

Learn in Depth

Mastering Embedded Systems Diploma

Unit 4 System Architecture

Lecture 2 Part 1

Collision Avoidance Report

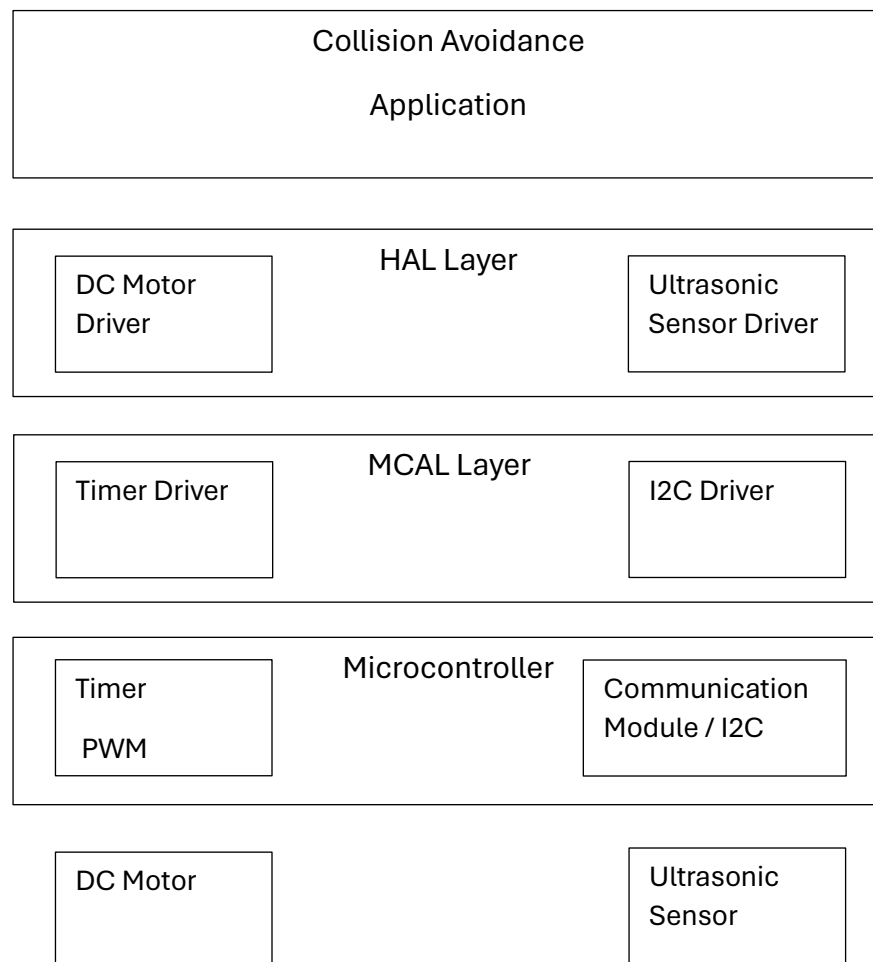
Using State Diagrams for System Design and Validation

