

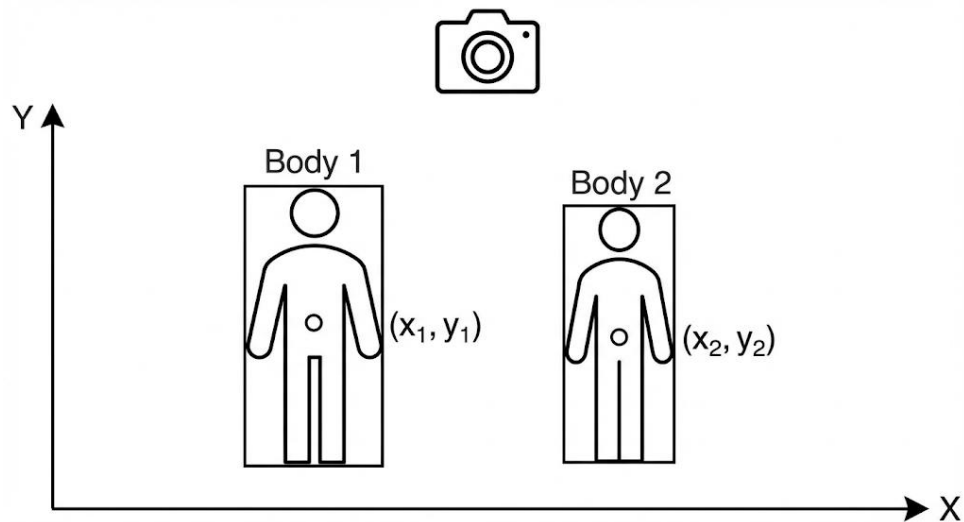
Software Design Document (SDD) – Sample

1. Introduction

In a camera-based collision detection system, objects such as people or vehicles are first detected from live video using computer vision techniques. Each detected object is enclosed within a rectangular region called a **bounding box**. These bounding boxes help identify the position and size of the objects in the image frame.

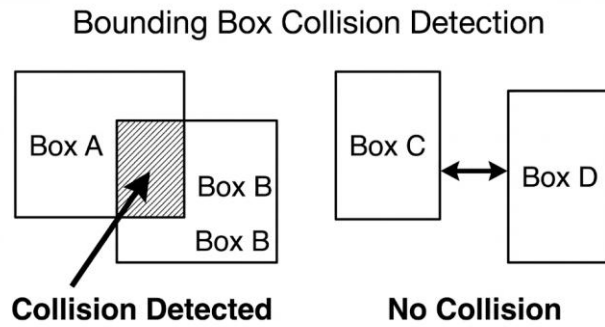
To calculate the distance between two detected bodies, the system finds the **center point of each bounding box**. These center points are represented as coordinate values in the form of (x, y) , where x and y indicate the pixel location of the object in the camera frame. Using these coordinates, mathematical methods such as **Euclidean distance** are applied to measure how far the two bodies are from each other and determine whether a collision has occurred.

2. System Architecture



Bounding boxes are rectangular regions drawn around detected objects in an image or video frame. They help identify the position and size of each body detected by the camera. In this project, bounding boxes are used to track bodies and determine collision by checking overlap between boxes.

3. Detailed Design

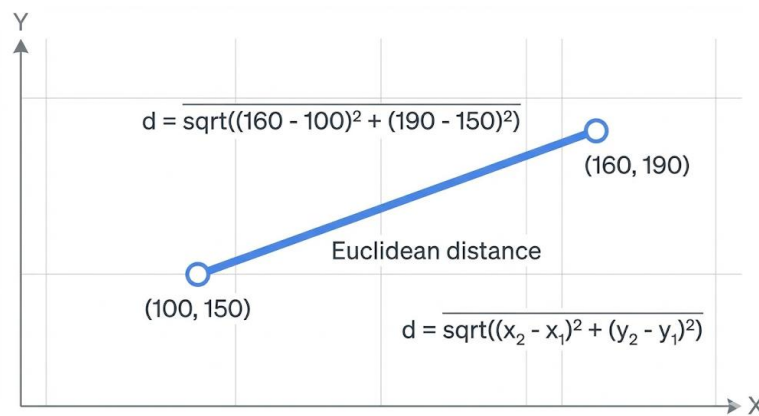


Bounding box intersection is a technique used to detect collision by checking whether the rectangular regions surrounding two detected objects overlap.

If two bounding boxes intersect, a collision is detected.

If they do not intersect, no collision has occurred.

4. Database Design



Euclidean distance calculates the straight-line distance between the center points of two detected bodies.

It is computed using their coordinate values obtained from bounding boxes.

This distance helps measure how close two bodies are and supports collision detection logic.

Formula:

$$Distance = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Example:

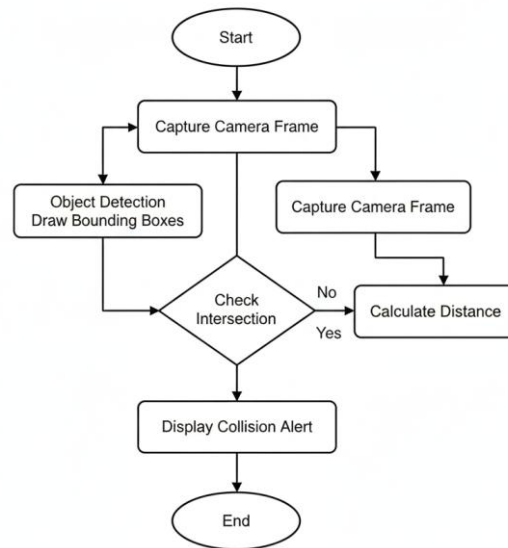
Body 1 → (100,150)

Body 2 → (160,190)

Distance ≈ 72 pixels

5. Design Constraints

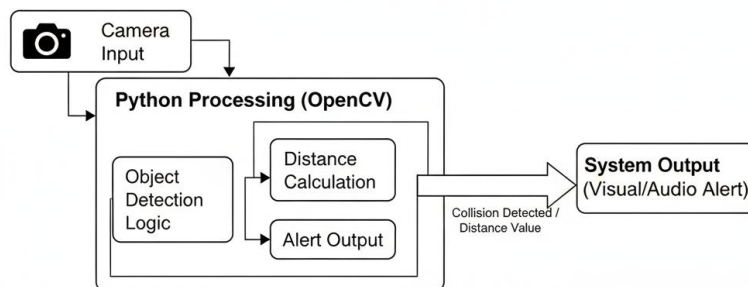
Camera-Based Collision Detection System



The system captures live video from the camera, detects objects, draws bounding boxes, checks intersection for collision, calculates distance using Euclidean formula, and displays collision alerts.

System Architecture

Camera-Based Collision Detection System Architecture



Input Layer: Camera

Processing Layer: Python + OpenCV

Logic Layer: Bounding box intersection and distance calculation

Output Layer: Collision alert and distance display