Mastering Embedded Systems

Unit 4

Data Structure

Collision Avoidance

Case Study:

We need to implement a Collision Avoidance system. Where, we have 3 main modules.

Ultrasonic sensor driver used to detect the distance between our moving object and any facing obstacles.

DC Motor driver used to move our object with a given speed.

CA driver used to set speed according to distance read from the ultrasonic sensor based on a predefined threshold.

Requirements:

UltraSonic Sensor Driver:

- Detect distance between object and obstacle.
- Send distance data to CollisionAvoidance Driver.

CollisionAvoidance Driver:

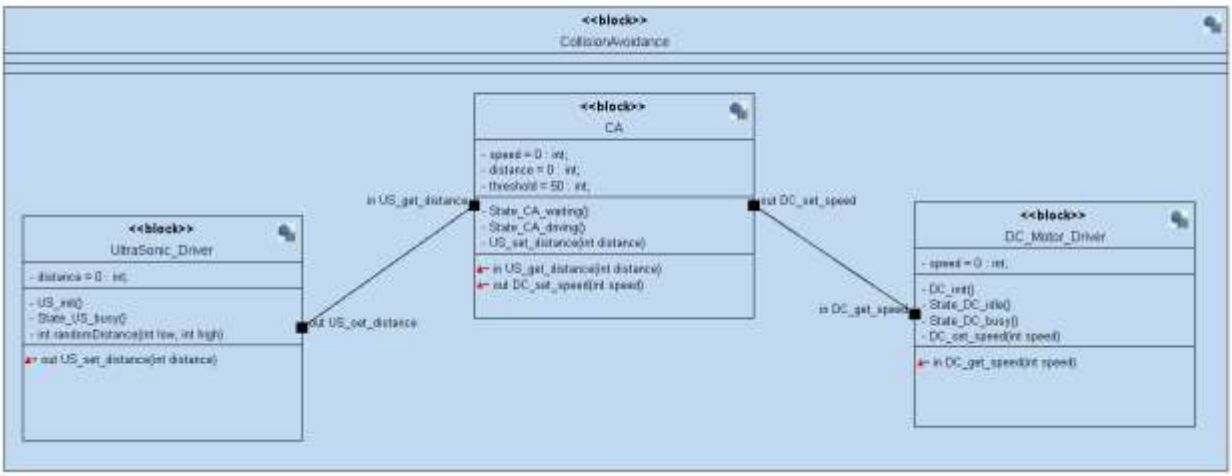
- Receive distance data from UltraSonic Sensor Driver.
- Compare distance with defined threshold.
- Send speed data to DC Motor Driver.

DC Motor Driver:

- Receive speed data from CollisionAvoidance Driver.
- Set new speed.

Main Block Diagram:

This diagram elaborates each of the nested blocks with their variables, methods and input/output signals and their connection with each others.

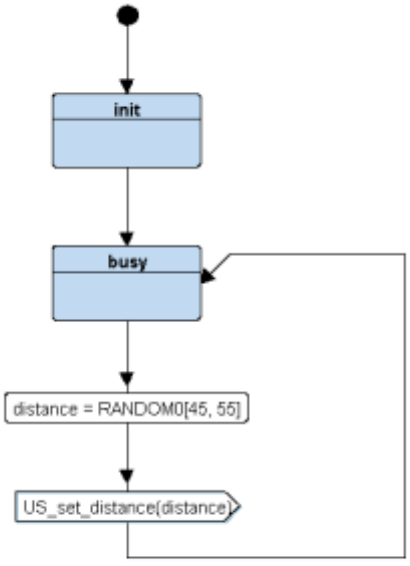


UltraSonic_Driver State Diagram:

This diagrams shows the following:

2 states: Init state and busy state.

1 trigger signal: US_set_distance(distance)

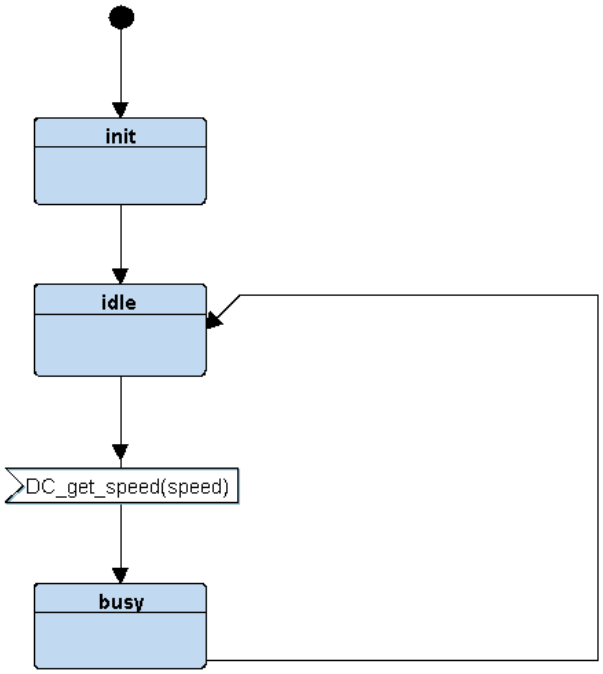


DC_Motor_Driver State Diagram:

This diagrams shows the following:

3 states: Init state, idle state and busy state.

