

eYSIP2016

TIVA MANUAL



Amanpreet Singh
Amit Raushan
Shubham Gupta

Duration of Internship: 10/06/2016 – 24/07/2016

2016, e-Yantra Publication

Contents

1	Tiva Manual	2
1.1	Abstract	2
1.2	Board Overview	3
1.2.1	Kit Contents [Source: Tiva C Series TM4C123G LaunchPad User's Guide]	4
1.2.2	Features [Source: Source: Tiva C Series TM4C123G LaunchPad User's Guide]	4
1.3	Hardware Parts Used	5
1.4	Interfacing of Hardwares	12
1.4.1	Tiva Robot	12
1.5	Block Diagram	17
1.6	Voltage Regulator Circuit Diagram	18
1.6.1	Steps for Assembling Tiva Robot	19
1.7	Software and Code	26

Tiva Manual

1.1 Abstract

This manual is related to use of **Tiva C Series TM4C123G LaunchPad Evaluation Board** to make a robot which includes two DC geared motor, a pair of wheels, 3 channel white line sensor, 1 Sharp sensor, buzzer & one 16x2 LCD display.

In case we need to transfer data from the robot to laptop/PC we can interface a XBee module with Tiva board. We can use this robot to get familiar with Tiva board and further it can be developed to do real world tasks. For example, the basic robot developed here can be programmed to work as white line sensing robot or as wall follower robot.

