Implementation of Line Follower Robot

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ABSTRACT

Line tracking is a critical component of robotics. An autonomous robot known as a "Line Follower Robot" can follow a line painted in either black or white on a surface with a contrasting color. It is designed to move automatically and adhere to the created story line. Invisible like a magnetic field, the route can also be seen as a black line on a white surface. It will go in the direction that the user specifies while avoiding any obstacles that may be in its way. Robots that are autonomous and intelligent can do intended task in uncontrolled conditions without constant human supervision. The expertise of mechanical engineering, electrical engineering, and computer science has been merged into this concept. The design and construction of a line-following robot using LDR sensors that always moves in the direction of the black mark on the white surface. The robot employs a variety of detectors to recognize the line, helping it to maintain its position on the track. DC motors are used to power the robot and steer the wheels.

Keyword: *Motor Driver, Line Follower, DC Motor, IR Sensors, Robot*

1. INTRODUCTION

1.1. What is a Line Follower Robot?

The line tracking robot was designed to be capable of following a black line painted on the floor without veering too far from it. Two sensors are mounted below the robot's front part of the body, and two DC motors propel its wheels forward. Two detectors' input signals are used by an internal circuit to control how quickly the wheel rotate. The motor is programmed such that it slows it down or even quits when a system detects a black line. Then, because to the difference in speed of rotation, turns are feasible. For example, if the detectors can detect a black line on the right, the wheel there will turn.

1.2. How to detect a Black Line?

Reflect Objects detectors, Model OPB710F, that are currently prepared at the Technological Lab, are the detectors utilized for this robot. A NPN Darlington phototransistor and an infrared emitting diode make up a single sensor. Depending on the amount of infrared light, outputs current is produced when a light emitted from of the diode reflects off an object and back into the phototransistor, triggering the base current of the phototransistor. In my situation, a black line reflects significantly fewer light than a white backdrop, therefore we can possibly identify the black line by determining the current. (The voltage from this energy is transformed.)

1.3. How to Control a DC Motors?

We repeatedly turn on and off DC motors with just a set voltage applied to the motors rather than supplying a continuous voltage from across motors. This is accomplished by turning on and off the mosfet by using trains of Pulse-width modulation pulses. The motors then experience average voltage, which is dependent on the Pulse-width modulation pulses' duty cycle. The average voltage has a direct relationship to rotational speed. It is simpler to operate DC motors with Pulse-width modulation than it is to change the voltage across them. A mosfet also uses very little power while switching.

2. BASIC FUNCTION

A line follower's fundamental tasks are as follows:

1) sensor arrays positioned on the robot's frontal end can be used to detect lines. An optical coupler, a set of infrared Light Emitting Diodes and phototransistors, has been utilized for this. Great clarity and high robustness are necessary for the lines detecting procedure.
2) Steer able robot needs a steering system for following. To accomplish this duty, 2 wheel motion-controlling motors are needed.

