

Learn in Depth

Mastering Embedded Systems Diploma

Unit 4 System Architecture

Lecture 2 Part 1

Collision Avoidance Report

Using State Diagrams for System Design and Validation

By: Yara Ashraf

Case Study

The collision avoidance system detects an object ahead via an ultrasonic sensor. If the distance between the system and the obstacle is less than the determined threshold, the robot will stop. If the calculated distance is more than the threshold, the robot will keep moving at the average speed.

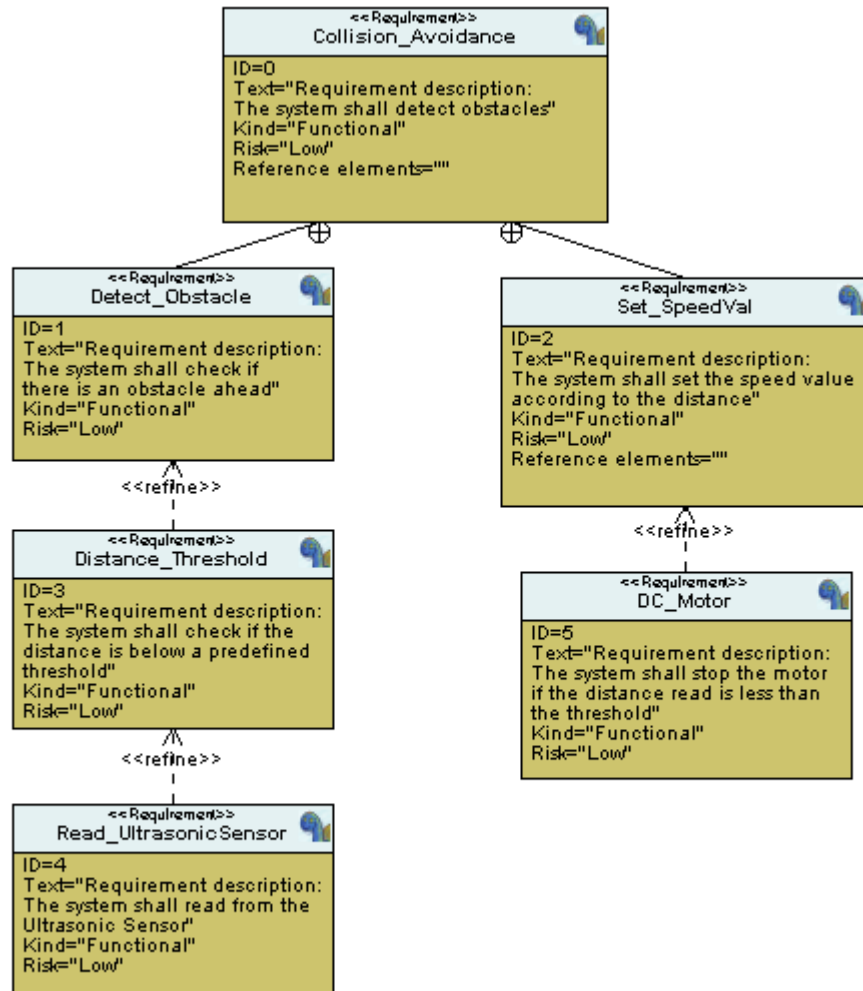
SDLC Method

V-Model

Algorithm Logic

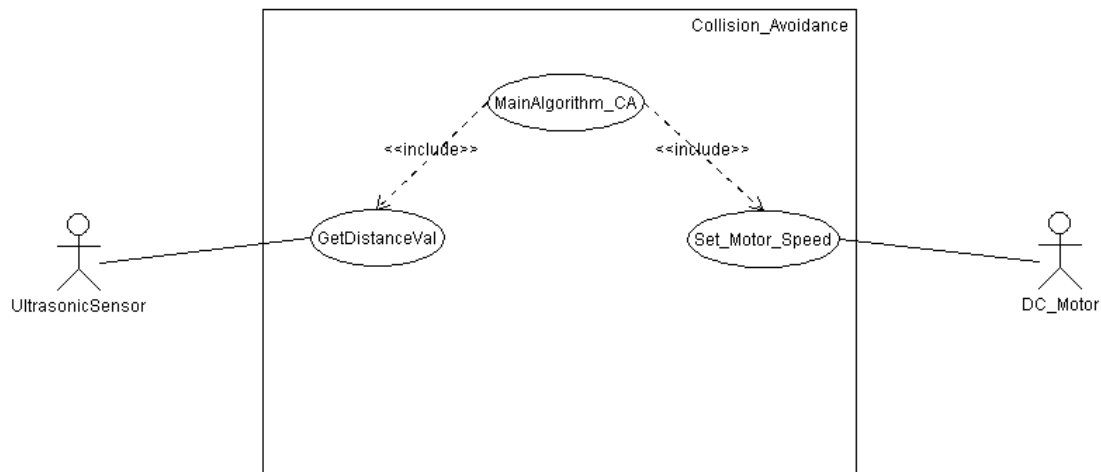
- Distance threshold = 50m
- If US distance \leq threshold, DC Motor speed will be set to 0m/s
- If distance $>$ threshold, DC Motor speed will be set to 30m/s

