RBE 550 – HW4 Section 6.3: Collision Checker

Mohamed Eljahmi

Overview of SAT Collision-Checker

The collision-checker module uses the **Separating Axis Theorem (SAT)** to test overlap between the vehicle's oriented bounding box (OBB) and obstacle polygons.

For each polygon edge, an outward normal defines a projection axis. If any axis yields non-overlapping projection intervals, the polygons are disjoint and the pose is collision-free.

Figures 1 and 2 illustrate detected and non-detected overlap cases, while Fig. 3 shows the decision flow used in the implementation.

SAT-based Collision Check pseudo code

COLLIDES(pose, obstacles) returns True if a collision is detected.

```
Function COLLIDES(pose, obstacles):
    veh_rect ← oriented box for vehicle footprint
    For each obstacle polygon:
       If polygons overlap via Separating Axis Theorem: return True
    return False
```

Collision checker:

Fig. 1 — Collision case (annotated).

The vehicle's-oriented rectangle overlaps an obstacle polygon; SAT finds no separating axis and collision detected.

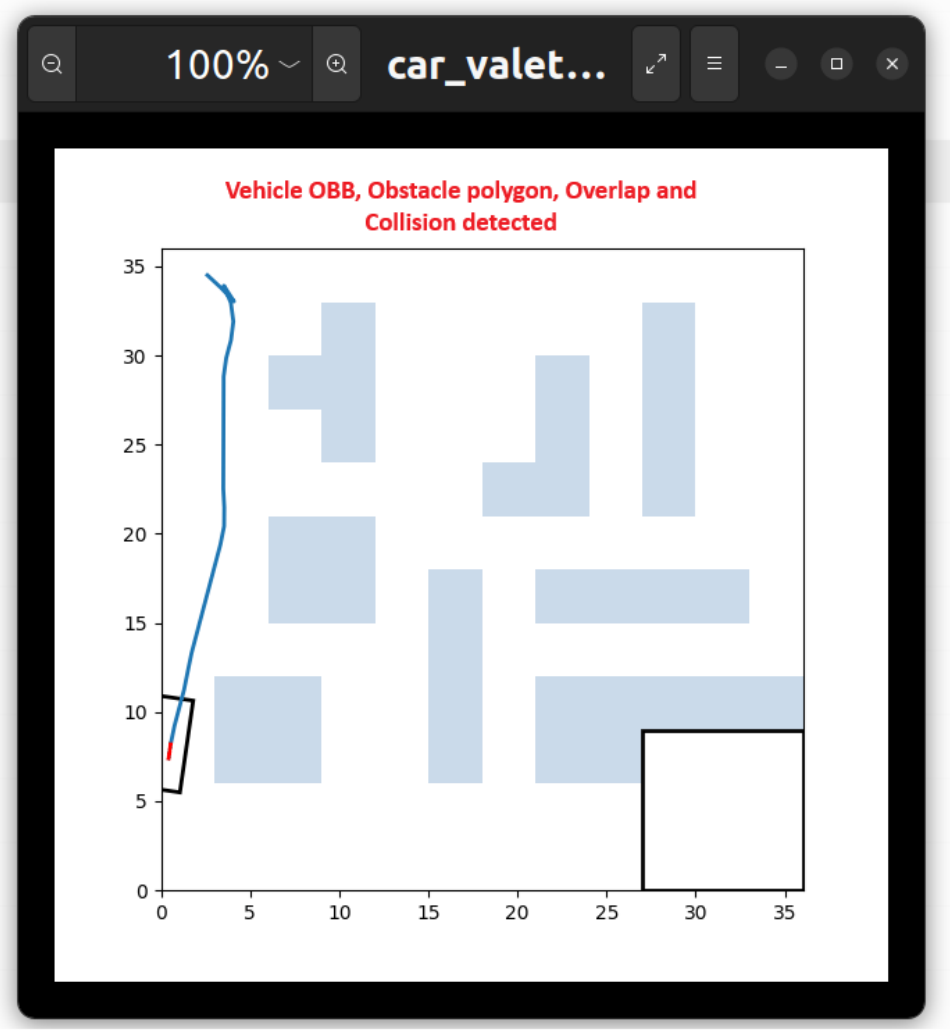

Fig. 2 — Clear case (annotated). The vehicle's rectangle is near the obstacle but not overlapping; a separating axis exists and no collision.