By: Yara Ashraf

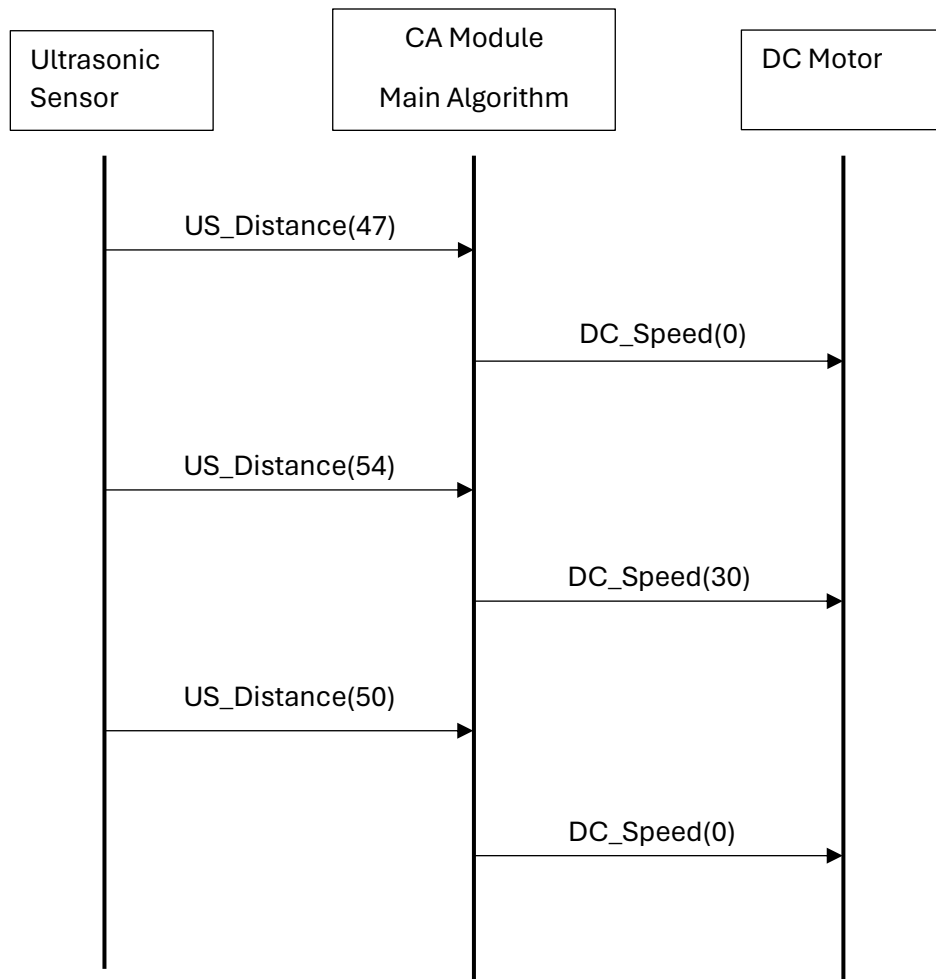
Case Study

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.