1 trigger signal: DC_get_speed(speed)

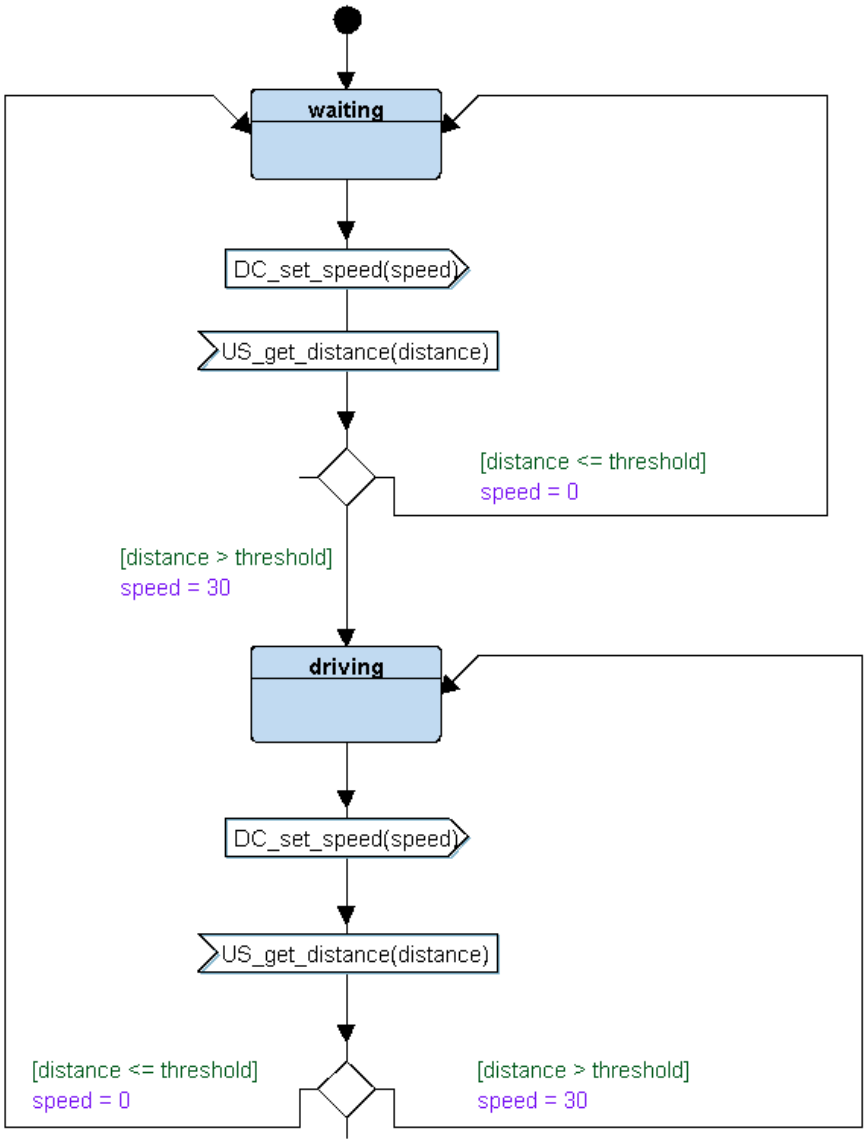


CollisionAvoidance State Diagram:

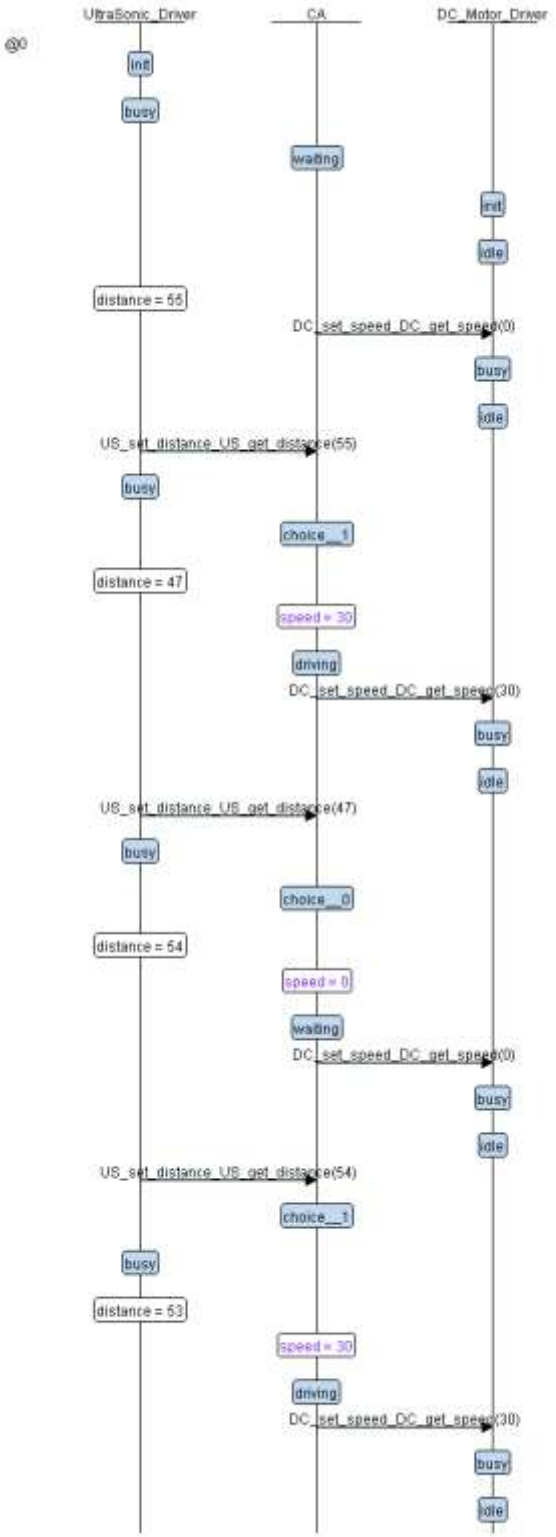
This diagrams shows the following:

2 states: waiting state and driving state.

2 trigger signals: DC_set_speed(speed), US_get_distance(distance)



Sequence Diagram:



Implementation Output: