Assembling Hardware for Testing Bot

This file contains instructions for connecting Standard Servo, DC motors, Motor Driver to ATmega2560 Development board for testing.

Required Hardware:

1. ATmega 2560 Development Board.
2. STK 500
3. 6-10 pin isp converter
4. A to B USB cable
5. Line following sensor
6. Standard Servo with connector
7. Geared DC motors with Encoder
8. L298N Motor Driver
9. Battery (Li-Ion) 3S
10. Jumper wires
11. Wheels with hex brass connector
12. Buzzer
13. LCD

Connection Instructions:

1. **ATmega2560 Development Board**

Figure 1: ATmega2560 Development Board

Figure 1 shows the main controller board that will be used for the programming. It has Atmega2560 controller. Refer the **Datasheets** folder for detailed information related to this board.

Figure 2 shows the order of numbering pins in a port. Please note that the pins in a port are numbered according to the positions of the notch. Be careful while numbering pins in PORTA, PORTK and PORTF as you are likely to make mistakes because the position of notch on these ports are different compared to other ports.

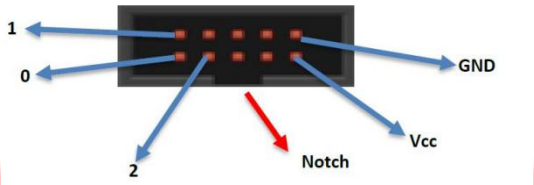

Figure 2 : Pin numbering of port

2. Standard Servo connections:

Connect Servo motor with ATmega2560 Development board according to the following Table 1:

Table 1: Standard Servo to Atmega2560 Board

Standard Servo	**ATmega2560 Development Board**
PWM (white wire)	PORT B5
Vcc (red wire)	PORT B Vcc
GND (black wire)	PORT B GND

After making the above connections, the setup will look like as shown in Figure 3.

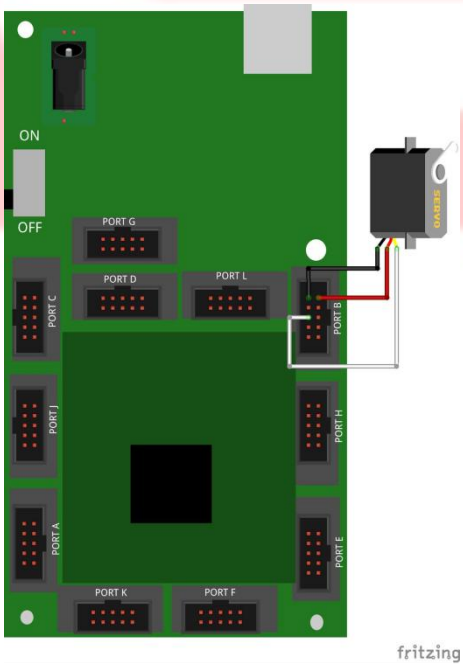

Figure 3: Connections for Standard Servo and ATmega2560 Development board

3. Motor with Quadrature Encoder

This section contains instructions to test motor with quadrature encoder.

Pin Diagram:

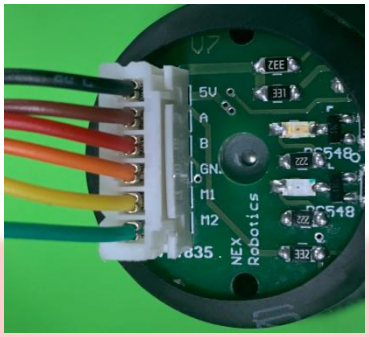

Figure 4: Pin diagram of motor

Note: Motor with quadrature encoder

Motor with quadrature encoder consists of six cables, two are for motor and four are for quadrature encoder sensor. Cable labeled "M1" and "M2" are connected to motor and other four are connected to quadrature encoder sensor as shown in Figure 4. Motor cables M1 and M2 can be connected to 10-15V power supply. But Vcc is to be connected to 5V. Be careful while connecting these pins with power supply, otherwise sensor may get damaged.

L298N Motor Driver:

This motor controller is based on the L298N heavy-duty dual H-bridge controller, which can be used to drive two DC motors at upto 2A each, with a voltage between 5 and 35V DC. The controller has fast short-circuit protection diodes, and a heat sink to keep the motor driver safe.

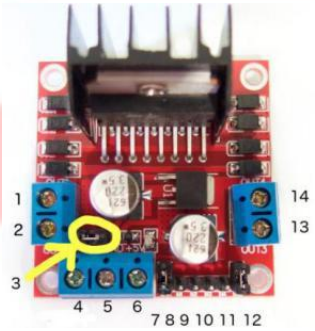

Figure 5: L298N Motor Driver

1. DC motor 1 - Out1 (DC motor wire-1)
2. DC motor 1 - Out2 (DC motor wire-2)
3. 12V jumper – This jumper has to be removed if supply voltage is more than 12V DC.
4. Motor supply voltage
5. GND
6. 5V output if 12V jumper is in place
7. DC motor 1 enable jumper. Connect to PWM output for DC motor speed control.

8. IN1 - Direction control pin for motor 1
9. IN2 - Direction control pin for motor 1
10. IN3 - Direction control pin for motor 2
11. IN4 - Direction control pin for motor 2
12. DC motor 2 enable jumper. Connect to PWM output for DC motor speed control.
13. DC motor 2 - Out1 (DC motor wire-1)
14. DC motor 2 - Out2 (DC motor wire-2)

Motor connection with L298N

Take motor with quadrature encoder board and connect M1 and M2 cables to Out 1 and Out 2 connectors of L298 module. Similarly connect M1 and M2 of second motor to Out3 and Out3 connectors of L298 module. After this the motor connection will be as shown in Figure 6.

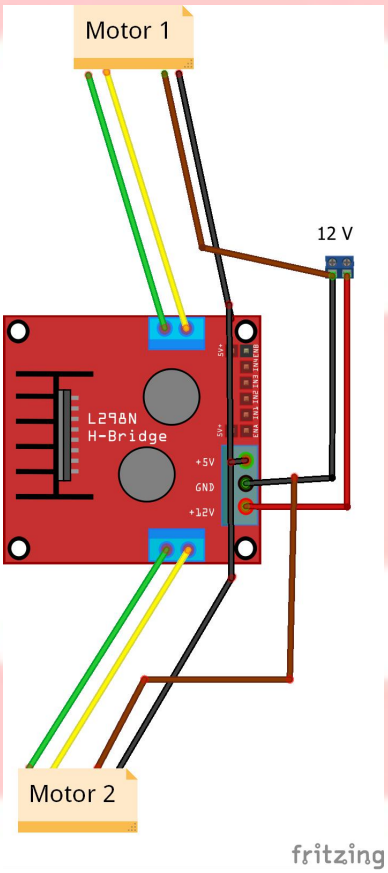

Figure 6: Motor with l298N driver

Now connect remaining connections of both motors with quadrature encoder boards to Atmega2560 development board as explained in Table 1:
(Here M1_Xx stands for first motor pins and M2_Xx stands for second motor pins.)

Table 1: Motor connection to Atmega2560 Board

Motor with Quadrature Encoder	Atmega2560 Development Board
M1_Ch-A	PORT D2
M1_Ch-B	PORT D3
M1_Vcc	L298 5V
M1_GND	L298 GND
M2_Ch-A	PORT E4
M2_Ch-B	PORT E5
M2_Vcc	L298 5V
M2_GND	L298 GND

After making the above connections, setup will look like Figure .

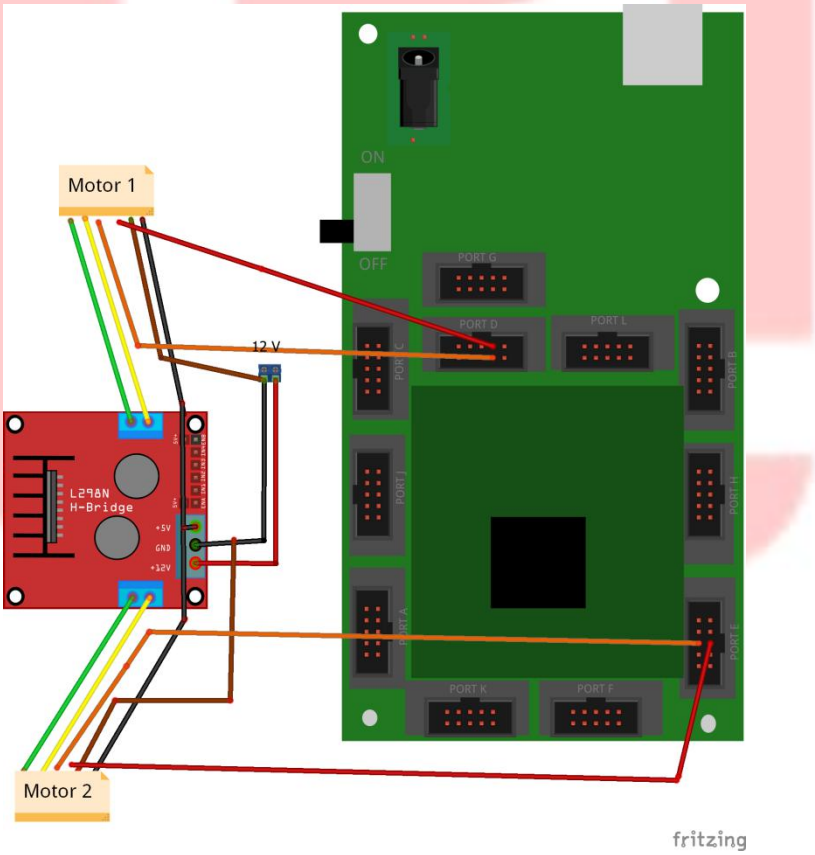

Figure 7: Connection for quadrature encoder with Atmega2560 Development Board

Connect the pins of L298 motor driver to controller as explained in Table 2:

Table 2: Connection of L298 motor driver with Atmega2560 Development Board

L298 motor driver	Atmega2560 Development Board
EN-A	PORT L3
A1	PORT A0
A2	PORT A1
B1	PORT A2
B2	PORT A3
EN-B	PORT L4

After connection your board should look like Figure 8.

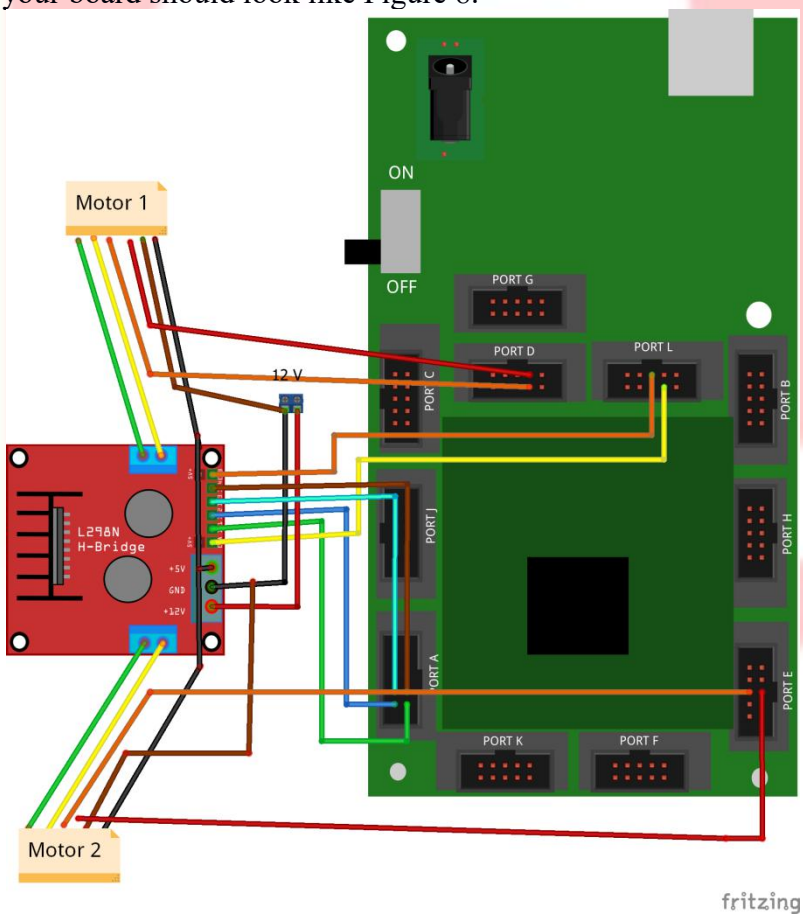

Figure 8 : L298 and ATmega Board connection

Important: Follow the link for the specification of encoder and motor.
Now power up the board by connecting Li-Po battery to L298 and Atmega2560 development board. For L298 board power is supplied by connecting battery to + and - connector. For Atmega2560 battery has to be connected through DC jack as shown in Figure 9.

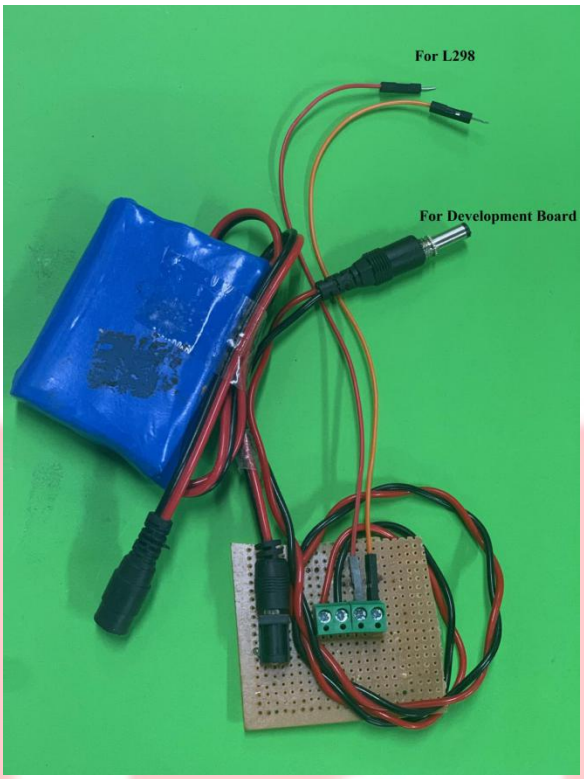

Figure 9 : Power Distribution

4. Buzzer Connection

This section explain the connection and testing of the buzzer module. Connect the buzzer module to the following pins on the ATmega2560 development board.

Table 3: Connection of Buzzer module with Atmega2560 Development Board

Buzzer Module	**ATmega2560 Development Board**
GND	GND
5V	5V
I/O	PORTB0

5. White Line sensor

This section explains about connection and testing of white line sensor. Connect the white-line sensor and the following pins on the ATmega2560 development board.

Note: Three potentiometer can be added optionally for thresholding. You can buy these pots and connect them otherwise you can short them together (1-2, 3-4 and 4-5).

Table 4: Connection of White line sensor with Atmega2560 Development Board

White-Line Sensor	ATmega2560	Potentiometer
PIN1	PORTF1	
PIN3	PORTF2	
PIN5	PORTF3	
PIN2		P1 (Middle Terminal)
PIN4		P2 (Middle Terminal)
PIN6		P3 (Middle Terminal)
PIN15,PIN16,PIN17	GND	
PIN19,PIN20	5V	

Note: The first and last terminals of each potentiometer will be connected to a 5V source and ground respectively.

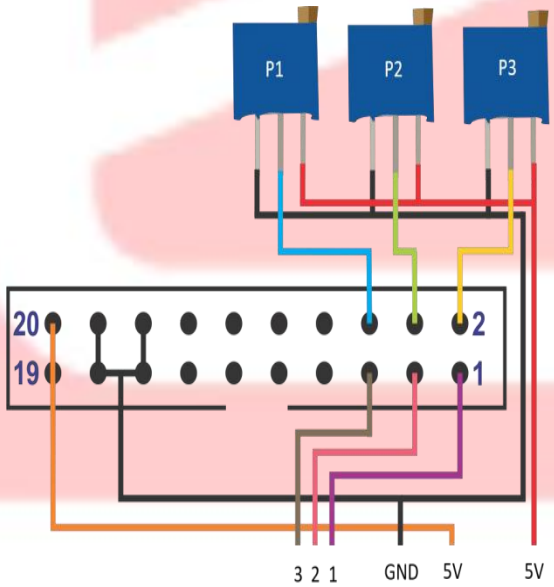

Figure 9: White-Line Sensor and Potentiometer's Connection

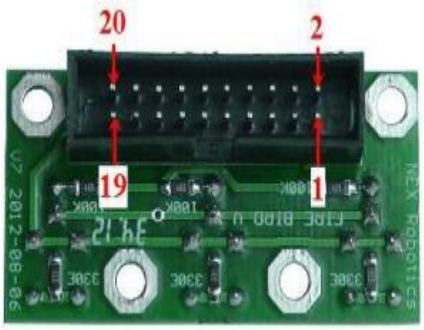

Figure 10: Pin Alignment for White-Line Sensor Module

6. LCD connections:

This section explains the connection and testing of LCD. Connect the pins of LCD to the Atmega2560 Development board as explained in Table 4.

Table 5: LCD connections to Atmega2560 Board

LCD	**Atmega2560 Development Board**
Vss	PORT C GND
Vdd	PORT C Vcc
Vee	3.3V
RS	PORT C0
R/W	PORT C1
EN	PORT C2
DB4	PORT C4
DB5	PORT C5
DB6	PORT C6
DB7	PORT C7
LED+	PORT J Vcc
LED-	PORT J GND

After making above connections, entire setup will look like Figure 11.

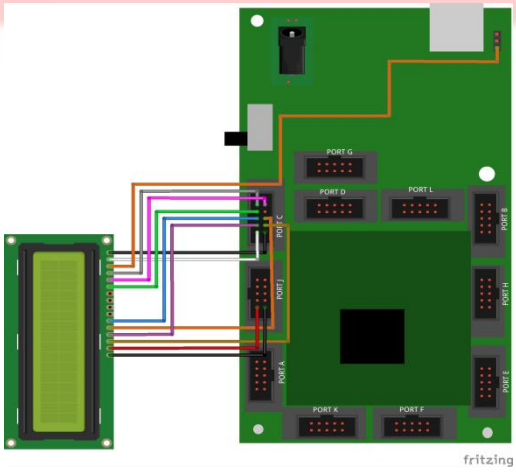

Figure 11: Connection of LCD with Atmega 2560 Development Board