# OBJECT DETECTION AND DISTANCE FOR A CAR

## BY USING TM4C123GH6PM ALONG WITH ULTRASONIC SENSOR


### Abstract

This project aims to implement object detection and distance measurement for a car using the TM4C123GH6PM microcontroller along with an ultrasonic sensor, enabling the vehicle to detect obstacles in its path and accurately determine their distance for safe navigation.



### Submitted by:

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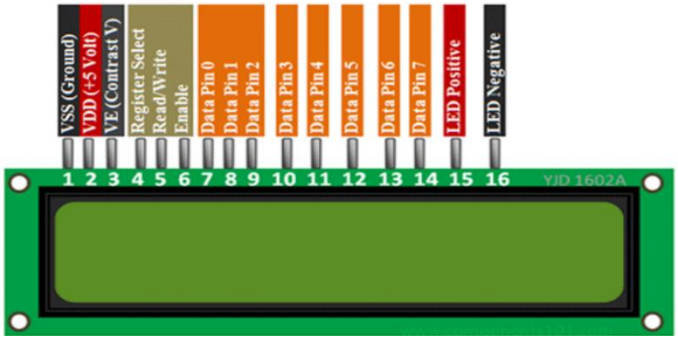
## Project's Objective

The processing component of the automobile in this project is a Tiva C Series microcontroller, model number TM4C123GH6PM. When an obstacle is too close to the car, the microcontroller causes the vehicle to stop. The ultrasonic sensor measures the distance between the vehicle and the obstacle in front of it. Obstacles up to 4 metres in front can be detected by the ultrasonic sensor. The following provides information on the necessary components, how they generally function, and how we are employing them to get the outcomes we are looking for.

## Interfacing 16x2 LCD on Tiva Launchpad

We will use it in our project to display the output speed and measured distance obtained using our Ultrasonic sensor.
The LCD has 16 pins, including data, control, power supply, and LED pins for the backlight.
Data pins D0 through D7 are used to transmit information for display or directives to the LCD controller. Therefore, to transfer data, these lines will be connected to TM4C123 GPIO pins. However, we'll be using this LCD in 4-bit mode (using only D4 to D7 pins).



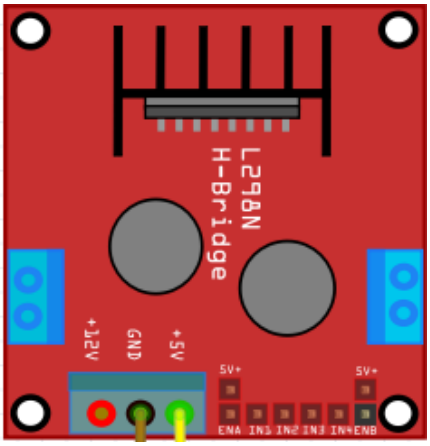

## Control Pins

1. **Register Select RS:** To send data to the LCD, we will connect an active high signal from the TM4C123 microcontroller to this pin.
2. **Read/Write:** is used to switch the LCD between read and write modes. To be in read mode when this pin is set to active high. Similarly, to be in write mode this pin is set to active low
3. **Enable:** This pin controls whether the LCD is on or off. This pin will disable the LCD controller if it is active low.

| **LCD PIN.** | Data pin 4 | Data pin 5 | Data pin 6 | Data pin 7 | RS | RW | EN |
|---|---|---|---|---|---|---|---|
| **TIVA PIN.** | PB4 | PB5 | PB6 | PB7 | PB0 | PB1 | PB2 |

| **LCD PIN.** | Vss | Vdd |
|---|---|---|
| **MOTOR DRIVER PIN.** | 5V | GND |

## L298N Dual H-Bridge Motor Driver



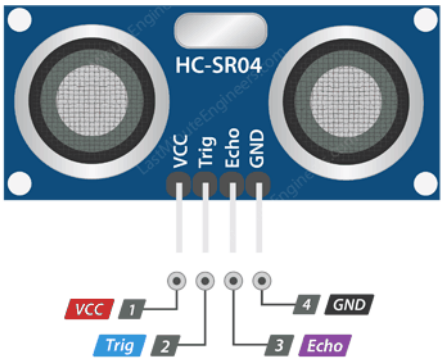

We'll use this hardware device to provide the current and voltage levels that our Tiva board can't provide and to derive our dc motors connected to tyres. For example, to provide 5v supply to our $V_{cc}$ pin of sensor (as Tiva can't give more than 3.3 volts).

