of landmark coordinates (mostly .y values) determine the gesture.  
  
3. Game Logic:  
 - Computer selects one of the three moves randomly.  
 - The result of each round (Win/Lose/Draw) is determined by traditional Rock-Paper-Scissors rules.  
 - Score is updated and displayed in the terminal after each round.  
  
4. User Interface:  
 - Live webcam video with hand landmarks drawn in real time.  
 - Game runs continuously until the user presses 'q' to quit.

# Features

• Real-time hand gesture recognition

• Automatic gesture classification

• Dynamic score tracking

• Keyboard interaction to exit the game

# Sample Game Rules Implemented

|  |  |  |
| --- | --- | --- |
| User Move | Computer Move | Result |
| Rock | Scissor | User Wins |
| Scissor | Paper | User Wins |
| Paper | Rock | User Wins |
| Same | Same | Draw |

# Limitations

• Requires good lighting for accurate detection

• Some gestures (especially scissor) may require practice to detect accurately

• Only one hand is processed at a time

# Conclusion

This project showcases the integration of computer vision and machine learning (via MediaPipe) in creating an intuitive, gesture-controlled application. It demonstrates how gesture recognition can be applied in gaming, user interaction, and human-computer interfaces.

# Future Enhancements

• Display score directly on the video frame

• Add UI elements for better game experience

• Improve gesture recognition with more robust logic

• Add sound feedback on win/loss