Department of Computer Science & Engineering
Independent University, Bangladesh

PROJECT REPORT

CSE 204 LAB
AUTUMN 2022

Line Following Robot

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1. Abstract:

This paper explains how a Line following Robot has been designed and how the robot follows a designated path. This paper also includes the equipment analysis, some problems that have been faced during robot structuring, what was done to fix them, and what implementation was used to control the movement of the robot by proper tuning of the parameters.

2. Introduction:

Line following robot (LFR):
As the name suggests, it is an automated guided vehicle, which follow a visual line drawn on the floor. Usually, the visual line is the path in which the line follower robot goes and it will be a black line on a white surface but the other way (white line on a black surface) is also possible. [1]
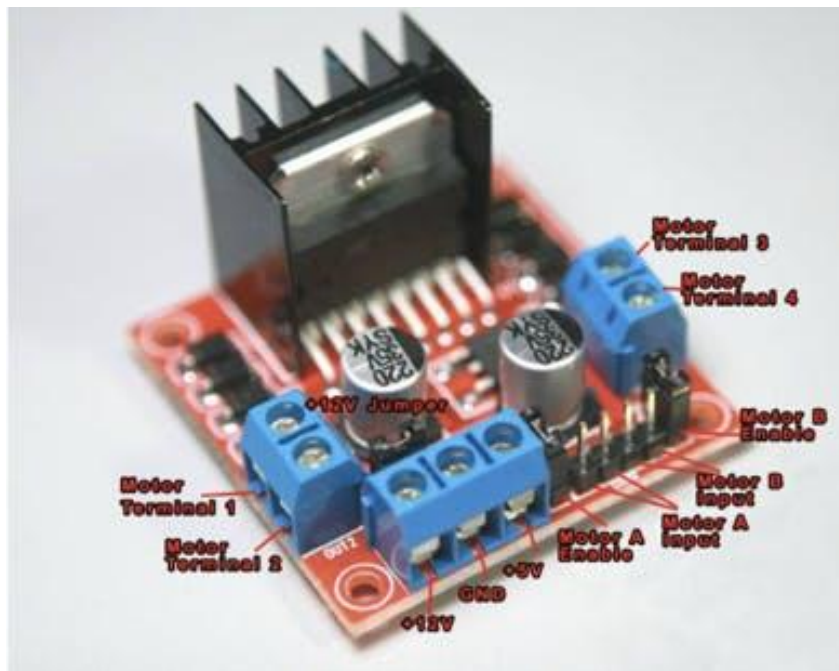
3. Problem Statement:

A. Detecting the black lines: In this project we will be using arrays of sensor for accurate detection of lines and movement. We will get this accuracy if we use arrays of sensor.


5 array IR sensor. [2]

B. Controlling the dc motors:
The H-Bridge Motor Drivers L298N drives the DC motors as they need more current than the arduino can give.
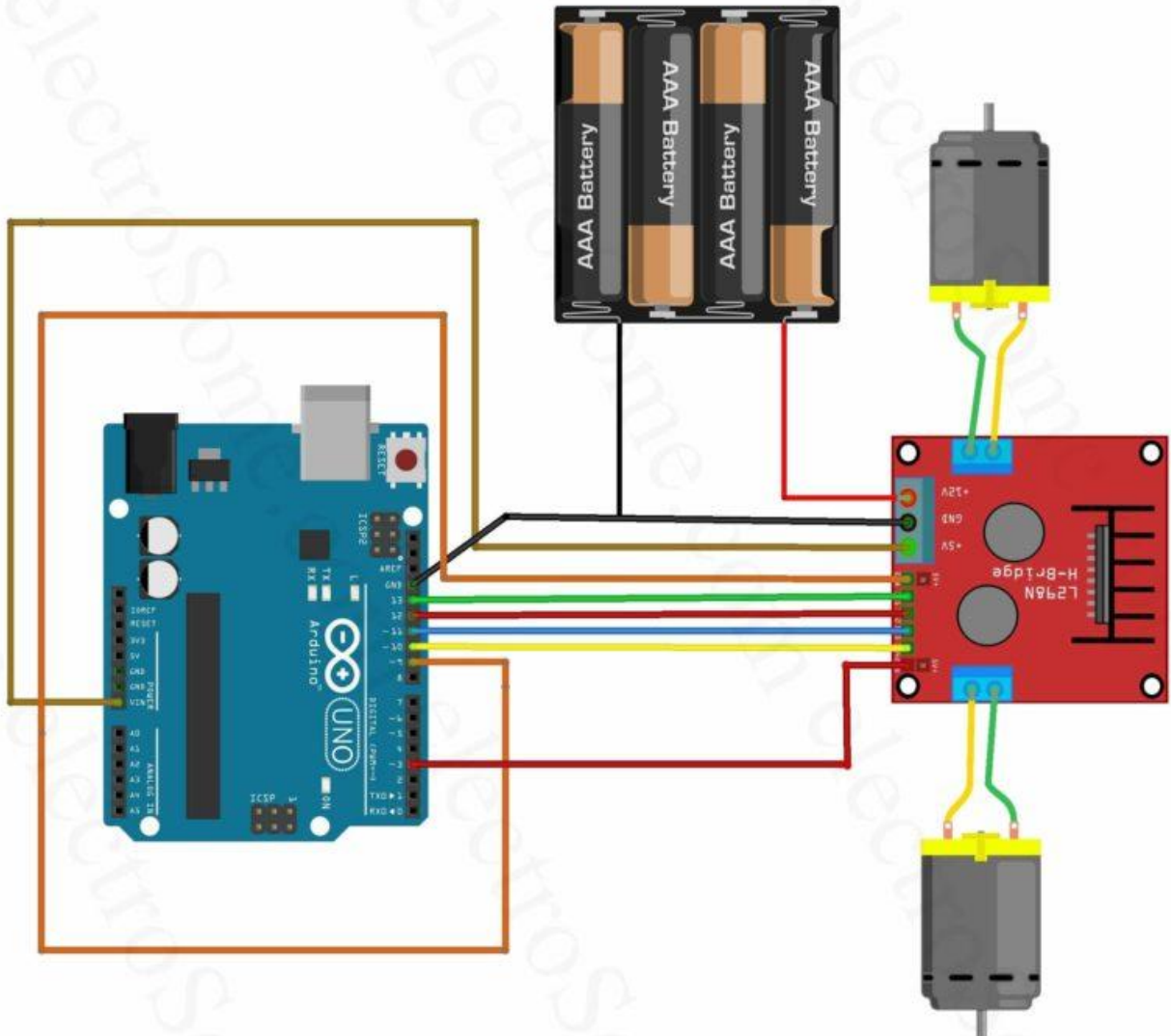
H-Bridge Motor Drivers L298N [3]

The L298N motor controller uses the H-bridge configuration, which is useful when controlling the direction of rotation of a DC motor. The other advantage of using an H-bridge is that we can provide another way of power supply to the motors. This is important when using an Arduino board where the 5V power source is not enough for two DC motors. [3] [4]

← For right turn.   ← For left turn.

H-bridge functionality. [4]
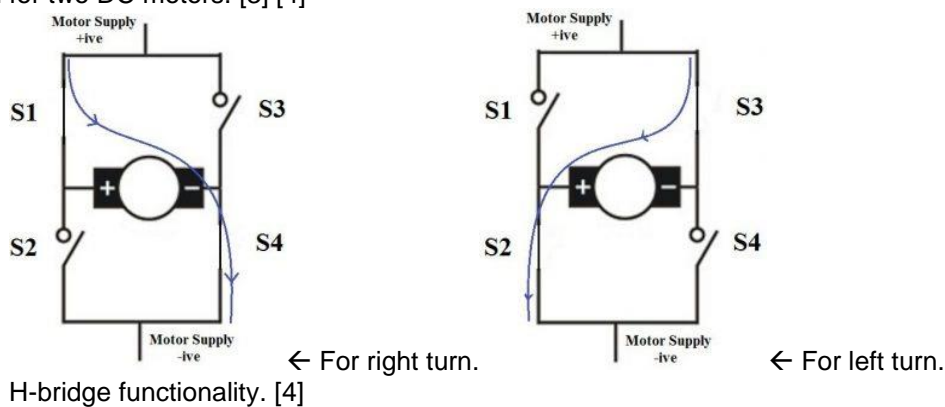
4. Topology with Circuit diagram:

← Schematic to control the motors. [4]

Circuit connections for L298N H-Bridge Motor Driver:

- Motor A wires are connected to motor terminal 1 and 2 of L298N, whereas Motor B wires are connected to motor terminal 3 and 4. IN1, IN2, IN3 and IN4 are connected to pin 2, 3, 4, 7 respectively.

- Now, Motor A and Motor B Enable should be connected to terminals on Arduino which have ~ sign, so that speed of these motors can be controlled using PWM. Here, they have been connected to pin 5 and 6.

- Other connections are clear from the schematic. [4]

After the connections of motor driver, motors and Arduino uno is established. Next task is to connect the 5 array IR sensor to the Arduino just like the schematic diagram shown below.
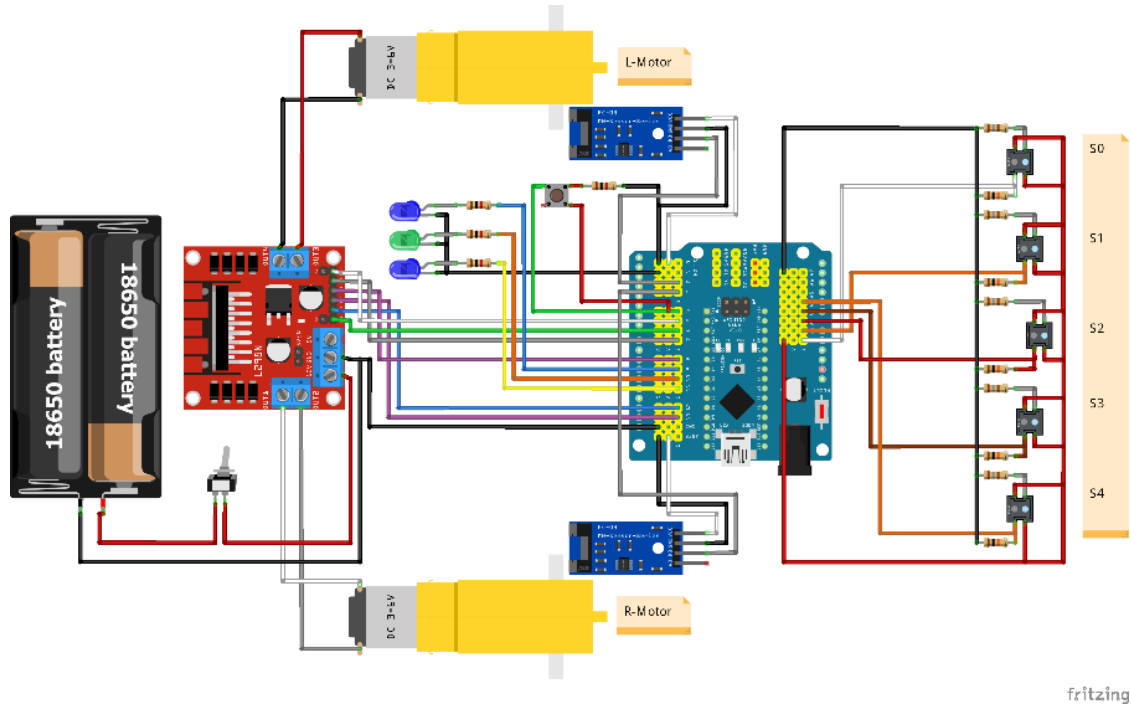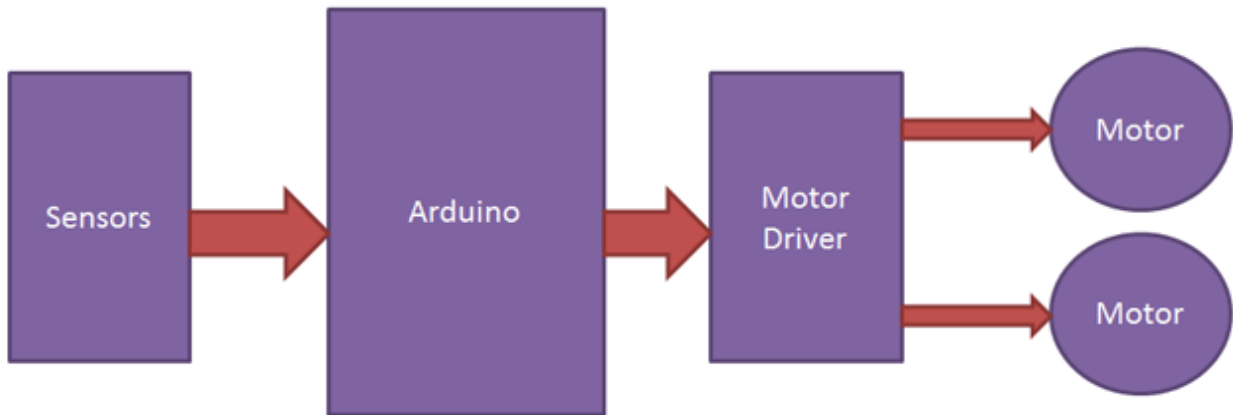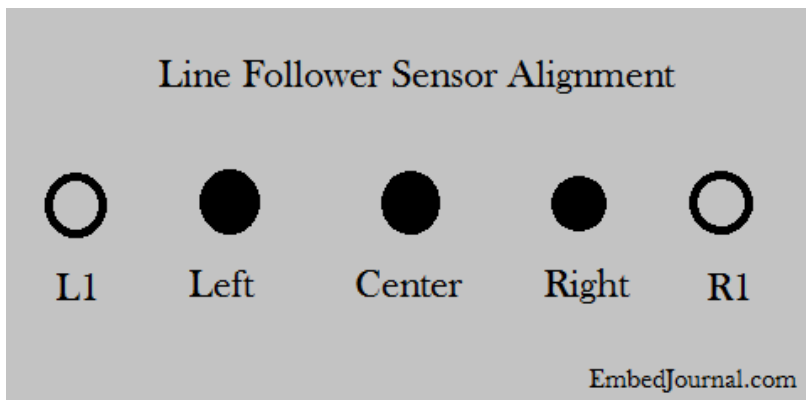

← Complete circuit schematic. [5]

5. The possible outcome of the Project (Progress with Expectation):

Flowchart of the robot receiving and executing operations.

← 5 array sensors and its applications.

We used a buck display to display the voltage of the battery which will help us to know when to charge the battery.

Buck display

Buck converter can display all kinds of good electrical appliances. With an led light, the display can be used as a relay, and this is the dc input equipment for the output of your computer to control the power supply, and the buck converter's voltage.

Li-ion charger

Fast lithium battery charger with 3 7v 4000mah 18650 li ion rechargeable batteries 4 watson np 60 lithium ion battery pack 3 7v 1000mah 2pcs gtf 26650 3 7v 8800mah rechargeable dual smart li ion battery charger ultrafire lithium ion battery charger 18650 3 7v 2200mah figure 1 discharge vole as a function of state charge battery soc is reflected in ocv lithium manganese oxide re 3 82v at 40 25 c

6. Discussion:

Robotics has a significant role in the global economy and everyday life. Another concern of robotics research is to be competitive and design patents for global industries according to their nature of applications. The demand for robotics technology is expanding in a wide range of applications and human activities, especially for manufacturing, medical, service, defense, and consumer industries. The Designed robot has five IR sensors and an Arduino UNO board. Arduino mainly controls the robot to follow the line.

18. Future Plan:

This line follower robot is the prototype of robots for industrial use. By studying this one can build line following robots for industrial use. Performance can be improved by using good materials and great sensing power also improves motor movement such as:

- Software control of the line type (dark or light) to make automatic detection possible.
- "Obstacle detecting sensors" to avoid physical obstacles and continue on the line.
- Distance sensing and position logging and transmission.
- Smarter Version of line followers are used to deliver emails within the office buildings and deliver medications in a hospital.
- This technology has been suggested for running buses and other mass transit systems and may end up as a part of autonomous cars navigating the freeway.
- Autonomous robots like line-following robots with modifications, are being used in the military to defuse bombs.

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19. Budget Information:

SL	Component	Quantity	Unit Cost (BDT)	Total (BDT)
1	Arduino UNO	1	1100	1100
2	Motor Driver L2098	1	200	200
3	Battery Holder Li-io (4 cells)	1	100	100
4	Battery (Li-on 3.7 × 4 = 13.2V) 18650	4	95	380
5	Buck converter & display	1	180	180
6	Yellow Body Kit (2 wheels)	1	550	550
7	Jumper wire male to female	1	70	70
8	5 array digital IR sensor	1	300	300
9	Li-ion Charger	1	250	250
			Total Cost (BDT)	3130

References

[1] Anusha, How To Make Arduino Line Follower Robot?, 2017.

[2] Line following array 5 sensor.

[3] S. Iqbal, Line Follower Robot, 2020.

[4] R. Chowdary, "Interfacing L298N Motor Driver with Arduino Uno," 2022.

[5] "Line Follower Robot v4," 2020.

Signature of Faculty:		Date (DD/MM/YY)	/ / 22