## Connections

The two blue components on the driver module will be connected to the motors that will rotate our car's tyres.
The pin marked as 12V will be connected to the power supply i.e battery to supply power to motor driver

| **DRIVER PIN.** | IN1 | IN2 | IN3 | IN4 | 5V | GND |
|---|---|---|---|---|---|---|
| **TIVA PIN** | PA2 | PA3 | PA5 | PA6 | Vcc | GND |

## Ultrasonic Sensor Hc-Sr04




The ultrasonic sensor that we are using consists of two ultrasonic transducers.
One of which acts as a transmitter that converts electrical signals into ultrasonic sound pulses of 40khz frequency.
While the other one acts as a receiver that will receive the reflected pulses and produce and output wave of width equal to the distance at which the reflection occurred because of an obstruction.

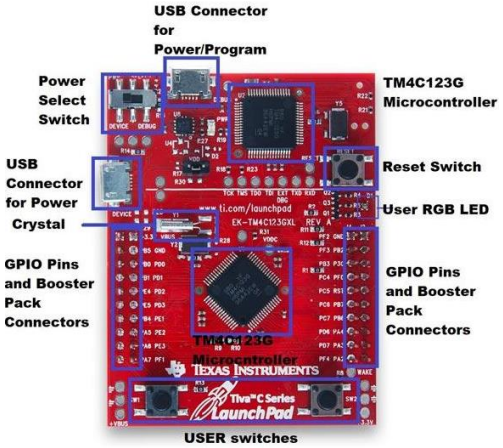
## Connection Pins

Ultrasonic sensor has four pins that needs to be configured to make it operational for our use.
**TRIG** Setting this pin high initiates bursts of ultrasonic pulses.
**ECHO** This pin will be high at the transmission of our pulse and will get to logic low when we'll receive the echo.(This pin will help us measure the distance of the object by measuring the time for which this pin was at logic high).
In order to find the time for which this pin was at logic high we'll use our Tiva pin in timer functionality: input capture mode.

| | | |
|---|---|---|
| **ULTRA-SENSOR PINS.** | Trigg | Echo |
| **TIVA PINS** | PE2 | PF4 |

| | | |
|---|---|---|
| **ULTRA-SENSOR PINS.** | Vcc | GND |
| **MOTOR DRIVER PINS.** | 5V | GND |

## TM4C123GH6PM Microcontroller:




TM4C123GH6PM will be the processing unit of the car.A highly integrated chip that contains all the components comprises a controller. Typically this includes a CPU, RAM, some form of ROM, I/O ports, and timers. The microcontroller also consists of the external bus that enables connection to external devices and components.

## Chassis kit:

The first step and the base of our robot is a chassis. The chassis has to include a body, two motors, 2 big wheels, a swivel wheel and a switch

## 2 DC Motors:

DC motor will be used in this project for the movement of the robot. The rear wheels will be driven by a motor. Depending upon the input of ultrasonic sensor and MSP430 (tiva), the speed of the motor varies. When the obstacle is at certain distance from the robot, it slows down at first and when it approaches the

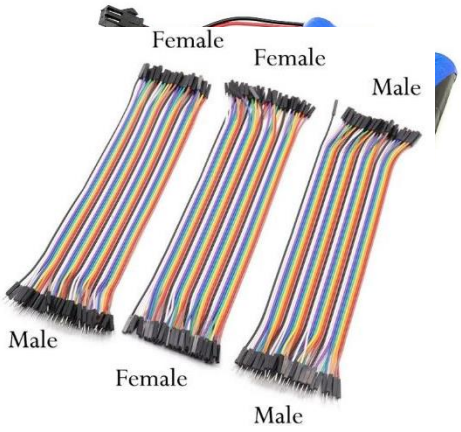
obstacle it slows down more, and after getting close to the obstacle, it stops.

## DC Battery:

Battery is the main power supply for the circuit**.** Microcontroller needs a minimum of 3.3V and maximum of 4.2V.For this, we use power bank.

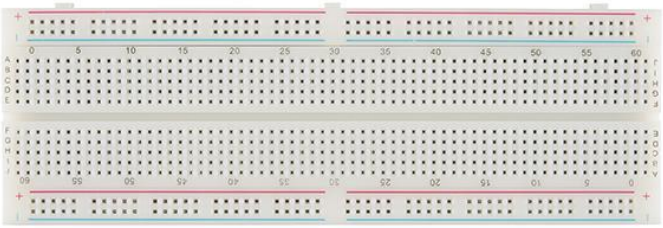
## Jumper Wires:

Jumper wires are simple wires that are used to connect electronic parts together to form a closed circuitry. According to the modules we are using we can use either male jumpers or female jumpers or male-female jumpers. To use with a bread board, we can use male-male jumper wires.