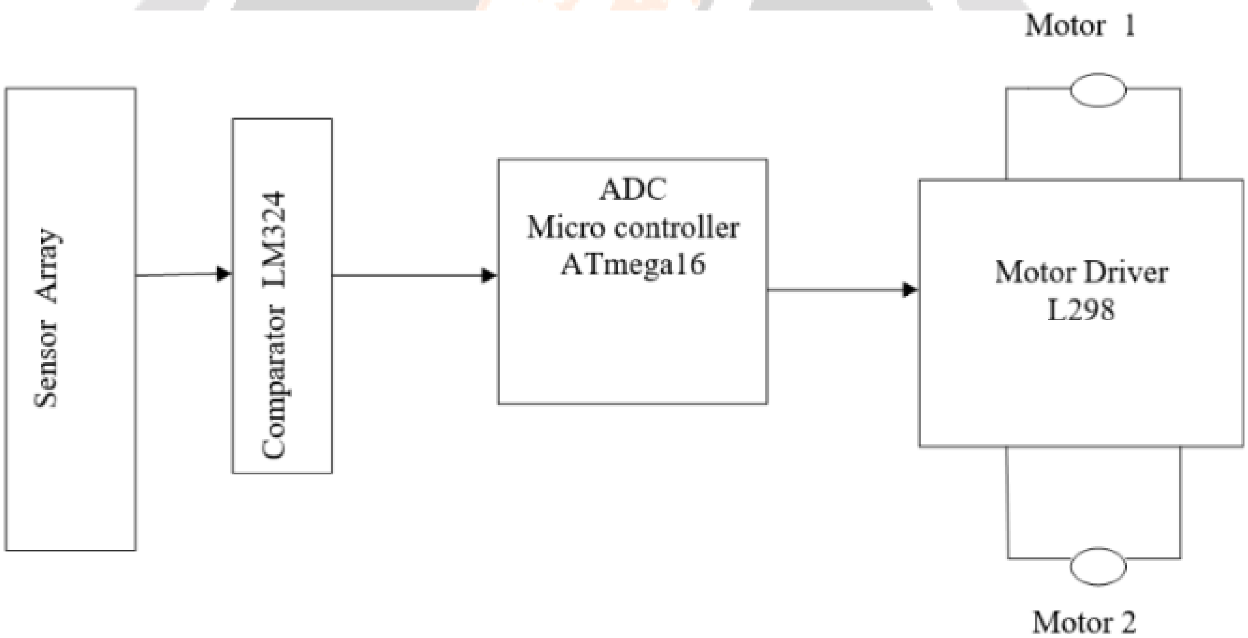


Fig.1. Basic Line Follower Robot Building Diagram

3. INPUT SYSTEM

One emitter and one receiver are used in infrared reflecting sensors. In the same way that a dark surface absorbs light so that the receiver cannot detect it, a white surface reflects light, allowing the receiver to sense it.When infrared light shines on a photo diode, that device's electrical resistance decreases. Utilizing a voltage divider circuit allows us to detect changes in resistance (as shown in fig.2).

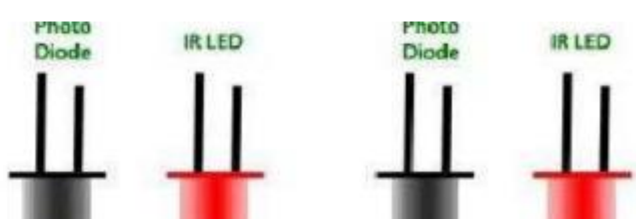


Fig.2. IR Reflective Sensor (Black surfaces absorb light, while white surfaces reflect it).

3.1. Infrared Sensor

A white or IR light source from a specific object or line is detected by an IR sensor, This then converts the reflected power into electrical power. An emitter and a detector make up a pair of infrared sensors. The sensor might be gray, black, or white, whereas the emitter is blue.

3.1.1. Infrared Emitter

An IR emitter is a arsenide-based light emitting diode (LED). It emits the very same energy that it senses, which has a wavelength of 880 nanometer. The quantity of light striking the IR phototransistors determines the base voltage, which functions as a transistor. As a result, it serves as a source of fluctuating electricity. More infrared light results in higher currents flowing through the collector emitter leads. A voltage drop in the PU resistor is brought on by the fluctuating current flowing through the resistors. The output of the instrument is evaluated as voltage.

3.1.2. Infrared Detector

A photo detector is an IR sensor. It produces power from the infrared energy emitted by the emitter. The basic process that governs the transformation of the energy of light into electric energy is the photoelectric effect. The resultant signal is derived from the negative side of the infrared sensor. A microcontroller's analog to digital conversion or an LM335 comparator can be utilized to input the output.

4. OUTPUT SYSTEM

4.1. Motor Driver

The motor driver serves as both a switch and an instrument for boosting current. As a result, a motor driver is inserted between the electric motor and the chip that controls it. Motor controller use the microcontroller's input commands to create the outputs that are required for the motor.

