1. Problem Statement

Recreational and amateur golfers struggle to accurately diagnose issues in their swing mechanics. Although over 66 million people played golf globally in 2023, affordable access to professional swing analysis remains limited. According to the R&A Golf Participation Report (2022), more than 40% of golfers rely primarily on self-practice and video recordings. However, such recordings often distort the swing plane due to changing camera angles, inconsistent framing, and lack of biomechanical reference points.

These limitations prevent golfers from accurately understanding the difference between *"feel vs. real"*, leading to persistent errors, inefficient practice sessions, and plateaued performance. With increasing accessibility to mobile cameras and computational power, there is a strong opportunity to build a low-cost, automated, and user-friendly tool that can provide real-time swing analysis without requiring expensive hardware or coaching.

The assignment aims to design a mobile-first, computer-vision–based system that can detect a golfer's swing, analyze key movement patterns, and generate actionable insights instantly.

2. Proposed Solution Overview

Develop **SmartSwing**, a mobile application that uses computer vision and data visualization to analyze a user's golf swing in real time. The system should work using only a smartphone camera and must be able to:

Core Functionalities

1. **Swing Detection**

   ○ Automatically detect the start and end of the golf swing from a recorded video.

2. **Biomechanical Analysis**

   ○ Extract keypoints (shoulders, hips, arms, club position) using pose estimation (e.g., MediaPipe, OpenPose).

   ○ Compute the swing plane, club path, and body rotation metrics.

3. **Performance Scoring**

- Generate a "Swing Accuracy Score" (0–100) based on backswing-plane consistency, downswing alignment, and rotational stability.

4. **Visual Feedback**

   - Overlay swing plane lines and corrective guidance directly on the video.

   - Show a breakdown of errors such as early extension, over-the-top downswing, or improper wrist hinge.

5. **Progress Tracking**

   - Store multiple swing sessions.

   - Visualize historical scores in a timeline chart.

   - Provide data insights on improvements and recurring issues.