## Breadboard:

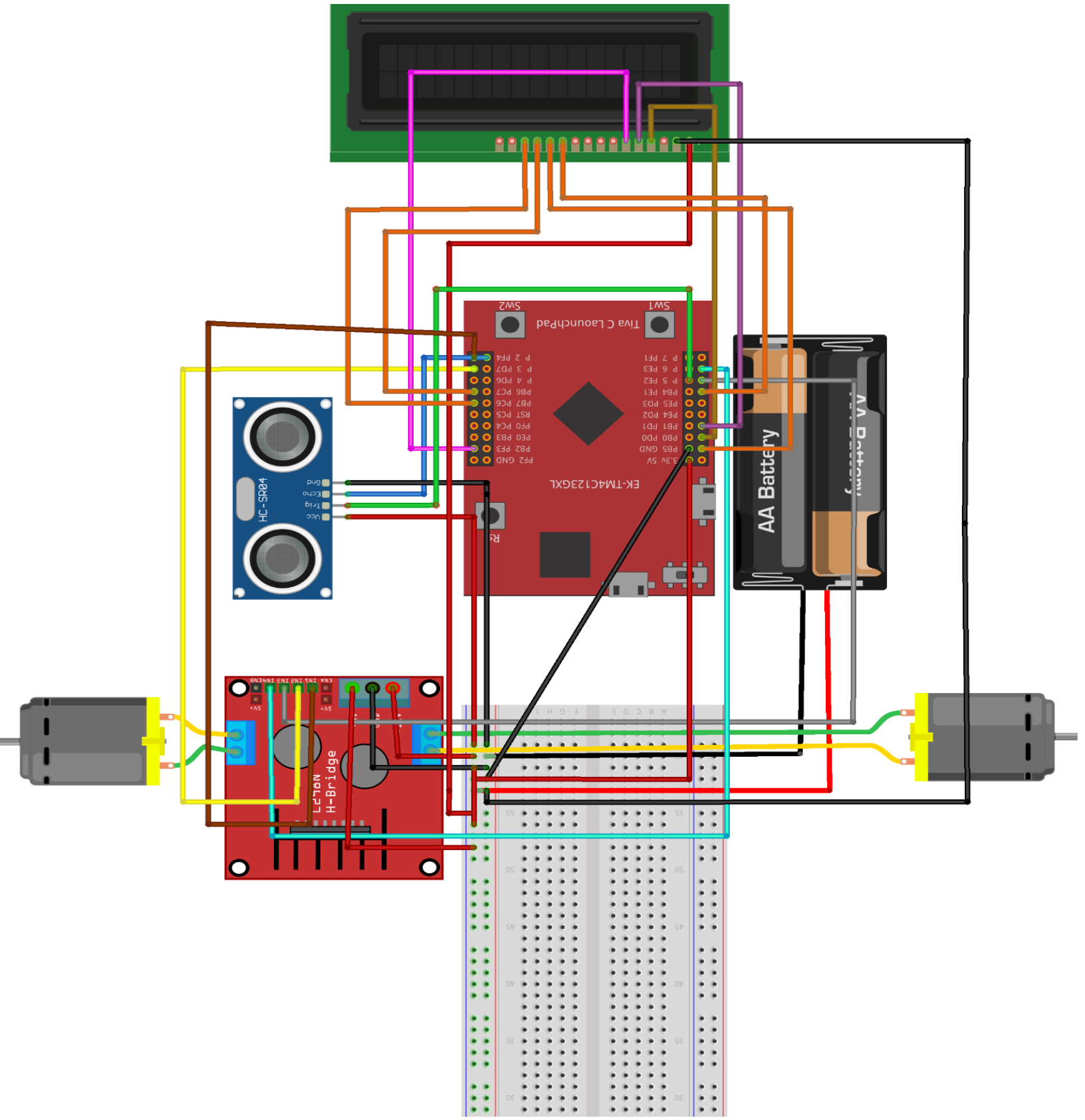
It is used to provide multiple connections from a single pin .



## Logic Diagram

In the logic diagram,the four consective orange wires coming out of the lcd terminals are data pin 5 to data pin 7 (from bottom to top).

| **Wires Colors** | Black | Red | Purple | Pink | Brown |
|---|---|---|---|---|---|
| **Connections** | GND | > 0V | R/W | EN | RS |


Tiva C LaunchPad
SW1
SW2
EK-TM4C123GXL
HC-SR04
Vcc
Trig
Echo
Gnd
AA Battery
H-Bridge

# Total Bill:

| Components | Price |
|---|---|
| ***Ultrasonic sensor:*** | *150/-* |
| ***TM4C123GH6PM Microcontroller:*** | *6500/-* |
| ***Chassis kit:*** | *700/-* |
| ***DC BATTERY:*** | *90/-* |
| ***Jumper Wires:*** | *300/-*<br>*100 each type of jumper wires* |
| ***Breadboard:*** | *170/-* |
| ***LCD*** | *350/-* |
| ***TOTAL EXPENSE*** | *8260/-* |