EMBEDDED SYSTEM PROJECT

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PROJECT GOALS

The project's main goal is to create an Embedded System inside a vehicle so that it can navigate the surrounding environment and avoid obstacles in its path.

Typically, such a robot is equipped with sensors, such as ultrasonic sensors, to detect obstacles and determine their proximity. The robot’s control system processes sensors data to make real-time decisions, adjusting its direction or speed to avoid obstacles.

Key to the obstacle avoidance functionality are distance sensors, commonly ultrasonic sensors, which emit signals and measure the time it takes for the signals to bounce back after hitting an obstacle.

• THE INPUTS AND OUTPUTS

INPUT	PIN
Echo Pin F (The Echo pin goes HIGH when the forward ultrasonic wave is transmitted and remains HIGH until the sensor receives an echo)	A2
Echo Pin R (The Echo pin goes HIGH when the right ultrasonic wave is transmitted and remains HIGH until the sensor receives an echo)	A0
Echo Pin L (The Echo pin goes HIGH when the left ultrasonic wave is transmitted and remains HIGH until the sensor receives an echo)	3

OUTPUT	PIN
Trig Pin F (is used to trigger forward ultrasonic sound pulses)	11
Trig Pin R (Is used to trigger Right ultrasonic sound pulses.)	13
Trig Pin L (is used to trigger Left ultrasonic sound pulses)	A1
ENA (Set motor A speed) Notice: we used 4 motors we connect the right motors and called motor a so motor A represent the two right motors.	10
IN1()	9
IN2()	8
ENB (Set motor A speed to) Notice: we used 4 motors we connect the left motors and called motor a so motor B represent the two right motors.	5
IN3()	7
IN4()	6

• THE HARDWARE COMPONENTS

COMPONENT	DESCRIPTION
Ultrasonic sensor	Ultrasonic sensors measure distance by sending and receiving the ultrasonic wave. The ultrasonic sensor has a sender to emit the ultrasonic waves and a receiver to receive the ultrasonic waves. The transmitted ultrasonic wave travels through the air and is reflected by hitting the Object. Arduino calculates the time taken by the ultrasonic pulse wave to reach the receiver from the sender.
DC Motor	-DC Motor A DC motor (Direct Current motor) is the most common type of motor. DC motors normally have just two leads, one positive and one negative. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction. -notice: we used 4 DC Motor.
Arduino Uno (ATmega328 P)	a microcontroller It has 14 Digital I/O Pins, flash memory with size 32KB, SRAM with size 2KB, EEPROM with size 1KB, Operating Voltage 5v and it's processor work with clock speed 16MHz.
L298 Motor Driver	• The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. • The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.
3V battery	We used 3 of it to afford 9v for the car.
Wheels	We used 4 of it.
jumpers	Wires We used as we needed.

- ## ALGORITHM

➢The initial for the car is to move forward.

➢The forward ultrasonic sensor will detect objects onboard 30cm.

➢Once, it found and object it will stop.