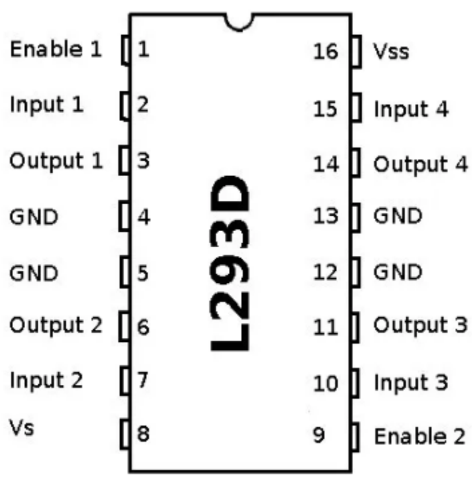
IC L293D

It is an electronic circuit that can drive both motors simultaneously. The voltage at which we want to run the motor is known as supply voltage (Vss). According to the motor's capacity, 6V for dc motors and 6 to 12V for gear motors are typically employed. Which amount of the input voltage should be regarded as high or low is determined by the logical voltage level. As a result, if we set the logical voltage level to be 5V, then the input voltage range will be from -0.3V to 1.5V for low voltage and from 2.3V to 5V for high voltage. The L293D has two channel. One motor is controlled by one channel.

Pin1 to 8 on channel 1

Pin9 to 16 on channel 2

An enable pin is used to activate a channel. Chip Inhibit Pin is another name for Enable Pin. All of the L293D IC's inputs (Pins No. two, seven, ten, and fifteen) are outputs from microcontrollers (ATmeg32). For instance, in our robots, we connected pins two, seven, ten, and fifteen of the L293D IC to pins fourteen, fifteen, and seventeen of the ATmega32 microcontroller, accordingly, so we can create Pulse-width modulation on pins fifteen and sixteen of the ATmega32 microcontroller. The input of the Right and Left motors receives each of the L293D IC's output (Pin No. three, six, eleven, and fourteen).



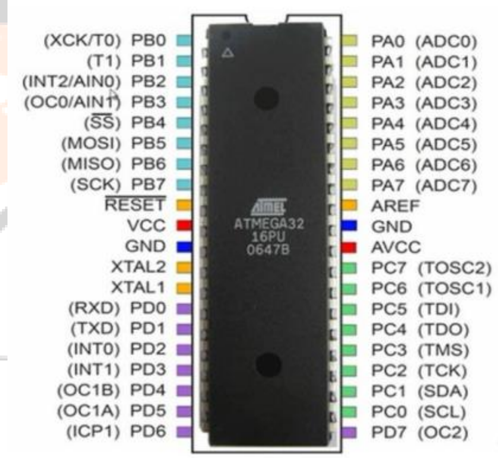


Fig. 3(a): Pin Diagram **L293D** **Fig. 3(b):** Pin Diagram ATMega32

5. WORKING

There are 3 scenarios in which line follower robots can be used.

1) In a straight line
2) Right direction
3) Left direction

5.1. In a straight line

When the center detector answer is lower and the 2 remaining detector responses are strong, we may anticipate our robot moving in a straight path. For example, in accordance with our arrangement, the center detector will always be located on the path, and since the path is black in color, it won't throwback the divergence black, consequencing in a low response from the detector, while the remaining 2 sensors will have a high response because they will be on a colorful ground.

5.2. Right direction

The response will alter if a right curvature is discovered on the path; for example, the responses of the 1st detector, which is to the right, will become lower since it will be face the black path, while the responses of the reaming sensors would be higher. Once this information is obtained, the management of the wheels is modified, allowing the left wheel to travel freely up to until mid sensors' reaction time drops. The technique is then repeated one more.

5.3. Left direction

The left-most detectors' reaction will shift from high to low when a left curve is located on the path since they will now be facing the dark or black area. The wheel's command then shifts. i.e., by retaining the left swivel while letting the right swivel to free rotate until the center detectors' responses switches from high to lower. The very same procedure is followed for every cycle, and as long as the serving is not moved, the robot continues to move it.

6. ADVANTAGES & DISADVANTAGES

6.1. Advantages

1. Robots move automatically.
2. Fit-and-forget approach.
3. applied across a great distance.
4. applications for defense.
5. It may be utilized at home for cleaning floors, etc.

6.2. Disadvantage

1. On a white surface, line follower robot adheres to a black line that is one or two inches wide.
2. sluggish motion and instability on various line thicknesses or acute angles.

7. CONCLUSION

The robot that follows lines successfully tracks the black line. There are several black lines in various directions above the white surface, yet the robot is still capable of sensing the lines and following the tracks. The robot can also carry a burden, maybe 500g.

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