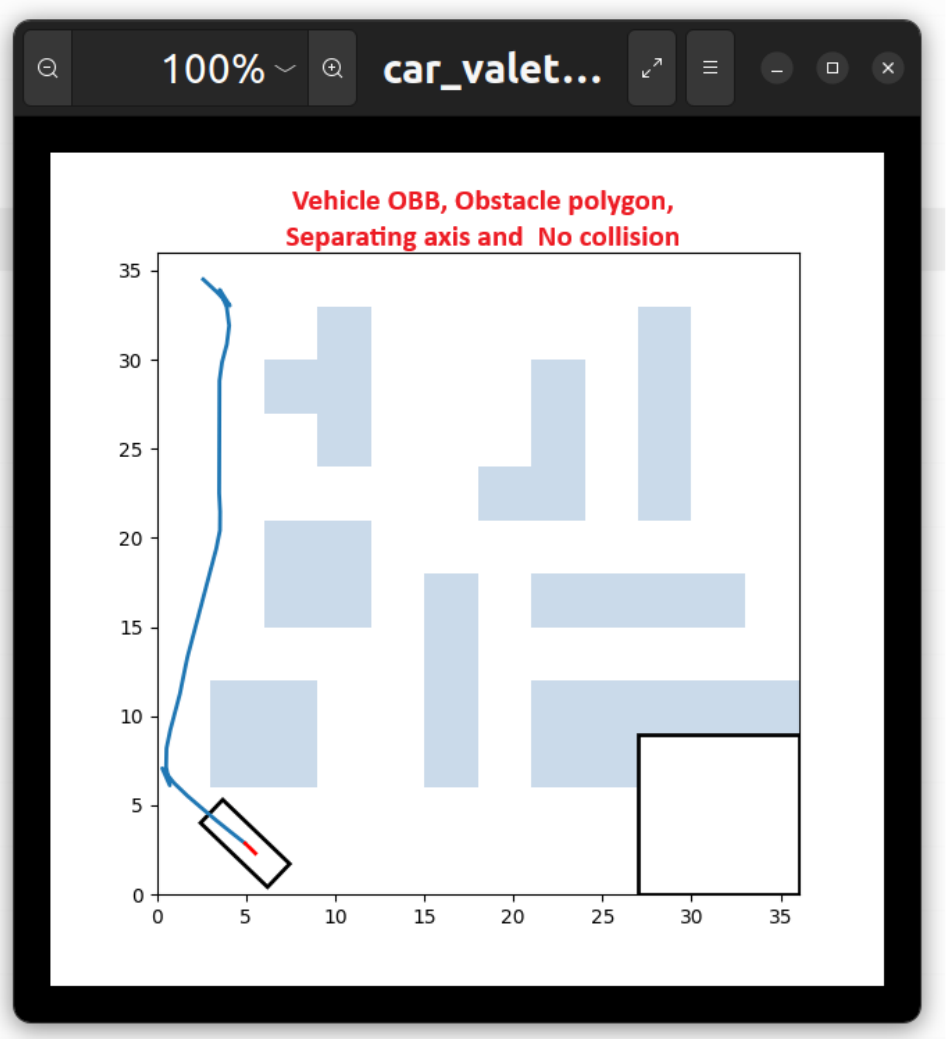

Fig. 3 — Another example of clear case (annotated). The vehicle's rectangle is near the obstacle but not overlapping; a separating axis exists and no collision.

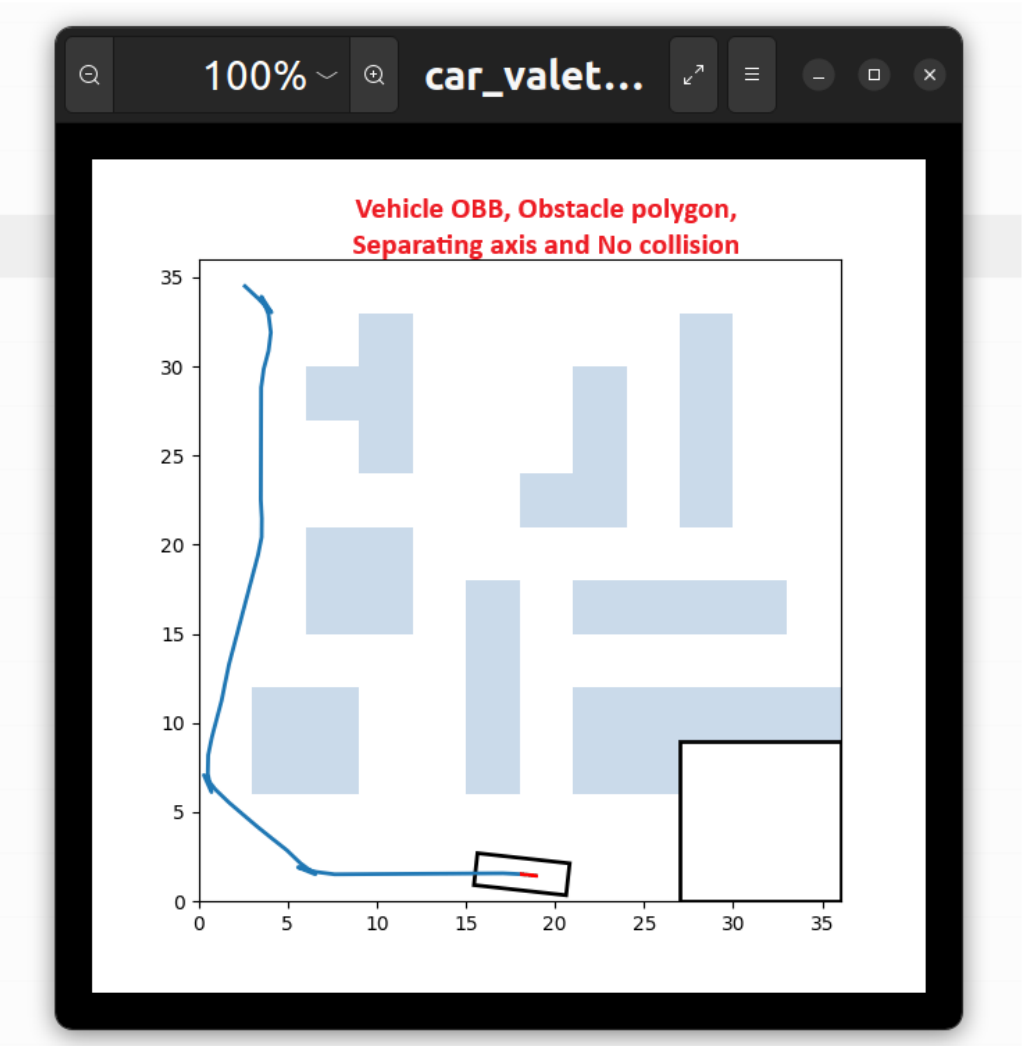

Fig. 4 — SAT Collision-Checking Flowchart