Actual System



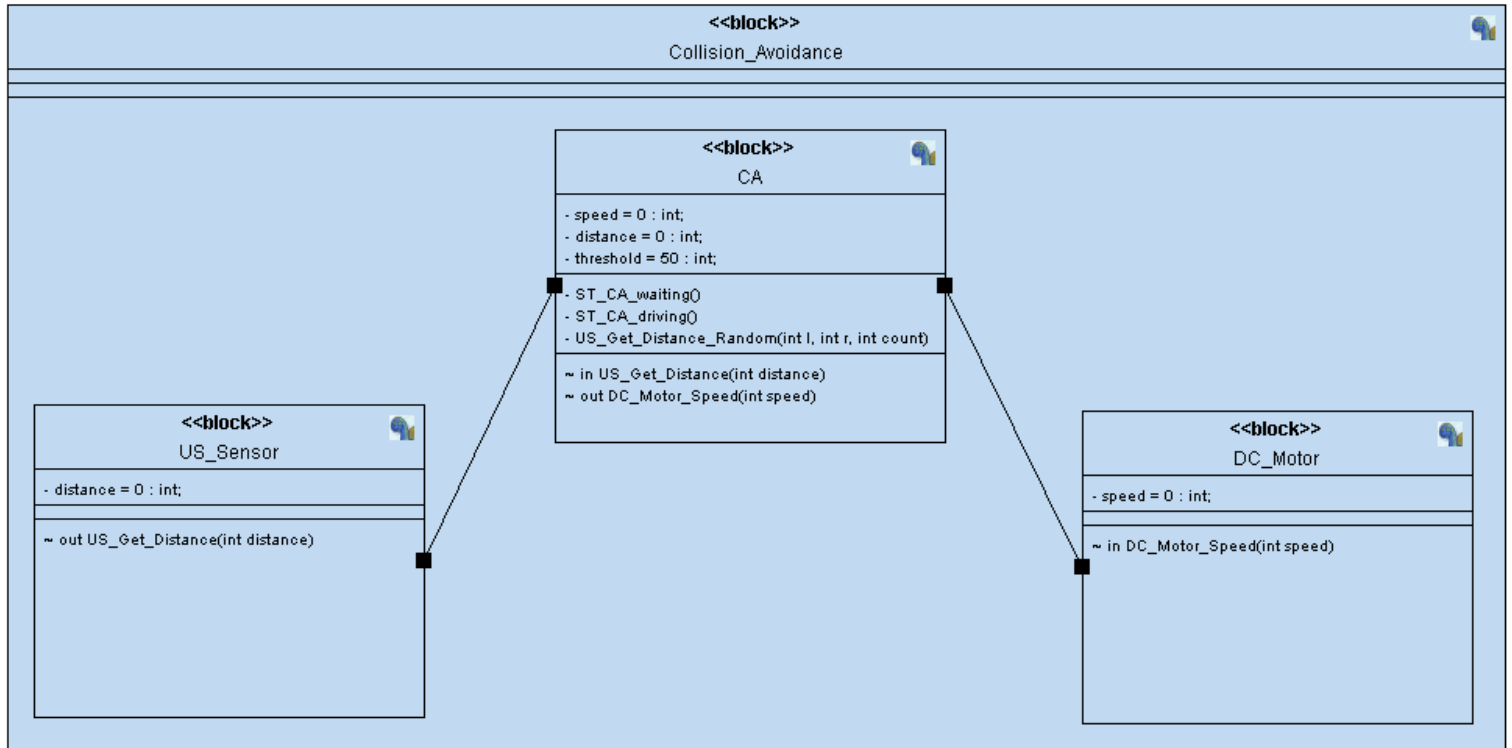
Sequence Diagram



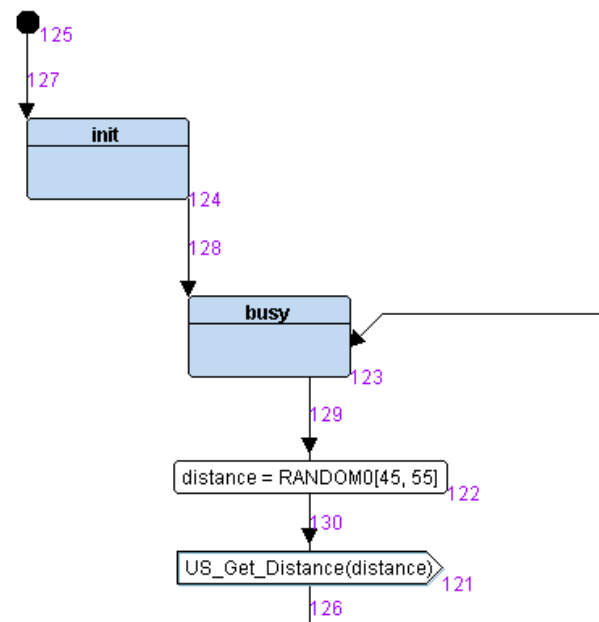
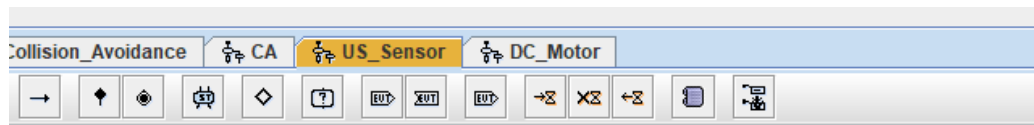
Algorithm Logic:

- 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

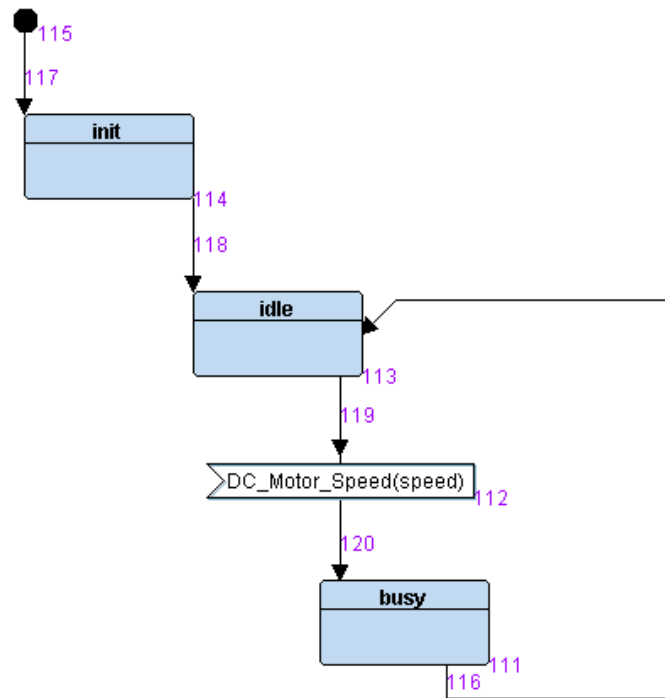
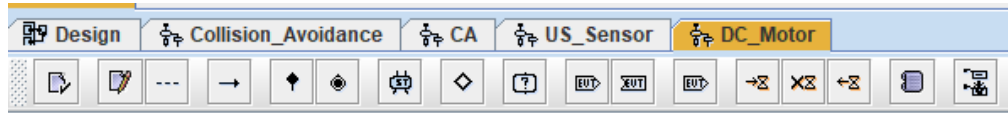
Block Diagram



