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SIMPLE TWO SENSOR BASED LINE FOLLOWER ROBOT WITHOUT MICROCONTROLLER

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Introduction

In this tutorial, we'll make a simple line follower which follows a black line on a white or vice-versa using simple basic components.

Things required

1. Sensor pairs (either LED-LDR or IR LED-Photodiode) (2)
2. 10k Ohm Potentiometers (2)
3. 7805 voltage regulator.
4. LM339 comparatorIC (1)
5. L293D motor driver IC (1)
6. 74LS04 Not Gate (1)
9. Breadboard (1)
10. A differential drive chasis

Sensor Circuit

We'll be basically dealing with two circuits here.

i) Sensor Circuit

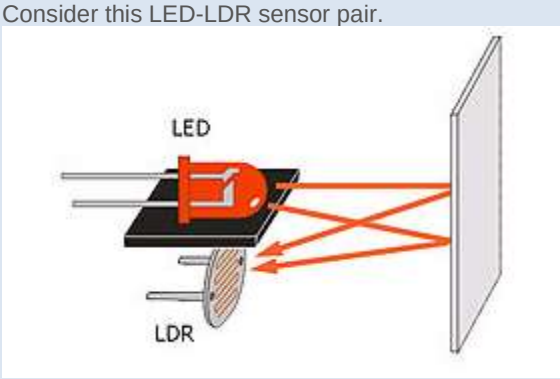
ii) Comparator-bjt circuit

Sensor Circuit

The sensor circuit will basically tell you whether your robot is on the line or out of line. The sensors suitable for this purpose are LED-LDR sensor, or IR LED-Photodiode sensor pair.

Now, let us see how it'll help to differentiate the line from the surface. We know the fact that a white surface will anytime reflect more rays than a black surface. This is the basic principle that we use to judge whether the sensor pair is on white line or black line.

Consider this LED-LDR sensor pair.



Now, when this sensor pair is on a white line,

=> more led light reflected by the surface

=> more light falls on LDR

=> lesser LDR resistance

=> the voltage across LDR will be less

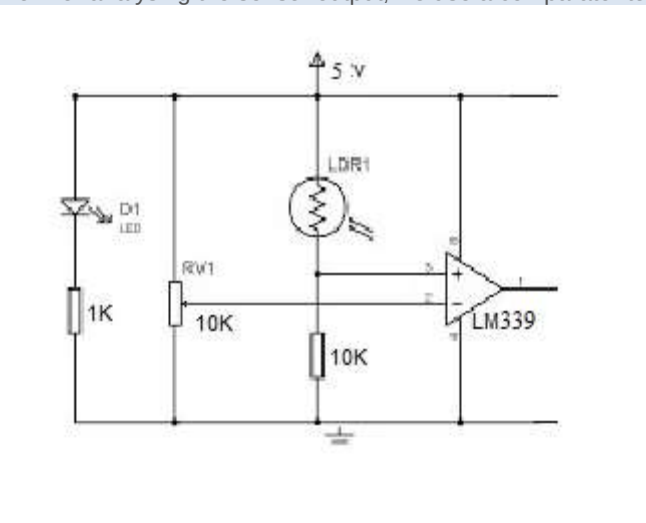
Similarly, when the sensor pair is on a black line,

=> the voltage across LDR will be high.

The 10k component is your potentiometer which you might have to set to the maximum range. This resistance, ideally should be near (R(light) * R(dark))^½ where, R(light) is the approximate resistance of LDR during light and R(dark) is the resistance of the same in dark.

Comparator Circuit

Now for analysing the sensor output, we use a comparator to get a digital output.



Now, the LED-LDR is connected to a comparator LM339. LM339 is an operational amplifier IC which is being used as a comparator. The non inverting terminal of op-amp (The + terminal) reads the voltage across resistor R. And, the inverting terminal of op-amp (The – terminal) reads the voltage that has been set at the potentiometer.

When on white line, V(ldr) less => V® more.

When on black line, V(ldr) more => V® less.

The voltage of at potentiometer (- terminal), V(pot) is such that :

V®white > V(pot) > V(R4)black

Such a voltage is set be setting up the corresponding potentiometer resistance.

Hence, now

When sensor on white line :

V®white > V(pot)

=> V+ > V-

=> Op-amp output = High

When sensor on black line :

V(pot) > V®black

=> V- > V+

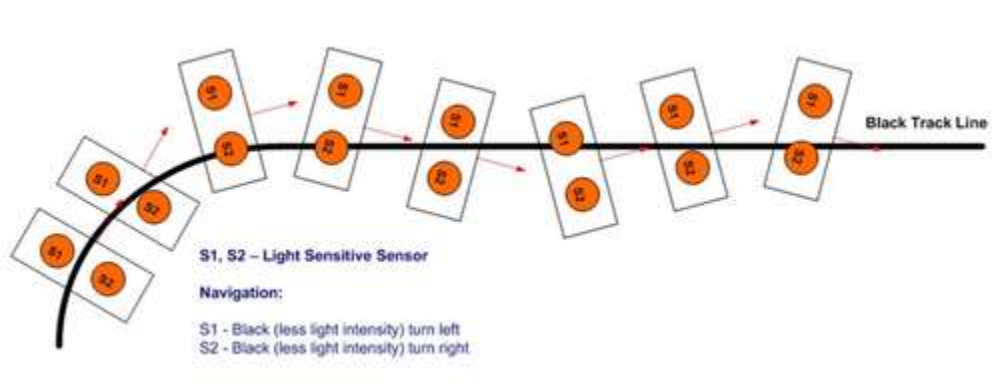
=> Op-amp output = Low

This is how we know whether the sensor is on black or white line.

Algorithm

Now, how do we implement this on our line follower?

In this tutorial, we'll be making a 2 sensor line follower which will be working as –



For the turns, we have two motors running in opposite directions.

Final Circuit