Requirement Diagram

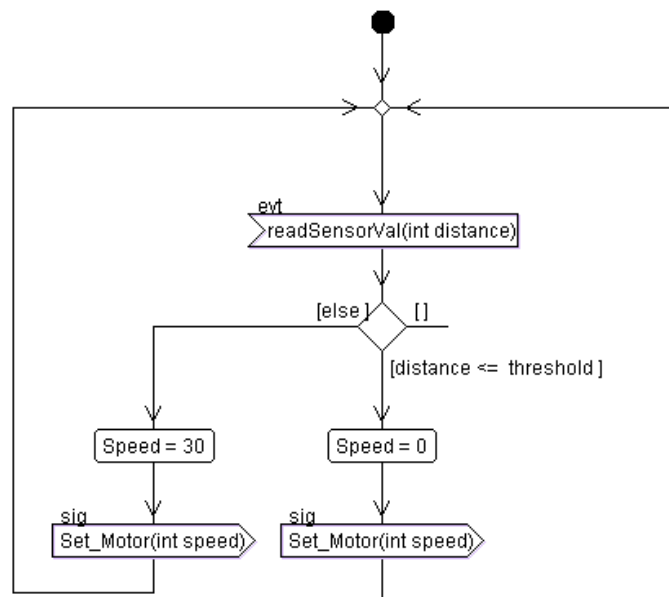


System Analysis

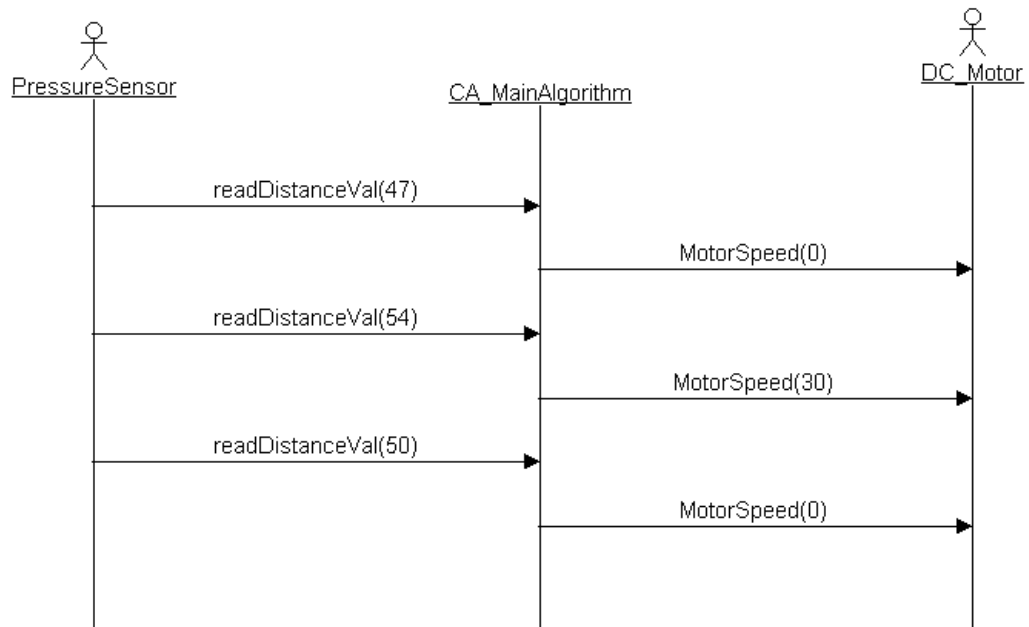
A) Use Case Diagram



B) Activity Diagram

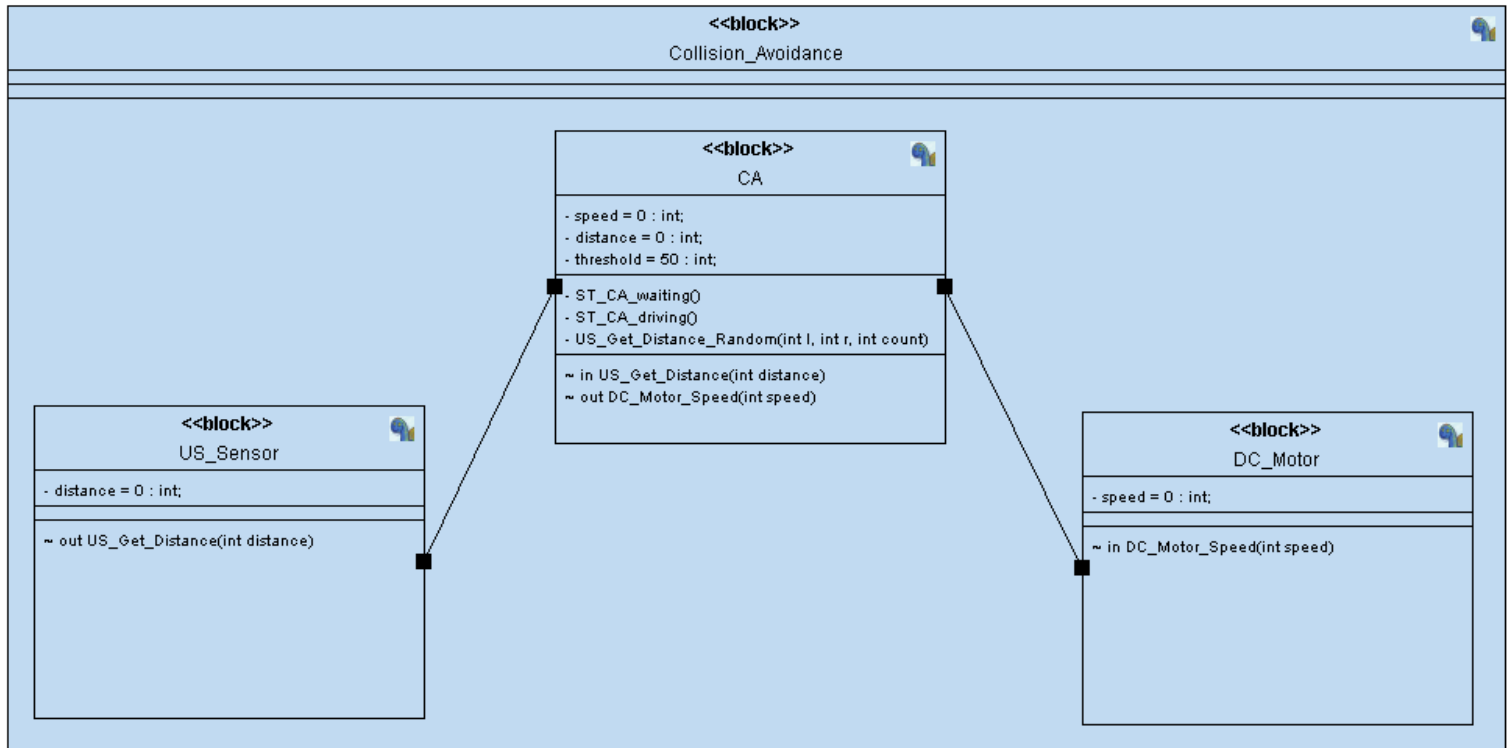


C) Sequence Diagram

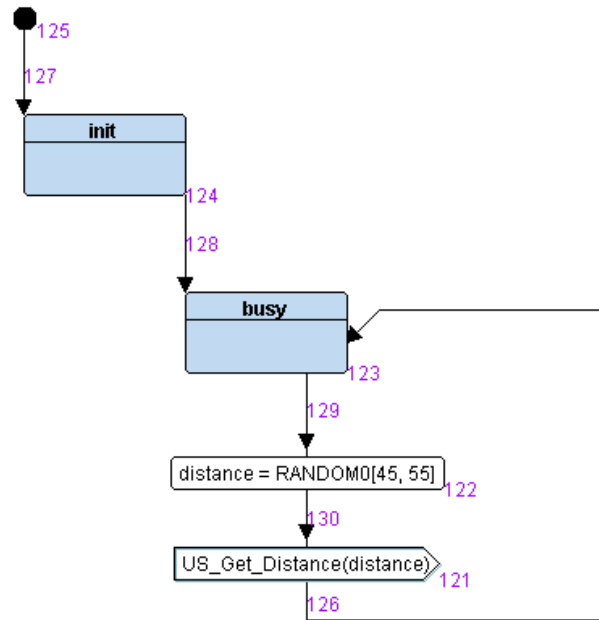


System Design

