

Nov 2021

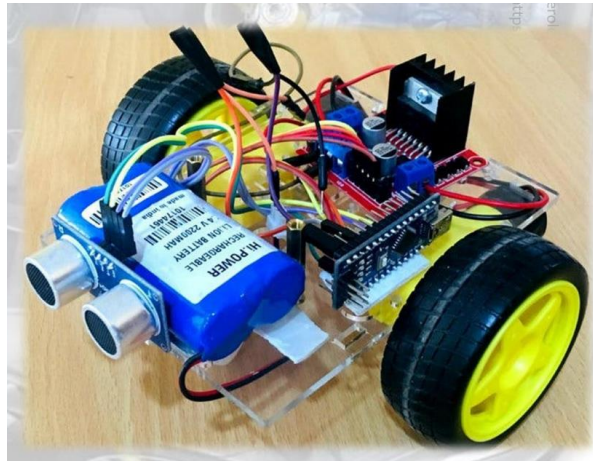
Collision Avoidance

SYSTEM ARCHITECTING
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Case Study:

A robot that moves by DC motors with knowing that the obstacles are at distance greater than 50 cm by using an ultrasonic sensor.



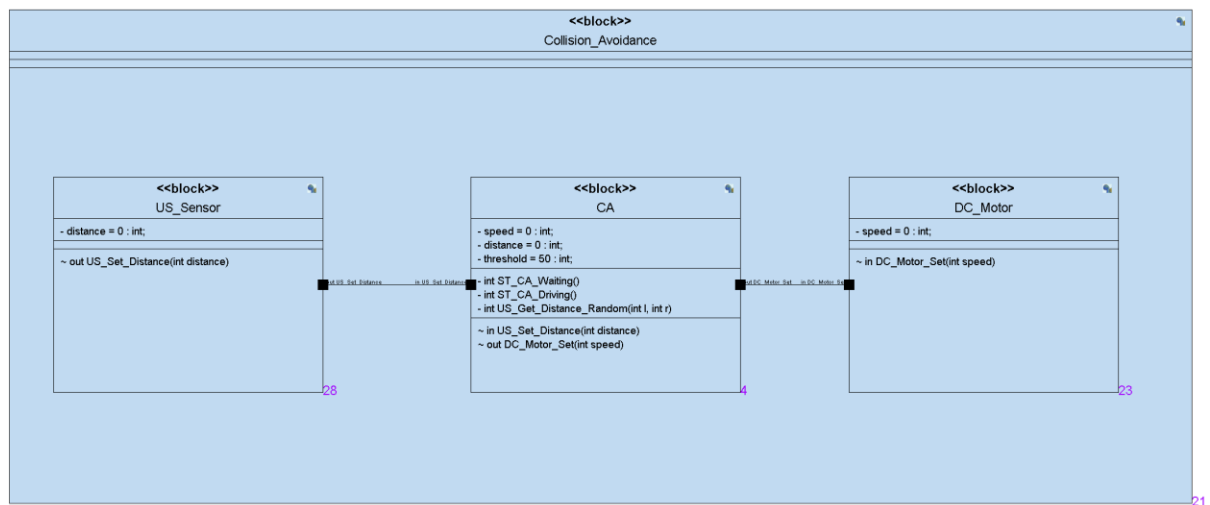
Assumptions:

- The sensor will always send accurate data.
- The motor will get the needed power.
- The MCU will work as intended.

How it works:

1. Get the ultrasonic sensor data.
2. If the data is greater than or equal to the threshold.
 - a. Set the speed of the motor to 30.
3. If the data is less than the threshold.
 - a. Set the speed of the motor to 0.
4. Repeat.

Block Diagram



We will have 3 blocks:

1. Ultrasonic.
2. Collision avoidance.
3. DC motor.

Ultrasonic:

This block will have the distance variable and will set it by the function `US_Set_Distance(int distance)`.

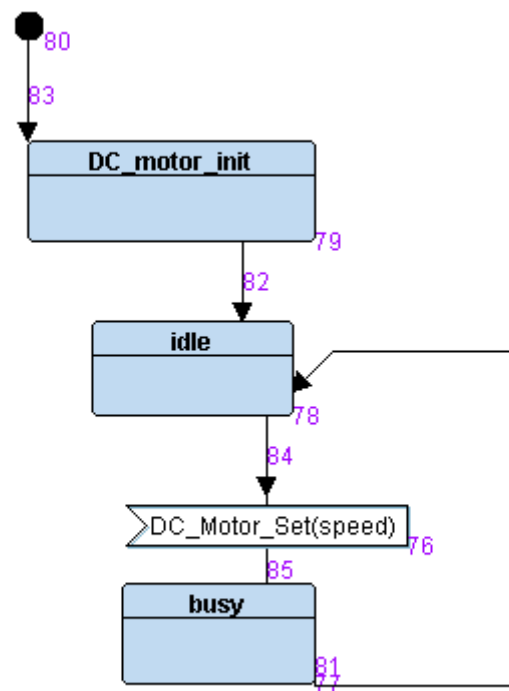
DC motor:

This block will have the speed variable and will set it by the function `DC_Motor_Set (int speed)`.

Collision avoidance:

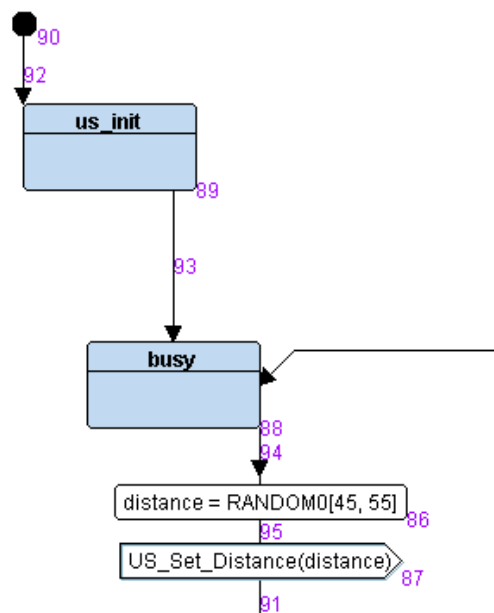
This block will have the distance, speed and threshold variables and will switch between the states by jumping to the functions: `ST_Waiting()` and `ST_Driving()`.