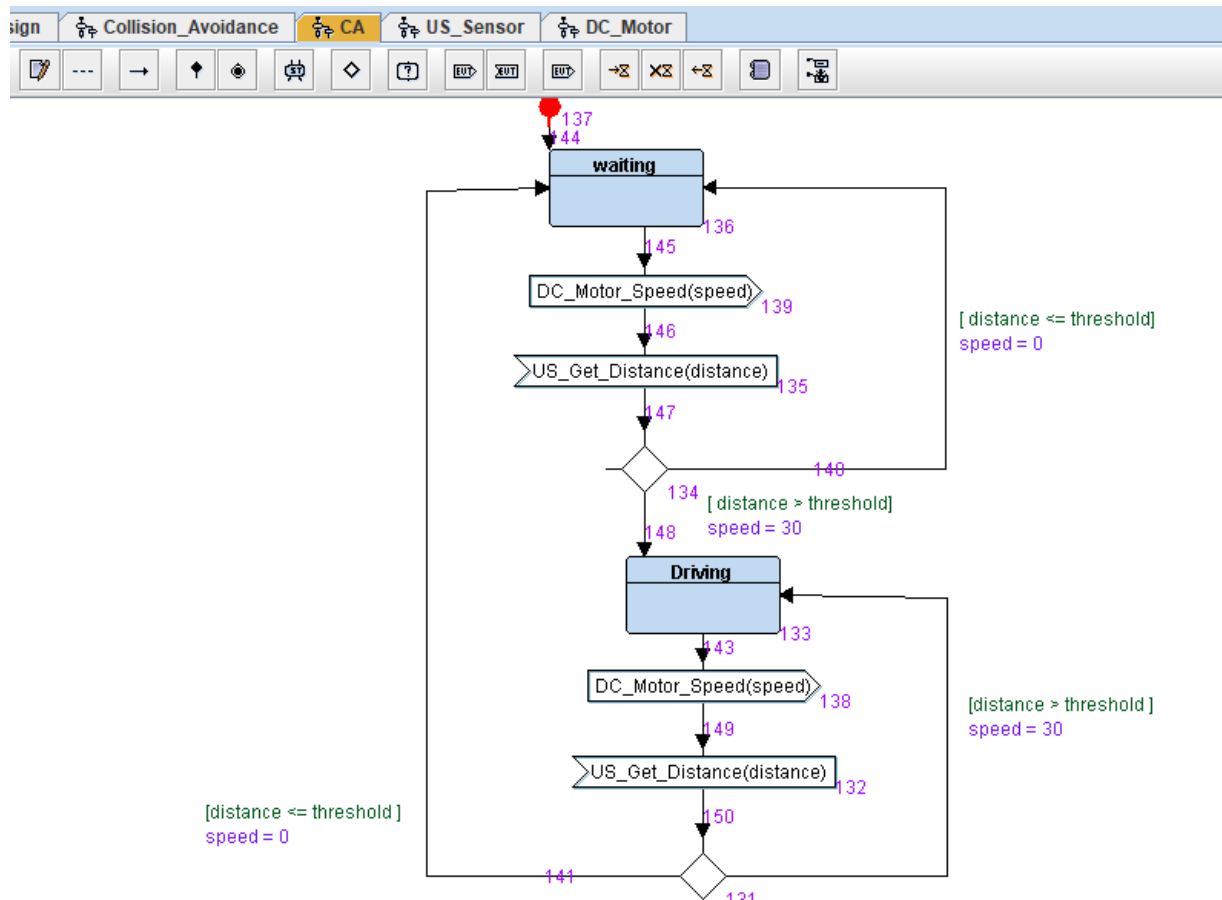
Ultrasonic Sensor Stage Diagram



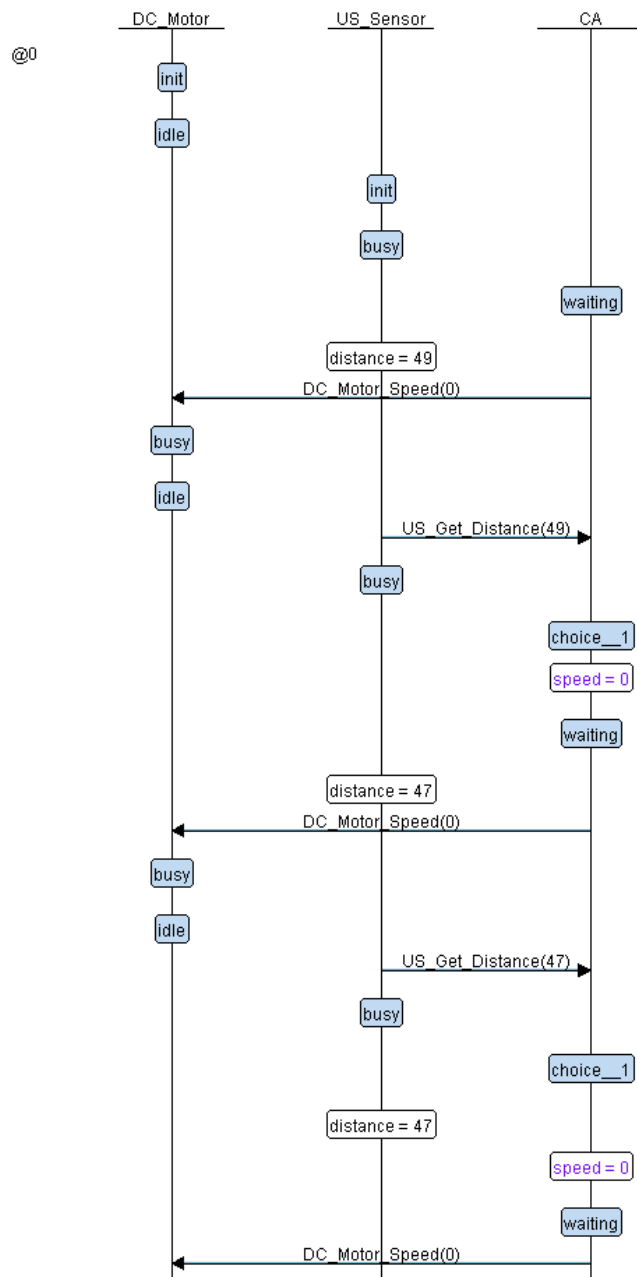
DC Motor State Diagram

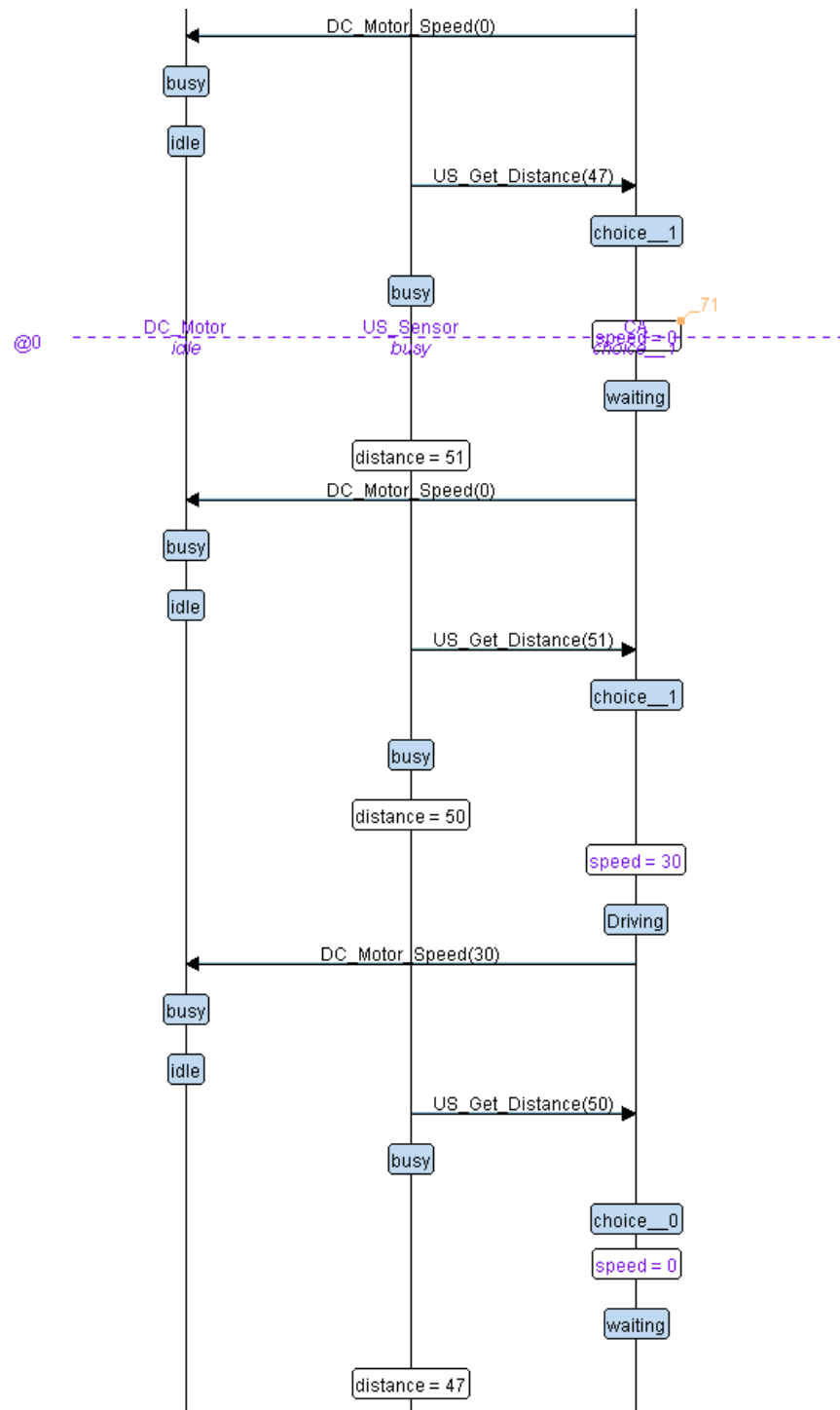


CA State Diagram

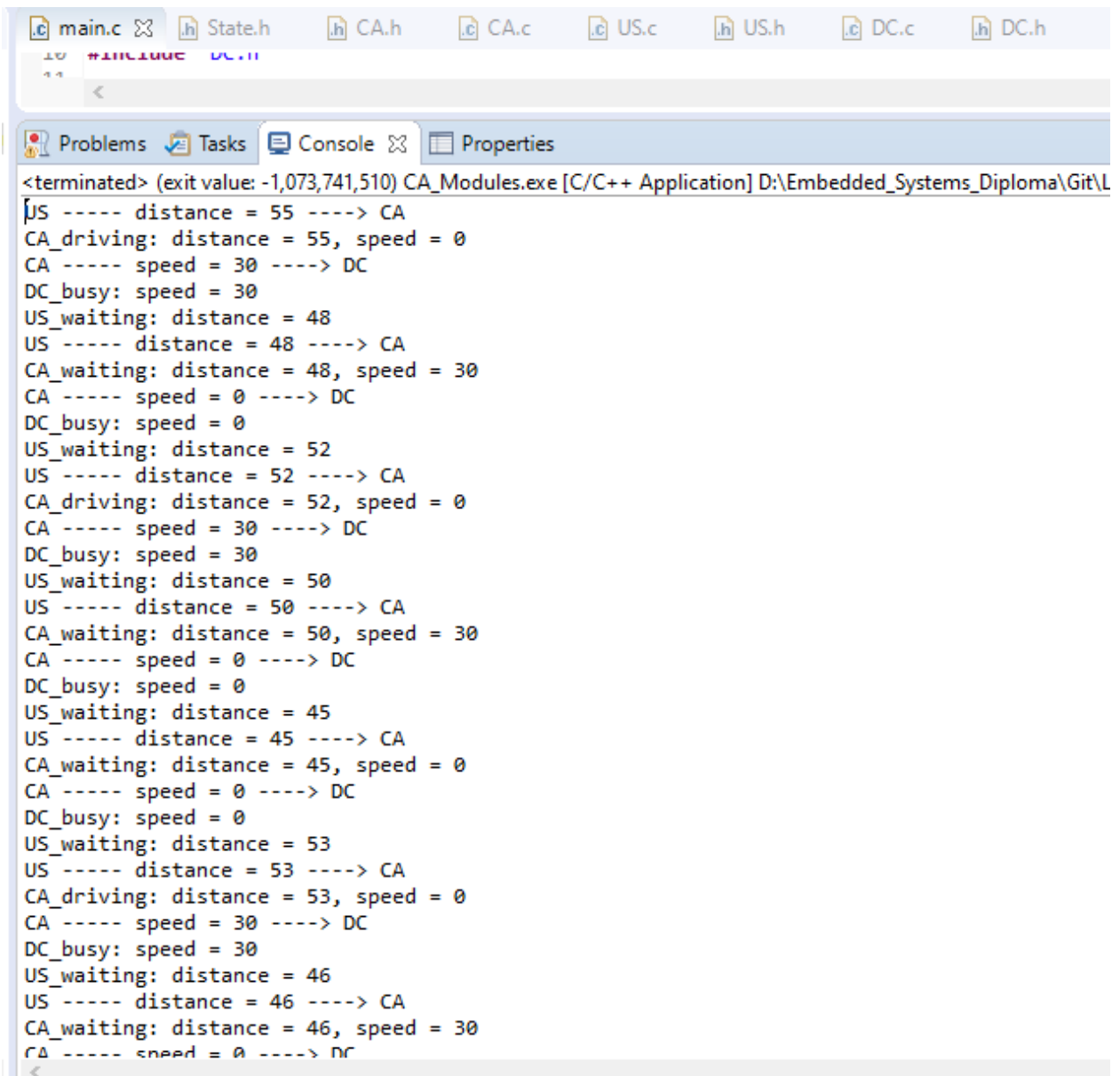


Simulation Trace





C Project Output



The screenshot shows a C++ IDE with several source files open in the top tab bar: main.c, State.h, CA.h, CA.c, US.c, US.h, DC.c, and DC.h. The 'Console' tab is active, displaying the output of the program. The output shows a sequence of state changes for three entities: US, CA, and DC, including distance and speed values. The program terminates with an exit value of -1,073,741,510.

```
<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
```