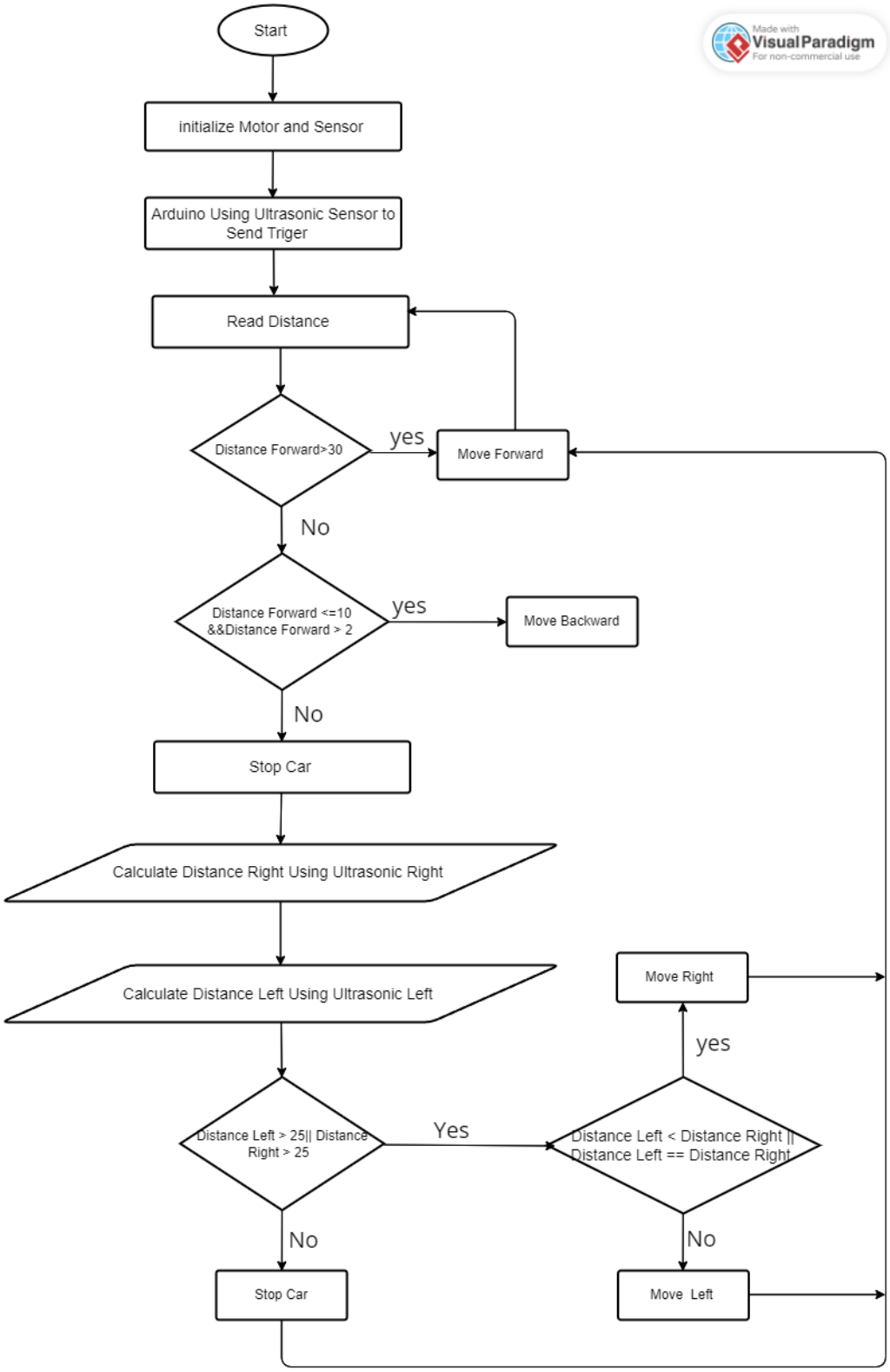
➢Then, check if there is object on both sides with the ultrasonic on the both sides.

➢If it detect an object on the right side it will go left and vice versa.

➢In case, there was no object on both sides it will give priority to go right.

➢In case, an object appear suddenly it will go back and perform the previous steps.

- # THE FLOWCHART



- # PROPOSE A TEST STRATEGY

➢We have 3 cases.

- **Case 1:** move forward
- **Case 2:** move right
- **Case 3:** move backward

Case 1:

The robot continue move forward().

If Cdistance(ultrasonic distance value) greater than 30cm.

Case 2:

If Cdistance<=10 &&Cdistance>2 close to object reverse() to get more space to change orientation and stop robot() and Turn servo Right to get ultrasonic value at right and Turn servo Left to get ultrasonic value at left then return to center.

pos(store in it the servo position) and start execute Comparison

Case 3:

Direction of rotation of the servo

- if(r>25||l>25) and if(r>l||r==l) the servo turnRight90()
- if(l>r) the servo turnLeft90()
- if(r<25&&l<25) the servo turnLeft180()

Then stop after execute comparison and reset all variables(Rdistance, Ldistance, Cdistance).