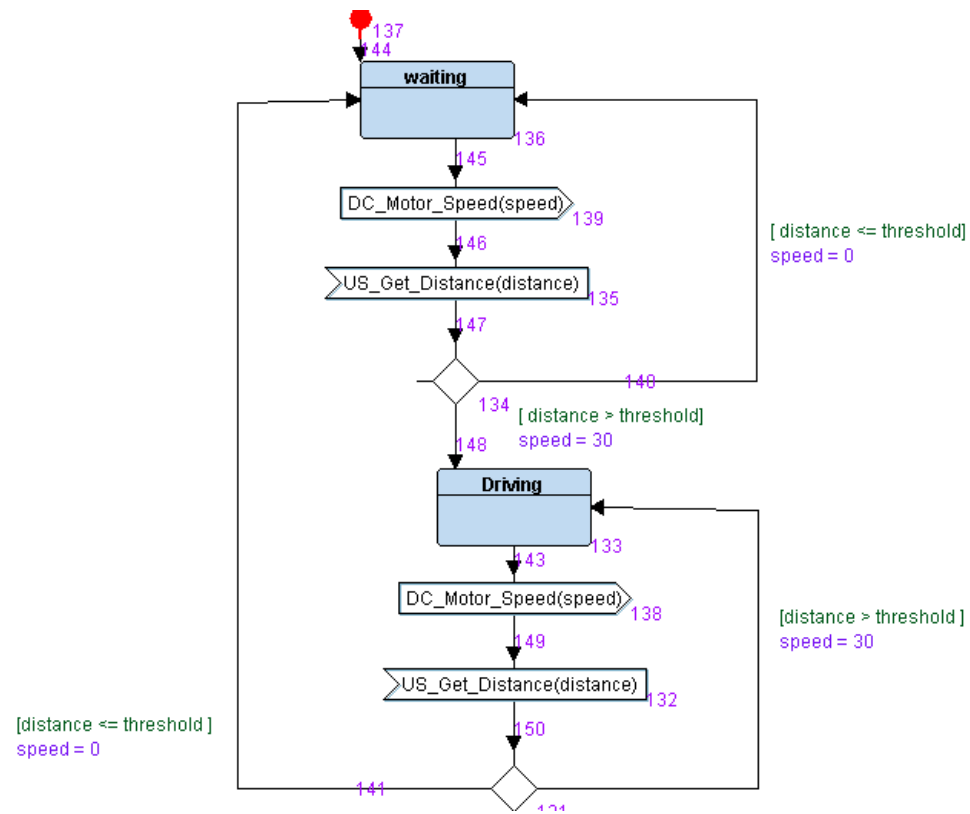
A) Block Diagram



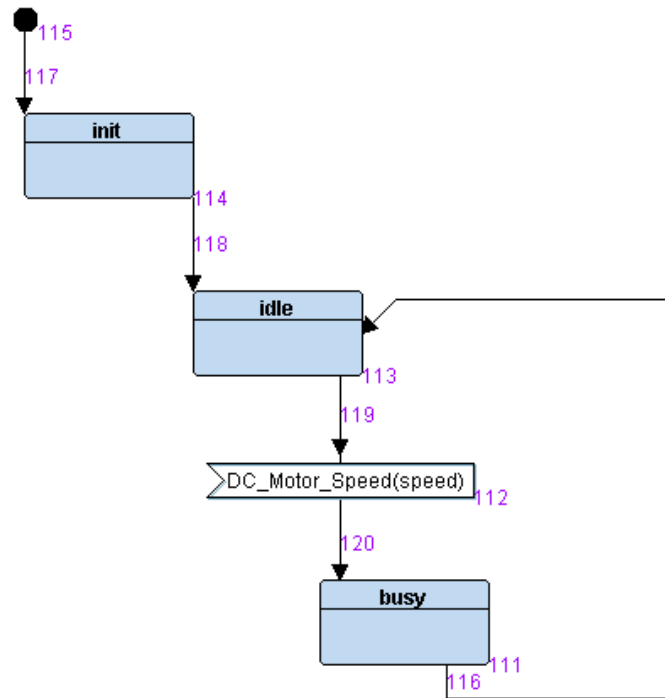
B) Ultrasonic Sensor Stage Diagram



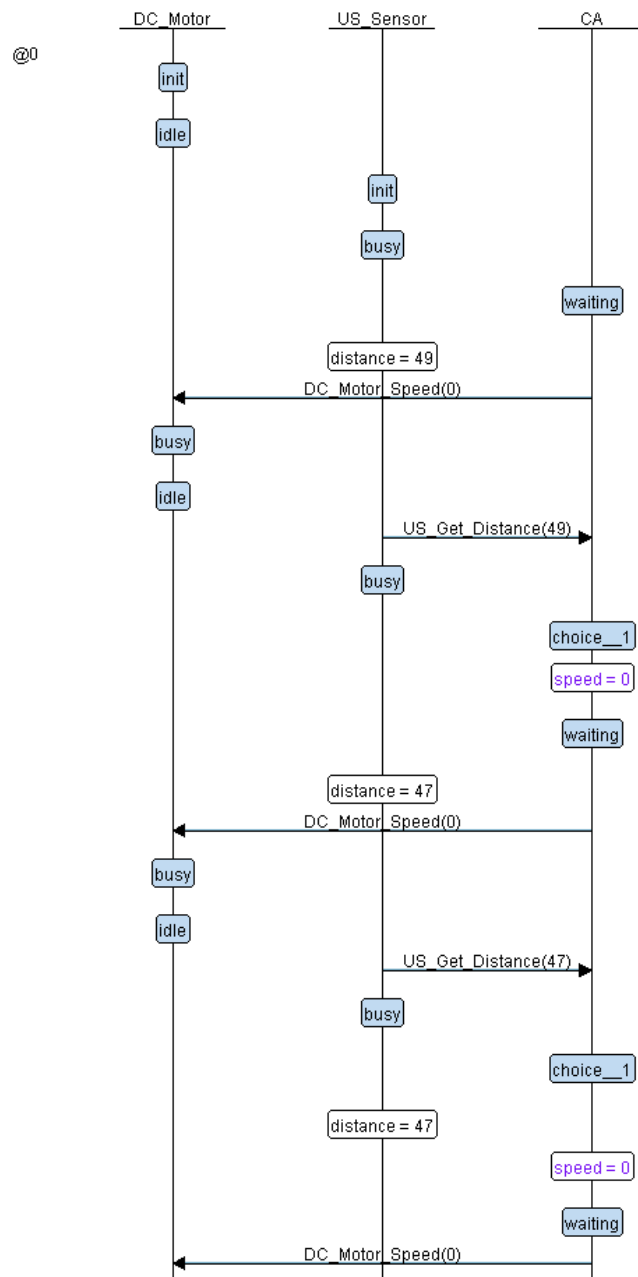
C) CA State Diagram

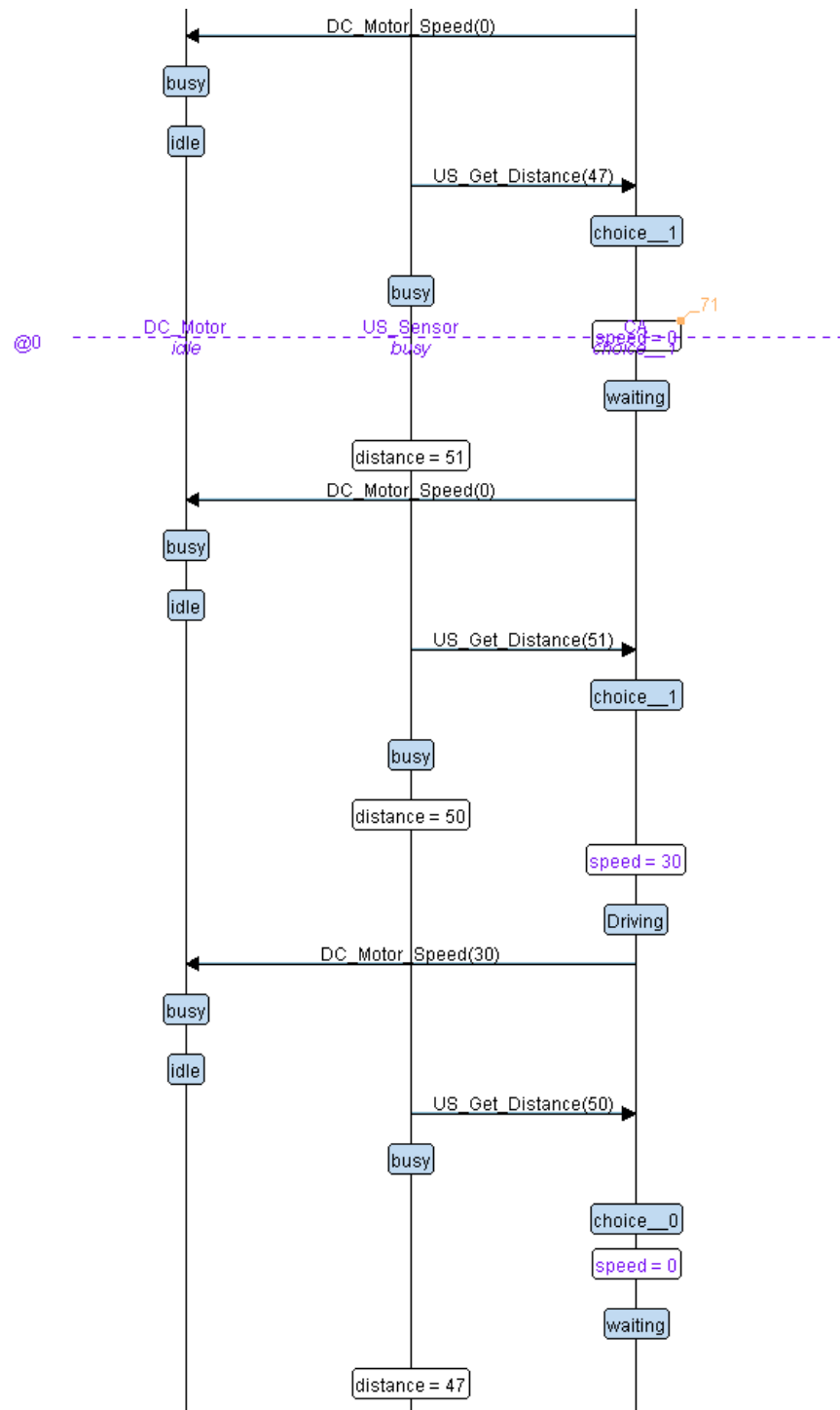


D) DC Motor State Diagram

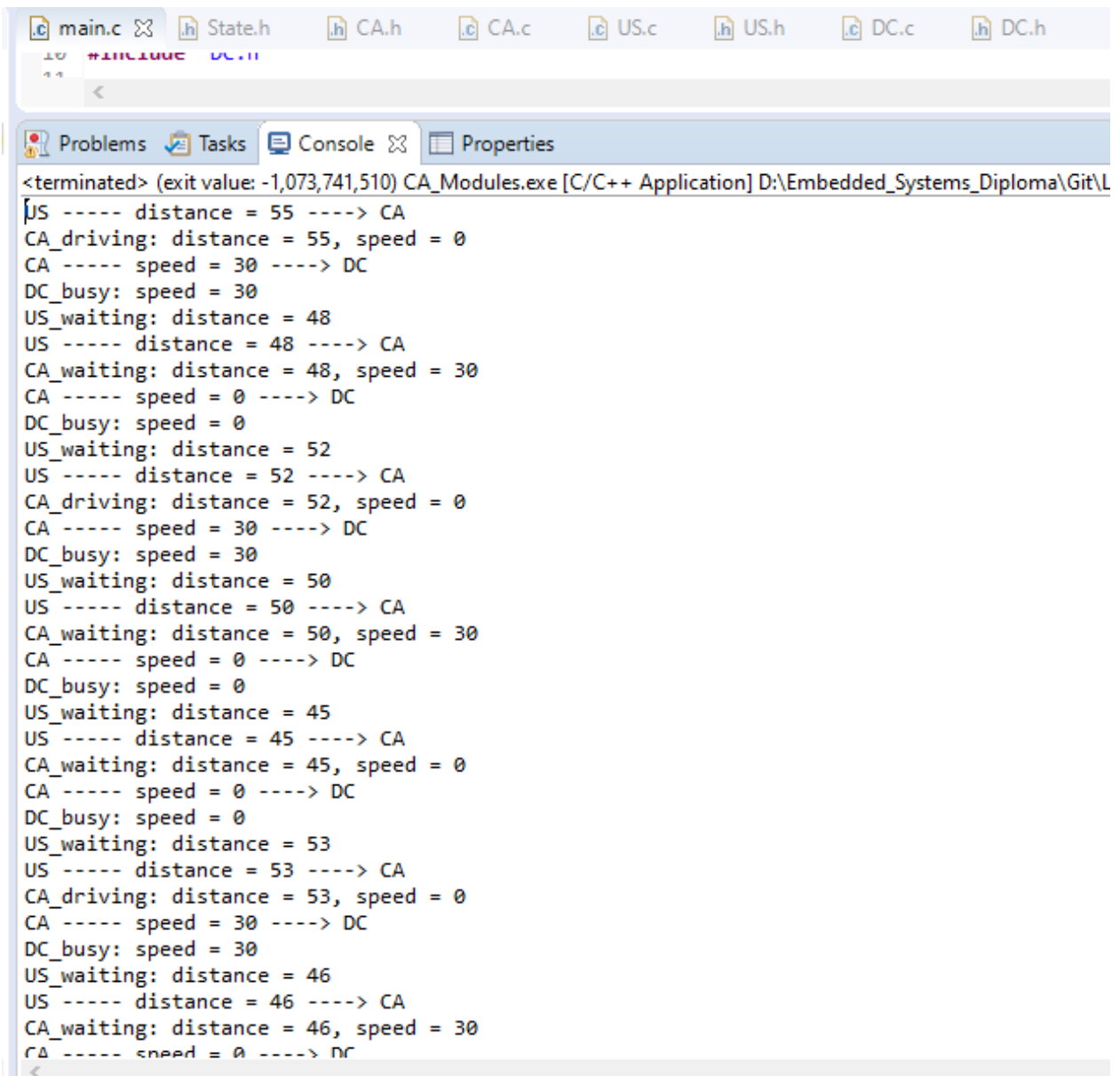