1.2. BOARD OVERVIEW

1.2 Board Overview

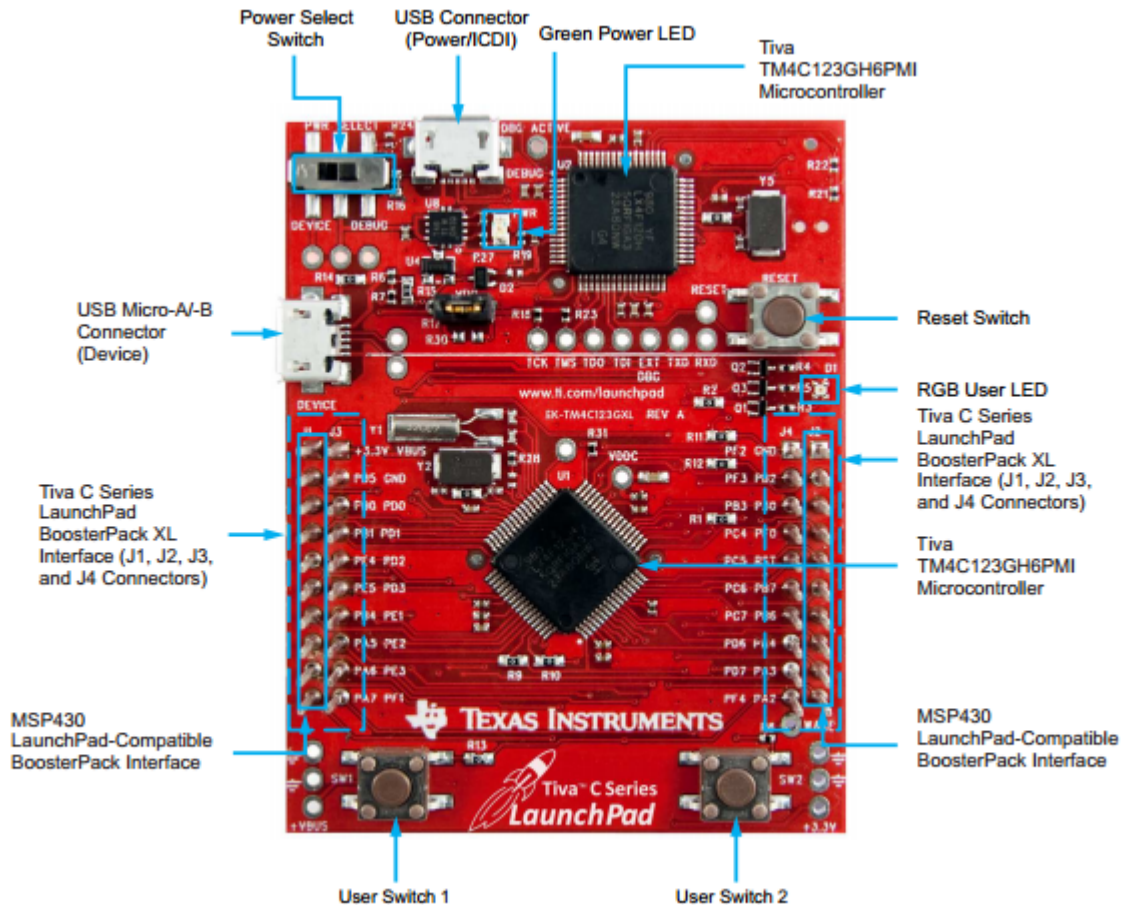


Figure 1.1: Tiva C Series TM4C123G LaunchPad Evaluation Board

This launchpad contains TM4C123GH6PM as microcontroller. The TM4C123GH6PM is a 32-bit ARM Cortex-M4-based microcontroller with 256-kB Flash memory, 32kB SRAM and 80-MHz operation; USB host, device and OTG connectivity; a Hibernation module and PWM; and many other peripherals.



1.2. BOARD OVERVIEW

1.2.1 Kit Contents [Source: Tiva C Series TM4C123G LaunchPad User's Guide]

The Tiva C Series TM4C123G LaunchPad Evaluation Kit contains the following items:

- Tiva C Series LaunchPad Evaluation Board (EK-TM4C123GXL).
- On-board In-Circuit Debug Interface (ICDI)
- USB micro-B plug to USB-A plug cable.

1.2.2 Features [Source: Source: Tiva C Series TM4C123G LaunchPad User's Guide]

Tiva C Series LaunchPad includes the following features:

- Tiva TM4C123GH6PMI microcontroller.
- Motion control PWM.
- USB micro-A and micro-B connector for USB device, host, and on-the-go (OTG) connectivity.
- RGB user LED.
- Two user switches (application/wake)
- Available I/O brought out to headers on a 0.1-in (2.54-mm) grid.
- On-board ICDI.
- Switch-selectable power sources:
 - ICDI
 - USB device
- Reset switch
- Preloaded RGB quickstart application
- Supported by TivaWare for C Series software including the USB library and the peripheral driver library

1.3 Hardware Parts Used

1. Tiva C Series TM4C123G LaunchPad Evaluation Board.

[Datasheet](#)

[Peripheral Driver Library](#)

[User's Guide](#)

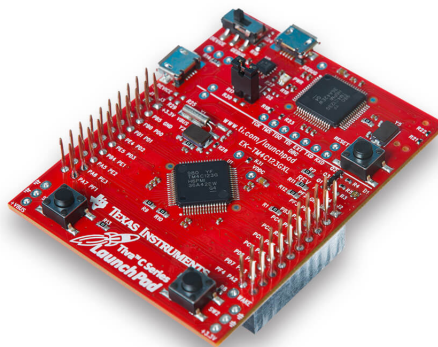


Figure 1.2: Tiva C Series TM4C123G LaunchPad

2. 2x DG02S Mini DC Geared Motor.

[Datasheet](#)



Figure 1.3: DC Geared Motor



1.3. HARDWARE PARTS USED

3. 2x Wheel - 65mm in Diameter



Figure 1.4: Wheel

4. L293D - Motor Driver.
[Datasheet](#)

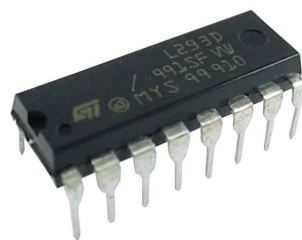


Figure 1.5: Motor Driver IC

5. 16x2 LCD.
[Datasheet](#)

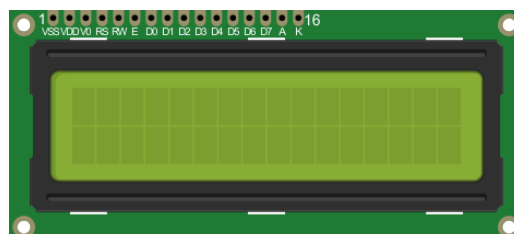


Figure 1.6: LCD 16x2 Display

1.3. HARDWARE PARTS USED

6. White Line Sensor Module.

[Manual](#)



