

# **Obstacle Avoiding Vehicle using Cortex M4**

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**Abstract:** In this project we build a obstacle avoiding autonomous car with a music feature in it. The basic idea of this project is that the car will calculate the distance from the obstacle and then it decides its path accordingly, Also there are priorities to run the car, avoid the obstacle and run the music. The on/off switch is toggled from bluetooth serial terminal instead of on board switch. Below in this document are details and working of the project.

## **Components used for Project:**

- Tiva Launchpad TM4C123GH6PM microcontroller (based on ARM Cortex M4)
- Power generator
- LM293D Motor Driver
- 4 DC motors for rotating wheels
- SG 90 Servo motor (0-180 degrees)
- Bluetooth module (HC-05)
- MAXIM MAX541
- LM 4041
- Audio Jack
- Ultrasonic Sensor (ZS-040)
- Breadboard
- Connecting Wires
- Ready to build Chassis for Robot car

## **Tasks Completed:**

- First we interfaced the Bluetooth module with the TM4C123GH6PM.
- Then used the Ultrasonic sensor to calculate the object distance from the vehicle.
- Wrote a function to calculate distance and then write that value in the Bluetooth.
- We build the distance measuring device using bluetooth and ultrasonic sensor and got the output on Bluetooth serial terminal.
- Connected the servo motor to the TIVA launchpad, so the ultrasonic can be mounted on servo motor to check the distance at various angle.
- Connected the LM293D motor driver to control the motors, their speed and to power the motors to rotate wheel.
- Build the chassis and mounted all the circuit on it and installed the servo(SG 90) and mounted the ultrasonic distance sensor on it.
- In the Final phase we added a audio file (16 bit format), which can be played with speaker.

