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# Line Follower Robot

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**ABSTRACT**: The Line follower robot is a mobile machine that can detect and follow the line drawn on the floor. Generally, the path is predefined and can be either visible like a black line on a white surface with a high contrasted color or it can be invisible like a magnetic field. Therefore, this kind of Robot should sense the line with its Infrared Ray (IR) sensors that installed under the robot. After that, the data is transmitted to the processor by specific transition buses. Hence, the processor is going to decide the proper commands and then it sends them to the driver and thus the path will be followed by the line follower robot. TABAR is a line follower robot designed and tested in order to attend at Tabrize line follower robots competition. But it encounter with some technical and mechanical problems. In this Paper, we have illustrated the process of design, implementation and testing TABAR, a small line follower robot designed for the line follower robots competition. The technical and mechanical issues and problems also have investigated.

**KEYWORDS:** Line Follower; Problems and solutiosn; Circuit; Actuator; Programing.

## I.INTRODUCTION

A Line Follower Robot is basically a robot designed to follow a line or path already pre-determined by user. This line or path may be as simple as a physical white line on the floor or as complex path marking schemes e.g. embedded lines, magnetic markers and laser guide markers. In order to detect these specific markers or line 'lines', various sensing circuit to expansive vision system. The choice of these schemes would be dep endent upon the sensing accuracy and flexibility required. From the industrial point of view, line following robot has been implemented in semi to fully autonomous plants. In this environment, these robot's functions as materials carrier to deliver products from one manufacturing point to another where rail, conveyor and gantry solutions are not possible. Apart from line following capabilities, these robots should also have the capability to navigate junctions and decide on which junction ignore. This would require the robot to have 90 degree turn and also junction counting capabilities. To add on to the complexity of the problem, sensor positioning also plays a role in optimizing the robot's performance for the tasks mentioned earlier. Line follower robots with pick – and – placement capabilities are commonly used in manufacturing plants. These move on a specified path to pick the components from specified locations and place them on desired locations. Basically, a line follower robot is a self-operating robot that desired and follows a line drawn on the floor. The path to be taken is indicated by a black line on a surface. The control system used must sense the line and man oeuvre the robot to stay on course while constantly correcting the wrong moves using feedback mechanism thus forming a simple yet effective closed loop system.

## II. LITERATURE SURVEY

In recent years a great deal of time and effort has been spent of developing system to enable an autonomous robot to follow a marked path using a vision system. Not surprisingly, the majority of this research has been towards modifying, or designing from scratch, a full-sized road vehicle so that it can drive on ordinary road without human supervision. Due to large amount of space available in an ordinary road vehicle, high performance computers can be used to perform complex image processing and typically, to maintain a mathematical model of the vehicle and the environment. Research into autonomous driving using smaller robots typically follows one of two approaches. In the first approach a mathematical model of the vehicle and its surrounding is generated, tested in simulation, and then applied to a robot built specifically for the purpose. In the second approach a combination of a visual servoing system and a kinematic model is used, again the robot is typically designed around the solution technique. Due to the size of

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these robots, the processing resources available are quite limited so simpler models and techniques, such as visual servoing are used to reduce the processing load.

## III. COMPONENT AND ITS DESCRIPTION

| Sr.no | Components | Quantity |
|---|---|---|
| 1. | Arduino Uno | 1 |
| 2. | L293D motor drive | 1 |
| 3. | IR sensor module | 2 |
| 4. | 9Volt battery | 1 |
| 5. | Battery Operated motor | 2 |
| 6. | Motor wheel | 2 |
| 7. | Castor wheel | 1 |
| 8. | Hobby robot chassis | 1 |
| 9. | Wires | As per requirement |
| 10. | Screw | As per requirement |
| 11. | Jumper Cables | As per requirement |
| 12. | Arduino Uno USB cable | 1 |

- **Components description :**

**1. Arduino Uno :**

Arduino Uno is an open-source microcontroller board based on the processor Atmega328P. There are 14 digital I/O pins, 6 analog inputs, a USB connection, a power jack, an ICSP header, and a reset button. It contains all the necessary modules needed to support the microcontroller. Just plug it into a computer with a USB cable or power it with an adapter to get started. You can experiment with your Arduino without worrying too much about is.

**2. L293D motor drive :**

The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

**3. IR sensor module :**

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

**4. Robot chassis :**

The chassis is the structural component for the robot which contains the drivetrain and allows the robot to be mobile by using wheels, tank treads, or another method. A chassis is sometimes referred to as the robot’s frame.

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## IV. BLOCK DIAGRAM AND WORKING PRINCIPLE

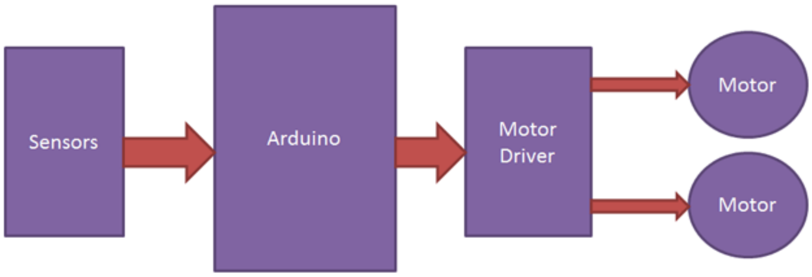


Fig : Block Diagram of Line Follower Robot

- **Working Principle:**

The Line Follower Robot uses two motors to control rear wheels and the single front wheel is free. It has 3 – Infrared sensors on the bottom for detection of black tracking tape. When the middle sensor detects the black color, this sensor output is given to the comparator LM358. The output of comparator compares this sensor output with a reference voltage and gives an output. The output of comparator will be low when it receives an input from the sensor.

We follow a simple logic to implement this project. As we know that black color is capable of absorbing the radiation and white colot or a bright color reflects the radiation back. Here we use 3 pairs of IR Tx and Rx. The robot uses these IR sensors to sense the line and the arrangement is made such that sensors face the ground. The output from the sensors is an analog signal which depends on the amount of light reflected back and this analog signal is given to the comparator to produce 0's and 1's.

Internally we have an OTP(One Time Programmable) processor which is used to control the rotation of the wheels. The rotation of these wheels depends up on the response from the comparator. Let us assume that when a sensor is on the black line it reads 0 and when it is on the bright surface it reads 1.

Here we can get three different cases, they are:

1. **Straight Direction –**

We can expect our robot to move in straight direction when the middle sensors response is low and the remaining two sensors response is high i.e., according to our arrangement the middle sensor will always be on the line and as the line is black in color it will not reflect the emitted radiation back and the response of the sensor will be low and the response of the response of the remaining two sensors will be high as they will be on the bright surface.

**2. Right Curve –**

When a right curve is found on the line the responses will change i.e. the response of the first sensor which is to the right will become low as that sensor will be facing the black line and the reaming sensors response will be high. The data is achieved the control of the wheels is changed i.e. the right wheel is held and the left wheel is made to move freely until the response from the middle sensor becomes low. Then the same process repeats again.

**3. Left Curve –**

When a left curve is found on the line the response of the most sensor will be changed from high to low as the sensor will now face the black or the dark surface. Then the control of the wheel changes i.e. by holding the left wheel and allowing the right wheel to move freely until the middle sensor changes it is response from high to low. The same process continues for all the turns and the robot moves continuously until the supply is remove.

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## V. RESULT

The objective of the line follower robot is to follow a line on its given path which is obtained for which it uses IR sensors which detects the line and sends the information to LM324 comparator and then to H bridge which controls the working of the wheel's. Microcontroller controls the other operations.

## VI. CONCLUSION AND FUTURE SCOPE

Though, the use of line follower robot is very common today. But, select optimal sensors to achieve high efficiency is still now a great challenge. This paper gives a solution on this matter. It discuss about the algorithm through which a line follower robot able to follow any 90 degree bends, T or + junctions using minimum number of sensors. It also discuss about the number of sensors a robot need to follow a simple line and calculate the minimum number of sensors a robot should have if it have to follow a path with critical sections like 90 degree turn, T-junction and + junction using this algorithm. Our robot successfully able to follow the sample path. Which proves the effectiveness of our proposed method. However, this robot had some limitations too. When we try to increase robot's speed, some problem occurs on 90 degree bend and junctions. It was because of the momentum of the robot it got through higher speed. We, solved this problem by reducing robot's speed at bends and junctions. In future we can extend our work on this point to ensure efficiency at higher speed.

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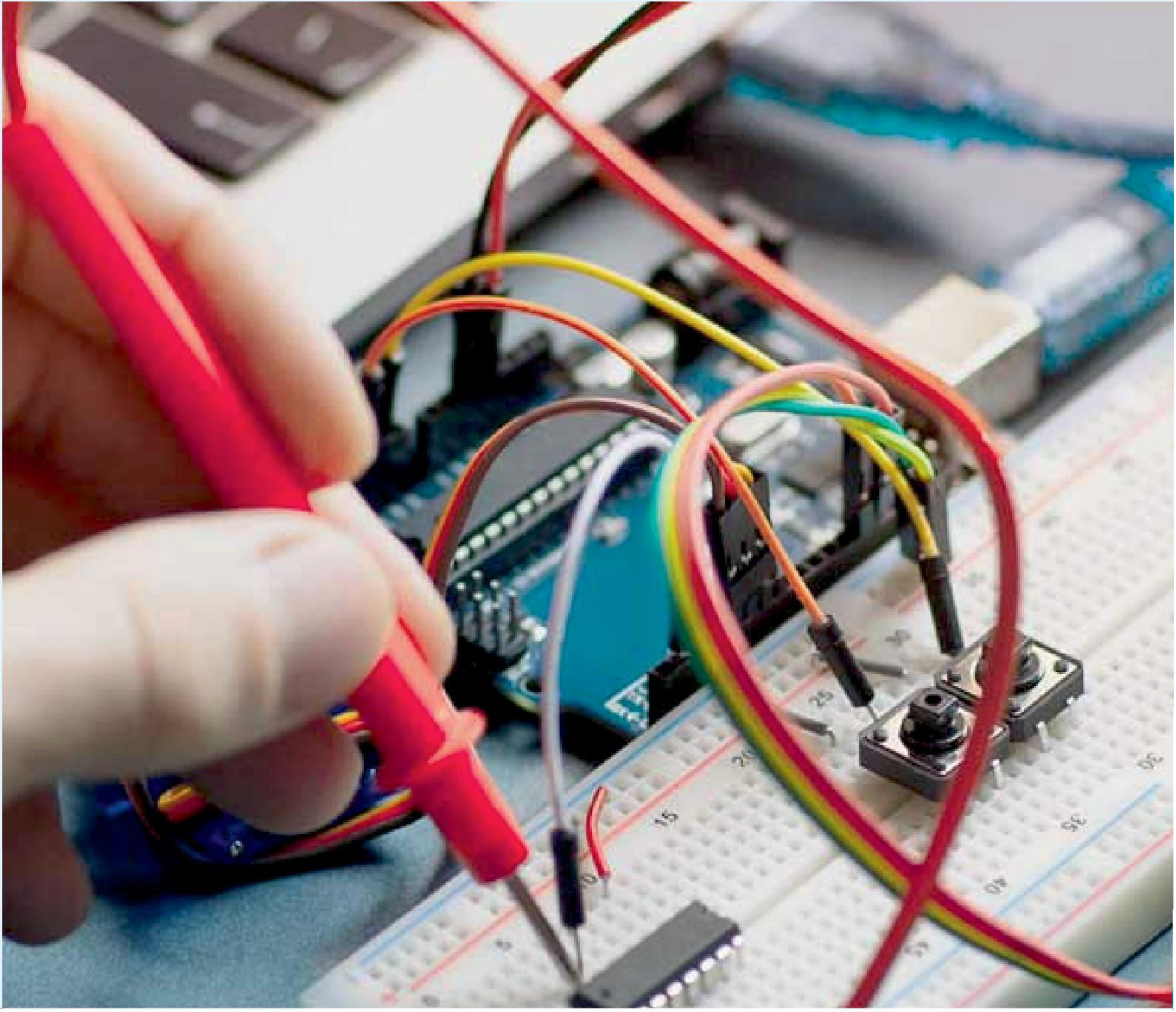


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