Figure 1.7: 3 Channel White Line Sensors

7. Sharp 0A41SK Sensor.

[Datasheet](#)



Figure 1.8: Sharp Sensor

8. Caster Wheel.



Figure 1.9: Caster Wheel

1.3. HARDWARE PARTS USED

9. LM3237 - Voltage Regulator.

[Datasheet](#)



Figure 1.10: LM3237

10. Heat Sink.

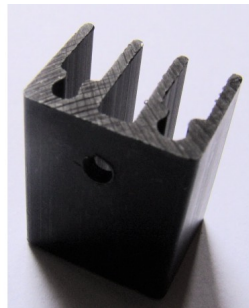


Figure 1.11: Heat Sink

11. 10 μ F Electrolyte Capacitor.



Figure 1.12: Capacitor



1.3. HARDWARE PARTS USED

12. Multi-purpose PCB board.

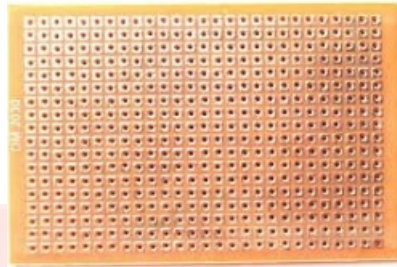


Figure 1.13: PCB Board

13. 12V Rechargeable Battery.



Figure 1.14: 12V Rechargeable Battery

1.3. HARDWARE PARTS USED

14. 20 Pin Planar Cable.



Figure 1.15: 20 Pin Connector Wire

15. Female Bug Strip.



Figure 1.16: Female Bug Strip

16. Male Bug Strip.

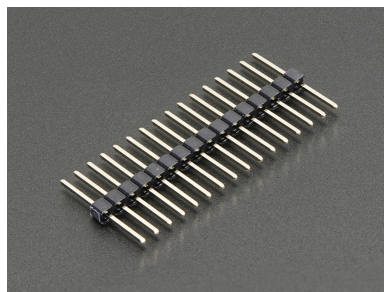


Figure 1.17: Male Bug Strip

1.3. HARDWARE PARTS USED

17. Male to Female Jumper Wires.



Figure 1.18: Jumper Wires

18. Plastic Chassis.



Figure 1.19: Chassis

19. XBee Module.



Figure 1.20: XBee Module

1.4. INTERFACING OF HARDWARES

1.4 Interfacing of Hardwares

1.4.1 Tiva Robot

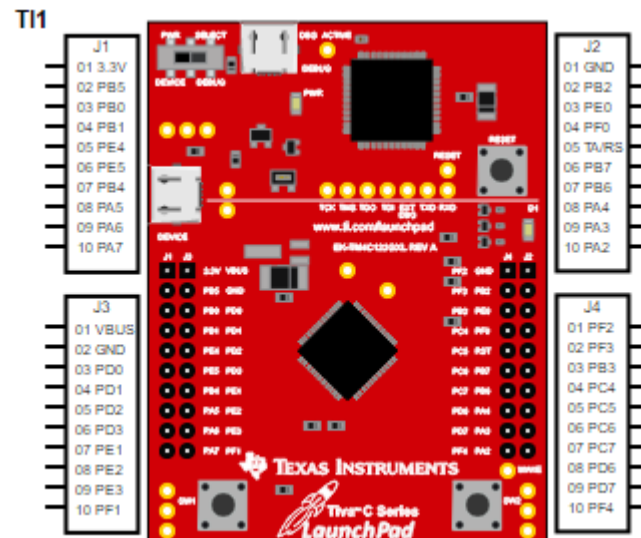


Figure 1.21: Tiva Board Pin Location

Connections of PORT pins of Tiva board with different components:

1. Interfacing of White Line Sensor

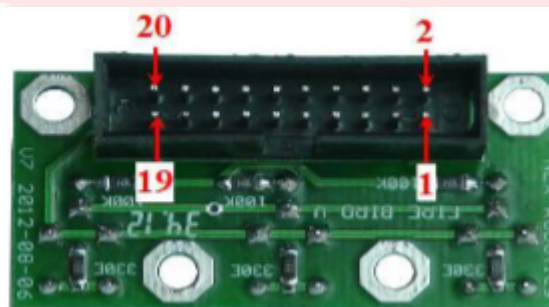


Figure 1.22: Pin Configuration of White Line Sensor

1.4. INTERFACING OF HARDWARES

Tiva Port Pins	Sensors Pin
PE1	1
PE2	3
PE3	5
VCC	2
VCC	4
VCC	6
GND	15
GND	16
GND	17
VCC	19

2. Interfacing of XBee Module

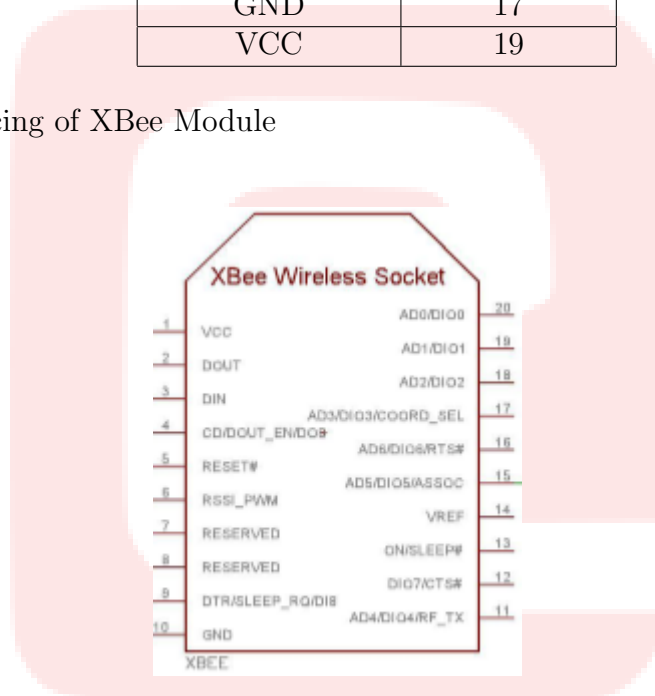


Figure 1.23: Pin Configuration of XBee Socket

Tiva Port Pins	XBee Pins
PC4	DOUT
PC5	DIN
GND	GND
VCC	VCC

1.4. INTERFACING OF HARDWARES

3. Interfacing of Sharp Sensor

Tiva Port Pins	Sensor Pins
PE0	SIGNAL
GND	GND
VCC	VCC

4. Interfacing of Motor Driver IC

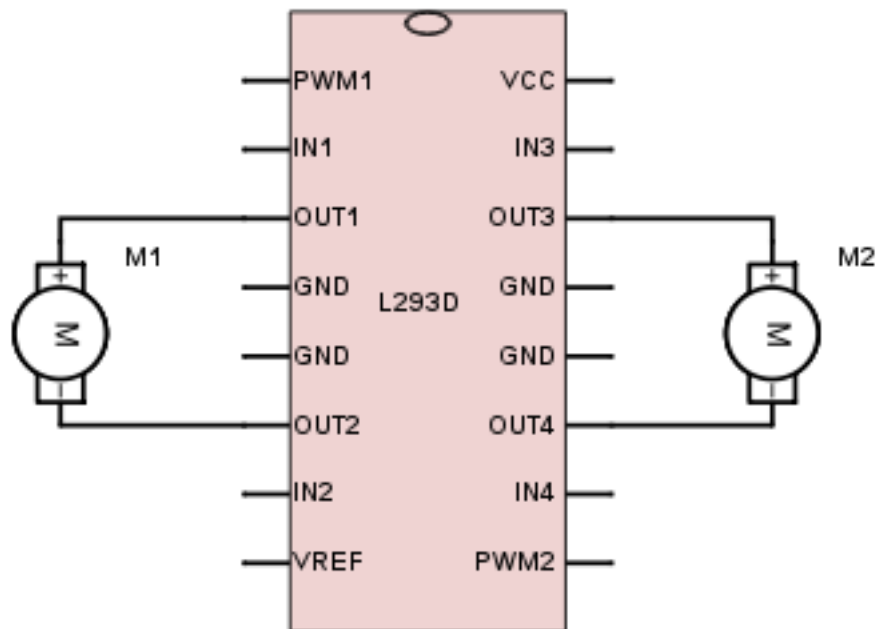