## **Working of the Vehicle:**

- Servo is used to check distance at 0, 45, 90, 135 and 180 degrees, by default we put servo at 90 degree that is the forward direction.

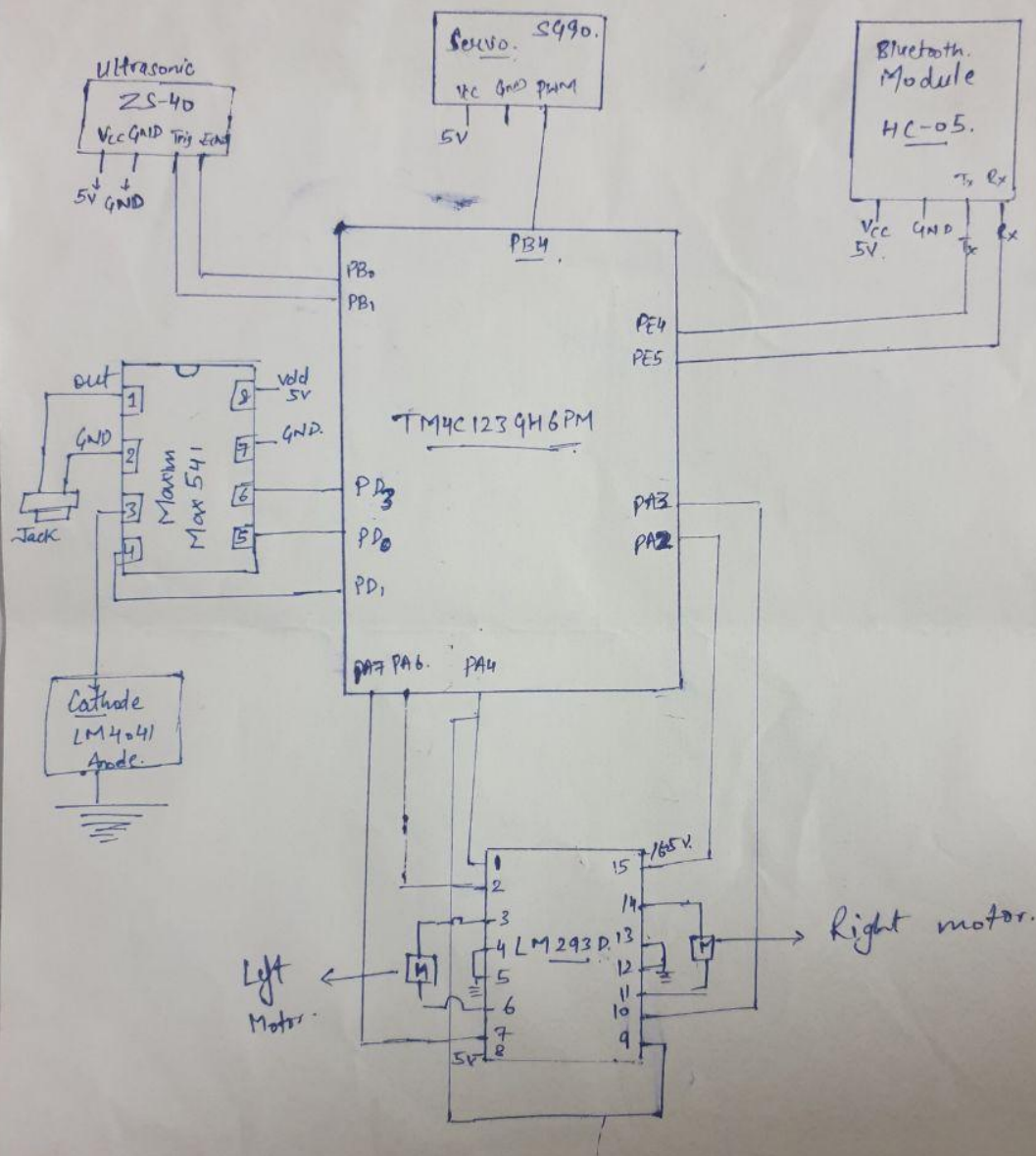
- When we send string 's' from bluetooth serial terminal to microcontroller it the vehicle starts moving in forward direction, if it detects an obstacle in front direction it will then turn 45 degrees and check for obstacle if not then turn to 45 and moves, if obstacle in 45 degrees direction then checks at 135, then at 0 degrees and at last 180 degrees, if the vehicle doesnot find any way in these directions, then it will go in reverse direction for 10 seconds and will check again in all directions and moves in direction where there is no object and moves so on.
- Four DC motors are used to rotate the wheels and to power and rotate them LM293D motor driver is used. More details about pin and connections are mentioned in the Circuit diagram.
- Timer 1A is used to create delay of 1 microseconds and Timer 2A is used to capture cycles.
- Initialization functions are done for timer 1A, 2A, GPIO Ports A, B, E, F and Bluetooth module.
- The Timer2A is used to capture the cycle when Echo sends a high signal, then waits for the Echo to send a low signal. As soon as the Echo sends a low signal, then the Timer2A captures another cycle.
- Using the difference in the cycles passed the time is found. Using the time measured and the velocity of sound the distance is measured.
- Then sent to serial Bluetooth monitor through UART communication using Bluetooth module.
- Power supply used is from power generator instead of ROE as it was more reliable in testing.
- LM293D requires 5v for itself and 12v for powering the motors, since we are powering the motors from 5-7v to reduce the speed of the vehicle.
- MAXIM MAX541 is a 16-bit Digital to Analog Converter used to convert the audio file.
- To convert this audio file SSI communication is used.