DC motor state machine



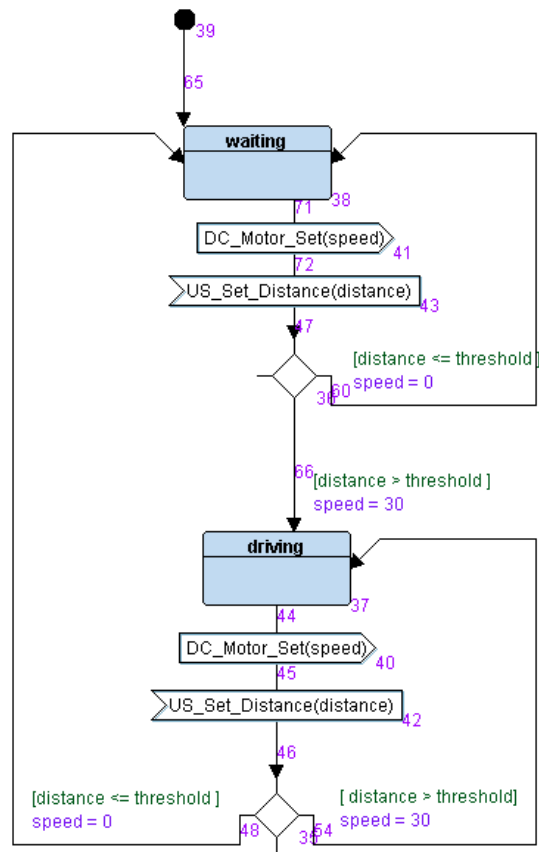
The DC motor will be initialized and begin at idle state and will go busy while setting the speed then return to idle.

US state machine



The ultrasonic sensor will be initialized and begin at busy state and keep sending the distance.

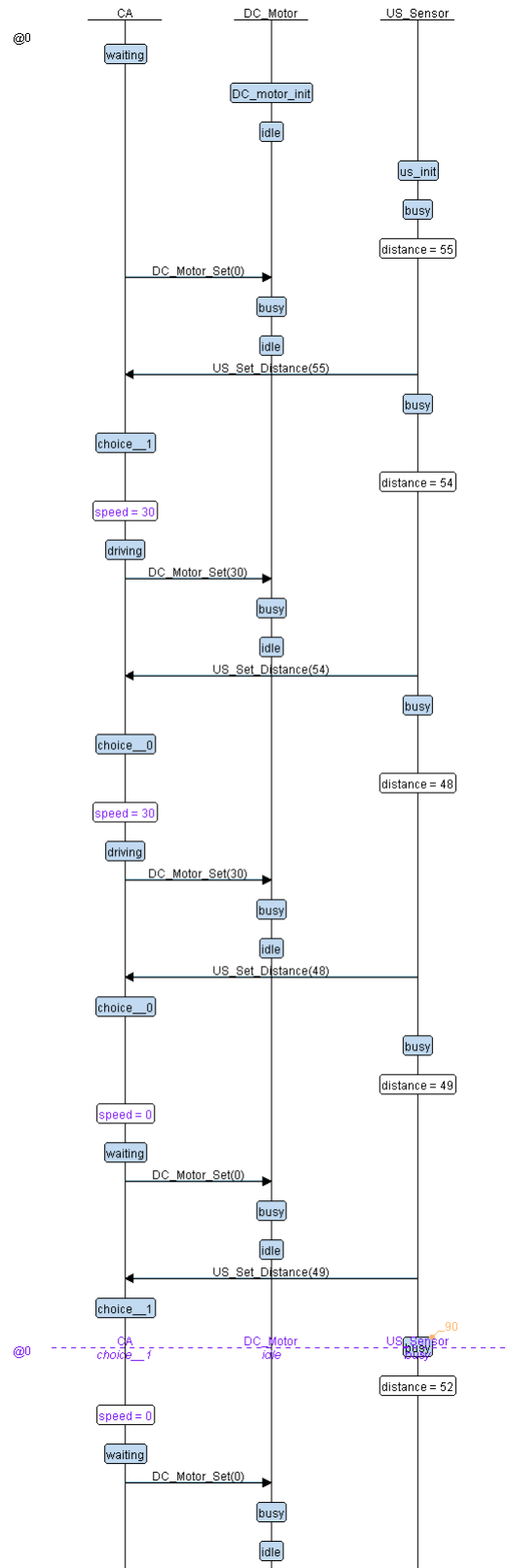
Collision avoidance state machine



The system will begin at the waiting state then sets the speed of the motor to zero and get the distance from the sensor then checks whether the distance is greater than the threshold or not.

If it is greater, it will switch to the driving state and set the speed to 30 and gets the distance again from the sensor then repeats the process.

Final Simulation



Implemented code output:

```
DC_init
US_init
US_Waiting state distance=53
US -----> distance=53 -----> CA
CA -----> speed=30 -----> DC
Driving state: distance=53 speed=30
DC_Busy state speed=30
US_Waiting state distance=54
US -----> distance=54 -----> CA
CA -----> speed=30 -----> DC
Driving state: distance=54 speed=30
DC_Busy state speed=30
US_Waiting state distance=54
US -----> distance=54 -----> CA
```