Figure 1.24: Pin Configuration of Motor Driver IC

1.4. INTERFACING OF HARDWARES

Tiva Port Pins	L293D Pins
PE4	PWM1
PA2	INPUT1
PA3	INPUT2
GND	GND
VCC	VCC
PE5	PWM2
PA6	INPUT3
PA7	INPUT4
VBUS	VREF

5. Interfacing of Buzzer

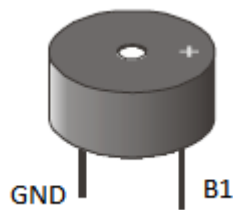


Figure 1.25: Pin Configuration of Buzzer

Tiva Port Pins	Buzzer Pins
PF0	B1
GND	GND

1.4. INTERFACING OF HARDWARES

6. Interfacing of LCD

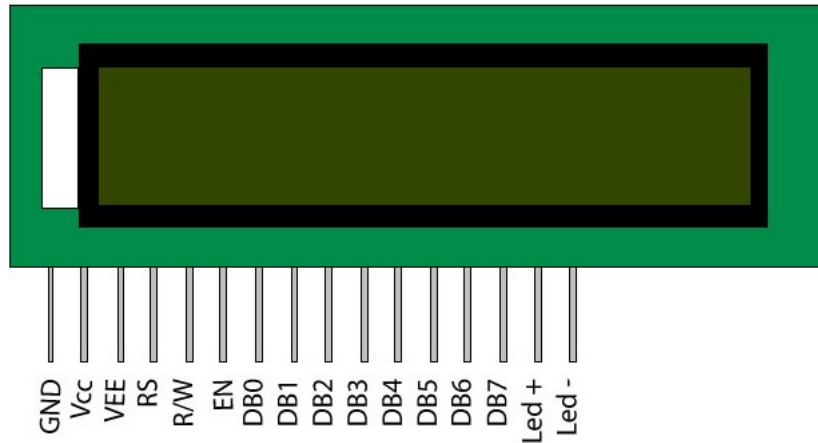


Figure 1.26: Pin Configuration of LCD Display

Tiva Port Pins	LCD Pins
GND	GND
VCC	Vcc
GND	VEE
PA4	RS
PA5	R/W
PC6	EN
PB0	DB0
PB1	DB1
PB2	DB2
PB3	DB3
PB4	DB4
PB5	DB5
PB6	DB6
PB7	DB7
VCC	Led+
GND	Led-

1.5 Block Diagram

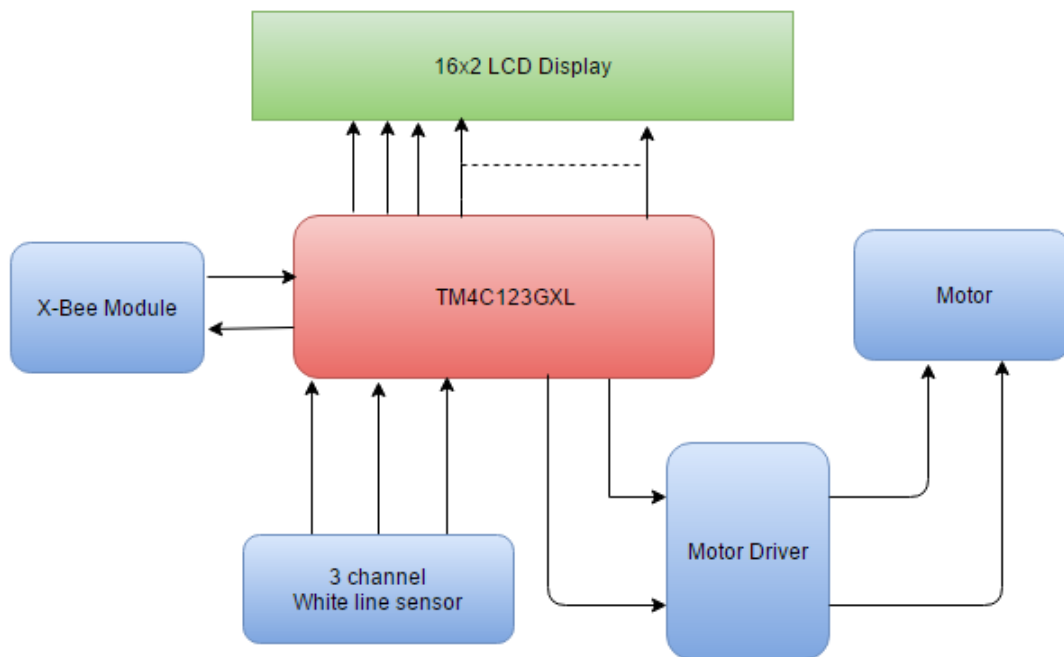


Figure 1.27: Block Diagram of Tiva Robot

Figure 1.28: Voltage Regulator Circuit Diagram

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

1.6.1 Steps for Assembling Tiva Robot

1. Gather/Buy all the components to be used for building the Robot.

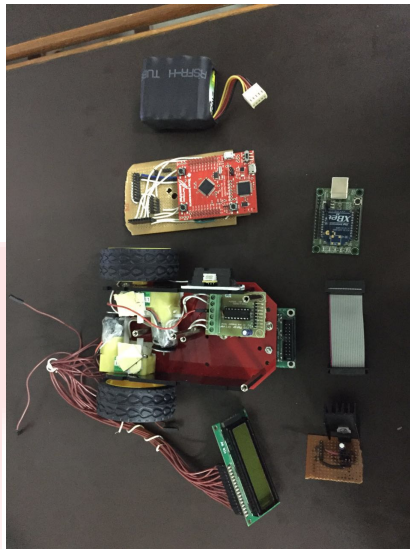


Figure 1.29: All the components used to build the Robot.

2. Assemble the chassis, two DC geared motors and two wheels. Then, connect the motors with the Motor Driver IC.

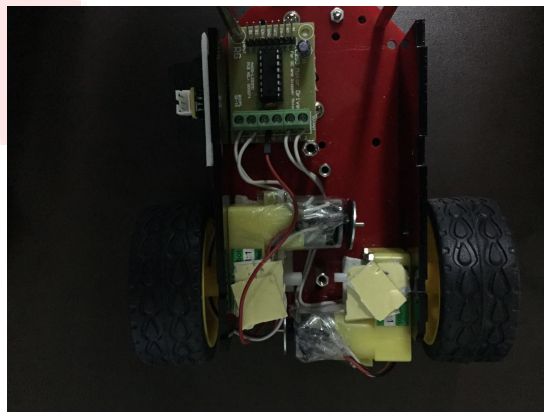


Figure 1.30: Motors and Wheels Attached to Chassis

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

3. Connect the White Line Sensors and Caster Wheel to the Chassis.

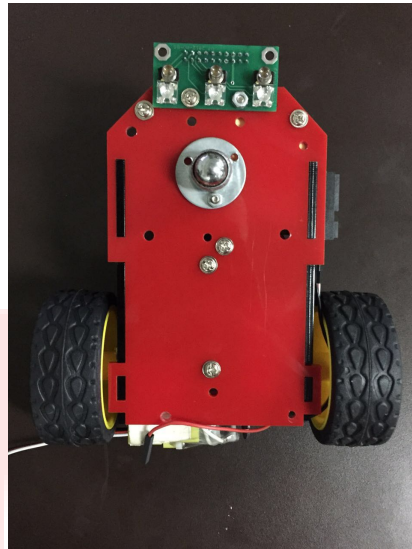


Figure 1.31: Caster Wheel and White Line Sensors Attached to Chassis

4. Attach Sharp Sensor to the Chassis.

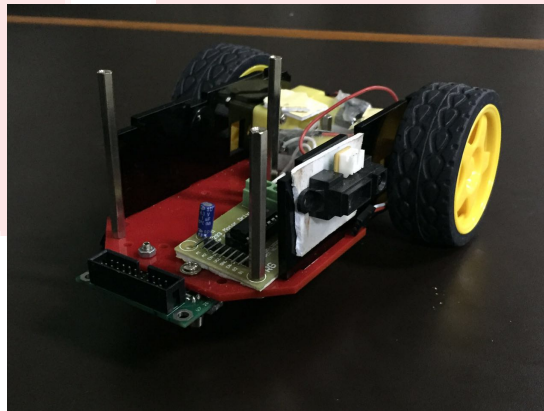


Figure 1.32: Sharp Sensor Attached to Chassis

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

5. Attach the Buzzer to the PCB board. Using the male bug strips (4x10) design a PCB board to which the Tiva board will be attached.

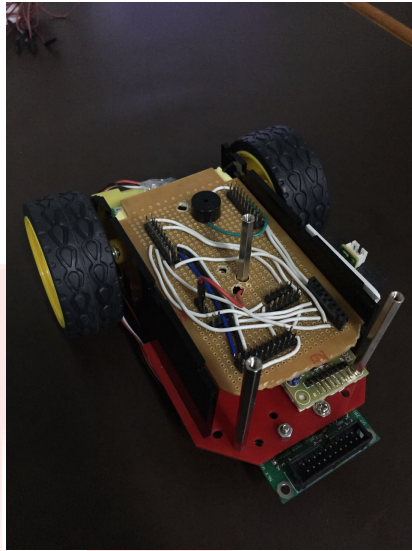


Figure 1.33: Buzzer which would be beneath the Tiva board

6. Attach Tiva board (TM4C123GXL) on the PCB board.

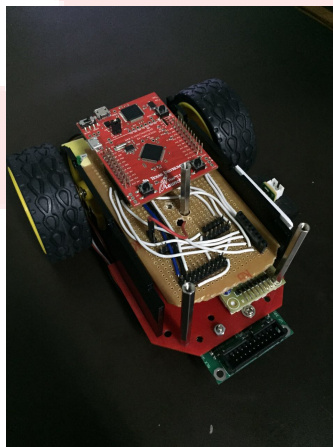


Figure 1.34: Tiva Board Fitted

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

7. Connect White Line Sensors using the 20 pin connector.

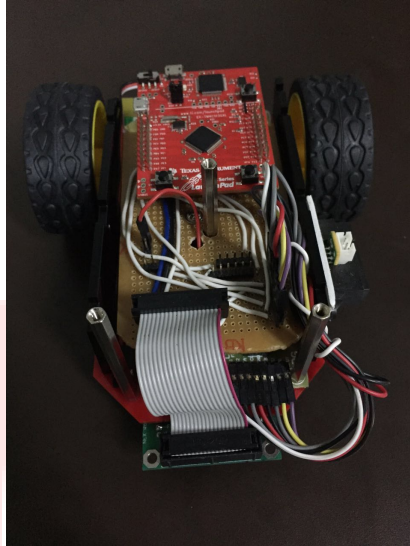


Figure 1.35: White Line Sensors are now connected to the Tiva Board.

8. Connect Sharp Sensor and Motor Driver IC to the Tiva Board.

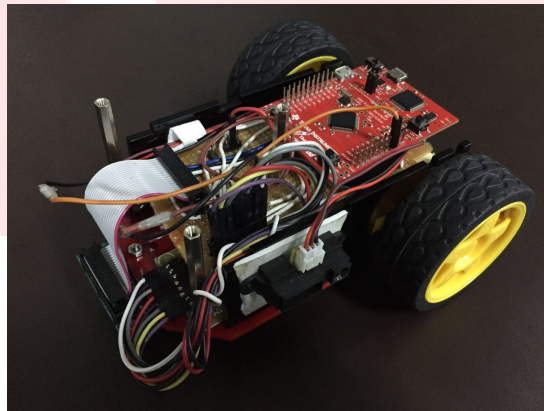


Figure 1.36: Sharp Sensor and Motor Driver IC are now connected to the Tiva Board.

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

9. Connect the LCD to the Tiva Board.

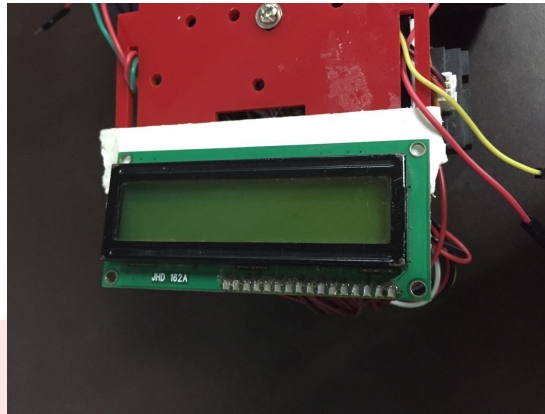


Figure 1.37: LCD after being attached to the Robot.

10. Connect the XBee to the Tiva Board.

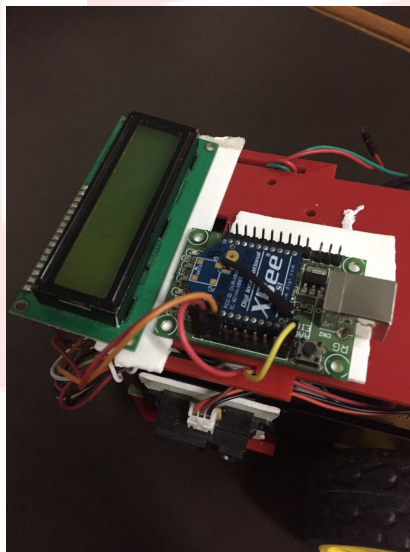


Figure 1.38: XBee after being attached to the Robot.

1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

11. Connect the Voltage Regulator Circuit and Battery to the Tiva Board.

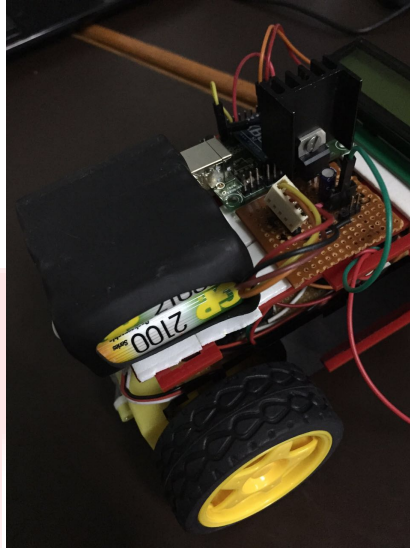


Figure 1.39: Voltage Regulator Circuit and Battery after being attached to the Robot

12. When the LCD is facing up the following photo can be seen to understand how to make the battery connections.

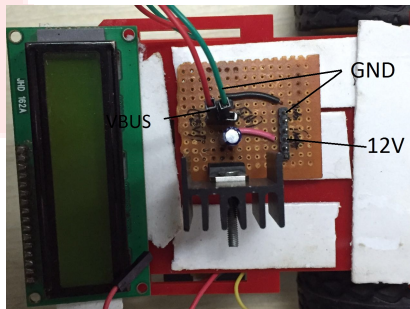


Figure 1.40: Configuration of battery



1.6. VOLTAGE REGULATOR CIRCUIT DIAGRAM

13. Now all the Components are attached to the Robot.

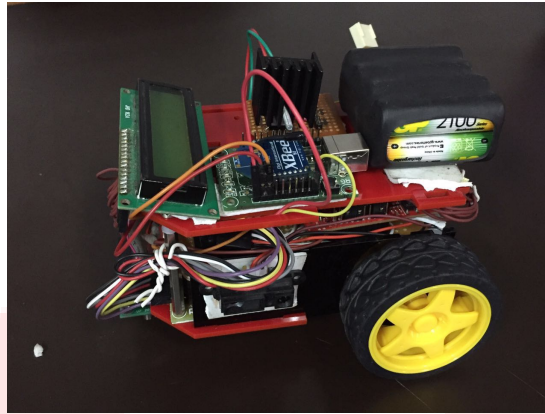


Figure 1.41: Tiva Robot.



1.7 Software and Code

- For programming Tiva board we used **Code Composer Studio v6.1.3**. It can be downloaded from the link given below. [Download link](#)
- Tutorials on creating new project in Code Composer Studio and some basic program to configure the port pins of Tiva can be found at [this link](#)
- Code for State Collection on the robot mentioned in this manual is available at the Github repository. [Github link](#)

