SC 627 - Motion Planning and Coordination for Autonomous Vehicles
Assignment I: Bug 1 Algorithm

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Bug Base Algorithm Flowchart

BugBase to Bug 1

Implementation of BugBase is done using a helper file which contains implementation of functions from E1.6 and E1.7.

In BugBase, the motive of the algorithm is to go along the direction of goal from start point. If in this path, the bot encounters any obstacle, it returns failure and if not then it reaches the goal.

In Bug 1, the change is when the bot encounters the convex obstacle, instead of returning failure, it starts to circumnavigate like in the Bug 1 algorithm and stores the information of the closest point to the goal around the obstacle.

Once the bot finishes the circumnavigation, it reaches the previously stored closest point. This is ensured by seeing that a small circle around the bot touches the line segment drawn from the leave point and goal. This is more effective than just checking with a point because of randomness of bot's movement.

Once the bot leaves the obstacle, we check if the vector from current position to goal and current position to centroid has the dot product negative. if not then the bot would circumnavigate the same obstacle again and the goal would be inside the obstacle, so we return failure.

Simulation results

With the given obstacle list and environment, we get the following results

<div align="center">

Result: Success
The total length of path: 27.346575435580032 metres
Total time taken: 798.4340562820435 seconds

</div>

```
        ┌─────────────┐
        │    Start    │
        └─────────────┘
               │
               ▽
            ╱Obstacle in╲      Yes      ┌─────────────┐
           ╲   path?   ╱ ──────────────▷│   Failure   │
            ╲         ╱                  └─────────────┘
               │
               No
               ▽
            ╱Reached goal?╲     No       ┌─────────────┐
           ╲             ╱ ─────────────▷│   Failure   │
            ╲           ╱                 └─────────────┘
               │
               Yes
               ▽
        ┌─────────────┐
        │   Success   │
        └─────────────┘
```
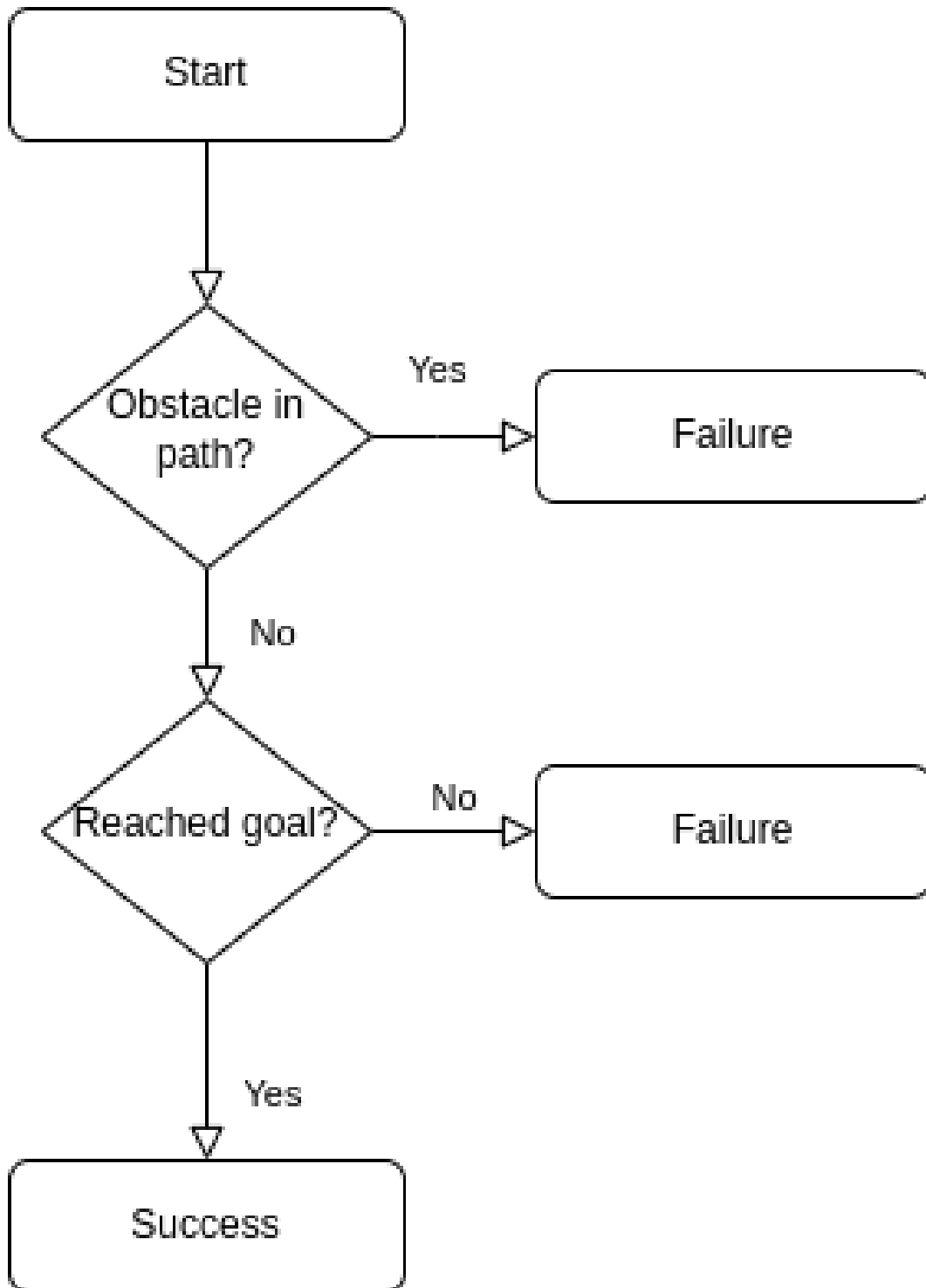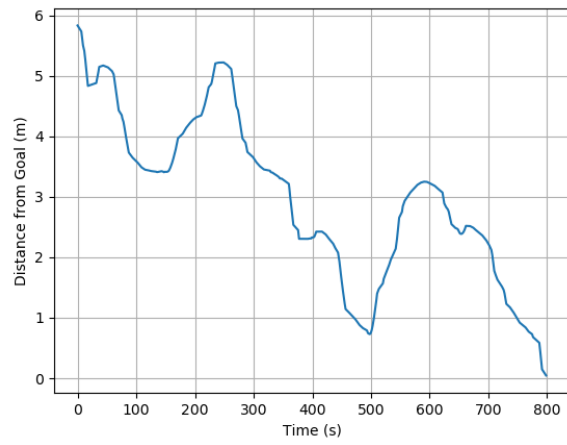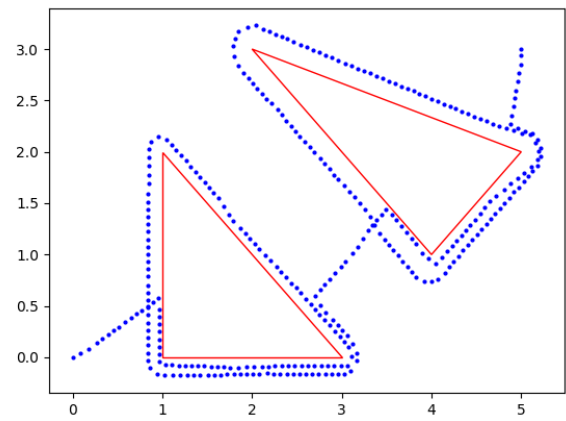
Figure 1: Bug base Algorithm

Figure 2: Bug to Goal Distance vs Time

Figure 3: Path visualization