Interactive Simulation Trace





C Project Output



```
<terminated> (exit value: -1,073,741,510) CA_Modules.exe [C/C++ Application] D:\Embedded_Systems_Diploma\Git\L
US ----- distance = 55 -----> CA
CA_driving: distance = 55, speed = 0
CA ----- speed = 30 -----> DC
DC_busy: speed = 30
US_waiting: distance = 48
US ----- distance = 48 -----> CA
CA_waiting: distance = 48, speed = 30
CA ----- speed = 0 -----> DC
DC_busy: speed = 0
US_waiting: distance = 52
US ----- distance = 52 -----> CA
CA_driving: distance = 52, speed = 0
CA ----- speed = 30 -----> DC
DC_busy: speed = 30
US_waiting: distance = 50
US ----- distance = 50 -----> CA
CA_waiting: distance = 50, speed = 30
CA ----- speed = 0 -----> DC
DC_busy: speed = 0
US_waiting: distance = 45
US ----- distance = 45 -----> CA
CA_waiting: distance = 45, speed = 0
CA ----- speed = 0 -----> DC
DC_busy: speed = 0
US_waiting: distance = 53
US ----- distance = 53 -----> CA
CA_driving: distance = 53, speed = 0
CA ----- speed = 30 -----> DC
DC_busy: speed = 30
US_waiting: distance = 46
US ----- distance = 46 -----> CA
CA_waiting: distance = 46, speed = 30
CA ----- speed = 0 -----> DC
```