### **Problems Faced:**

- Servo motor was not working with ROE 3.3-5v power supply conversion, so this issue was resolved by using power generator in lab.
- Issue in Timer0A handler function, program was stuck at that as it was generating at every 10 seconds. Fixed this issue by calculating distance when servo rotates the ultrasonic sensor.
- PWM was not working for controlling the speed of the DC motors, to fix this used low power supply(5 to 7 volts) to keep the speed of the car reduced.

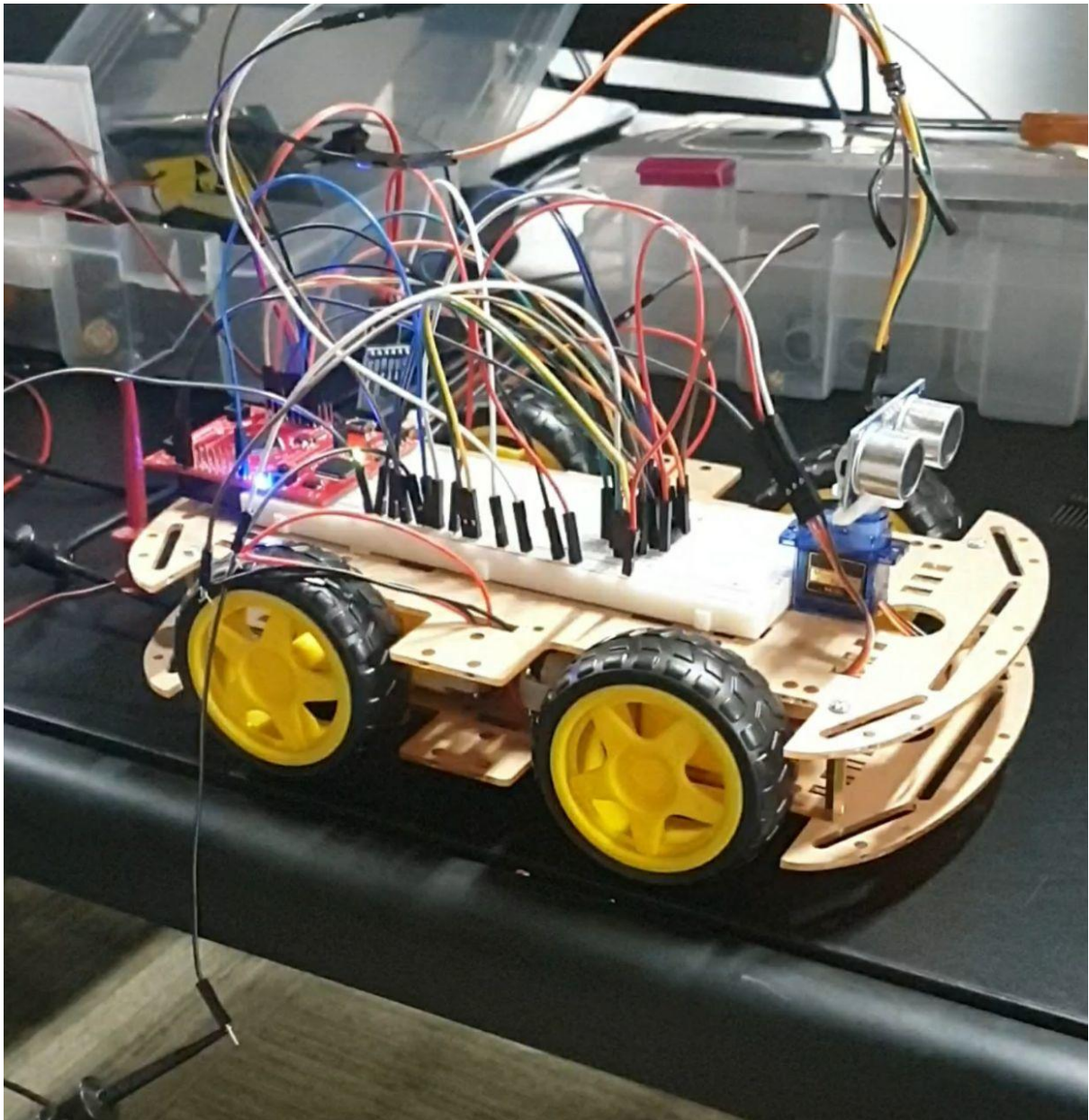
### **Circuit Diagram:**

# obstacle Avoiding Robot.

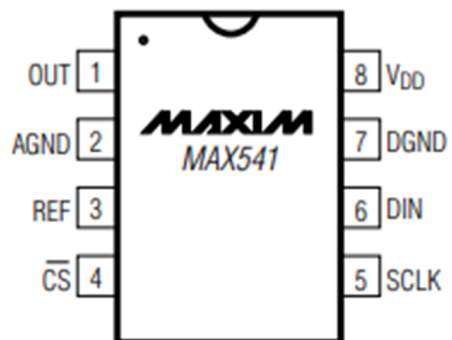


Circuit Diagram

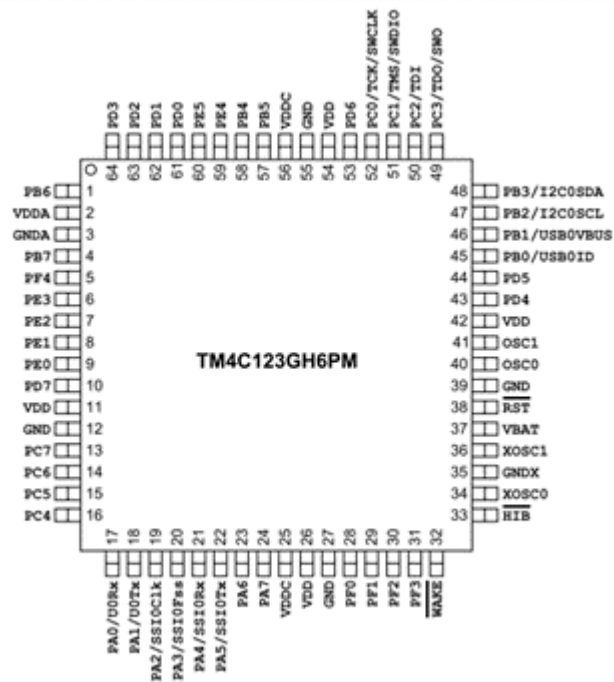
Vehicle Image:



Maxim max 541:



## TM4C123FH6PM pin diagram:



## LM293D Pin Diagram:

