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Line Follower Robot Using LabVIEW

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***Abstract*— Path-following is an important task in the applications of autonomous robots. This paper presents a new method for the control of line-following of mobile robots. This line follower robot is basically designed to follow a black line which absorbs the IR radiation. The hardware can be divided into three parts. The sensor, arduino-board and the driver circuit for motor. Here we used the LabVIEW as the platform..**

***Index Terms*— Robot, LabVIEW, Arduino, sensor, motor driver circuit.**

I. INTRODUCTION

This robot is basically designed to follow a black line predetermined by the user. This line or path may be as simple as a physical black line on the floor put by the user or as complex as path marking schemes e.g. embedded lines, magnetic markers and laser guide markers. In order to detect these specific black lines, various sensing schemes can be used. These schemes may vary from simple low cost line sensor to expansive vision sensors. The choice of these schemes would be dependent upon the sensing accuracy and flexibility required. Line following robot has been implemented in semi to fully autonomous plants also. Here the robots functions as materials carrier to deliver products from one manufacturing point to another where rail, conveyor cannot reach. In manufacturing plants the improved version of this robot with pick and place capability are used. These move on a specified path to pick the components from specified place and put them on predetermined locations. Basically, a line-following robot is a automatic and self-operating robot that detects and follows a line drawn on the floor. The path to be taken is indicated by a black line on a white surface where the IR sensor can sense the floor. The control system used must sense the line and make 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. SENSOR DESIGN

To detect infra-red energy radiated by the heat trail a pyro-electric sensor based lithium tantalite's formed into a thin plate capacitor and has a temperature dependent spontaneous polarization perpendicular to the electrode surface, infra-red radiation rises the temperature of the lithium tantalite's, which in turn changes its polarization and this can be measured as a voltage across the capacitor electrodes, proportional to the incident radiation. Due to current leakage paths through the sensor and associated amplifier, the capacitor voltage decays away with time. Because of this the sensor only gives an output for changes in the incident infra-red

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radiation.

To provide a differential signal for guiding a mobile robot two sensor outputs are taken at points 5 cm. apart. A single pyroelectric sensor is mounted at the end of a servo controlled arm and this system is put inside an aluminium enclosure. The servo positions the pyroelectric sensor over one of two apertures in the enclosure or at a central location where it is screened from external radiation. Because only one sensor is used for both measurements there are no problems of matching the characteristics of two individual devices. However, this arrangement means that there is a time difference between readings at the two sensor sites. The above figure shows a diagram illustrating the major compcinents of the sensor. The output of the pyroelectric sensor is amplified and converted to digital form by an 8- bit analogue to digital convener.

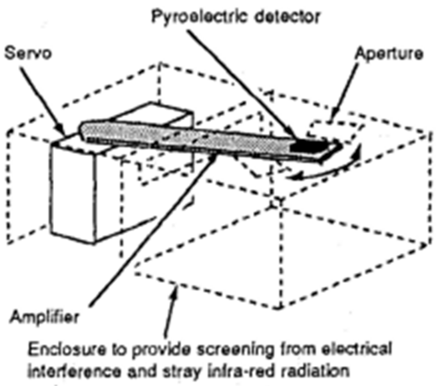

Figure 1. A diagram of the underside of the thermal sensor

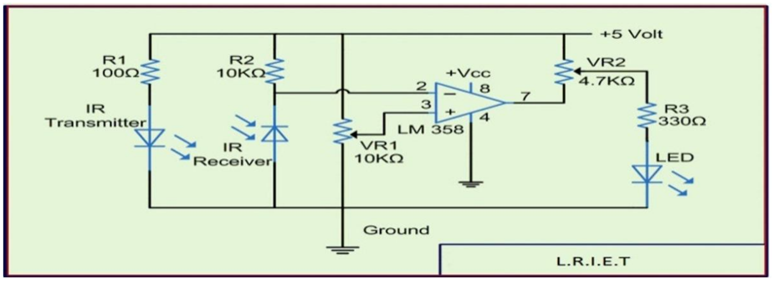

Figure 2. Circuit Diagram of IR Sensor

A Motorola 68HCll microcontroller coordinates the functions of the sensor by controlling the position of the servo and digitizing the resulting heat reading. Sensor outputs are requested by sending an Is' to the sensor over an asynchronous serial communications link at 9600 Baud and thermal readings are returned over the same link as two consecutive bytes. One sensor scan is completed in 1.2 seconds. The first version of the thermal sensor had the servo mounted in the same enclosure as the pyro-electric sensor. Heat generated by the servo caused substantial drift in the sensor characteristics. This effect has been minimized by mounting the servo outside the enclosure and running the sensor for some time before performing uacking experiments to allow its tempera- to stabilize.

III. AURDINO UNO

Arduino Uno is a microcontroller board with the IC ATmega328P. It has 14 digital input/output pins, a power jack, a 16 MHz quartz crystal, 6 analog inputs, a USB connection, an ICSP header and a reset button. Here Unorepresents the very first version of arduino,. It contains everything needed to support the microcontroller; we can simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong.

Figure 3. Arduino UNO

IV. DC MOTOR

A DC motor is a class of electrical machines that converts direct current power into mechanical power. The most common types of these rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow either clockwise or anticlockwise in part of the motor. Most types produce rotary motion.

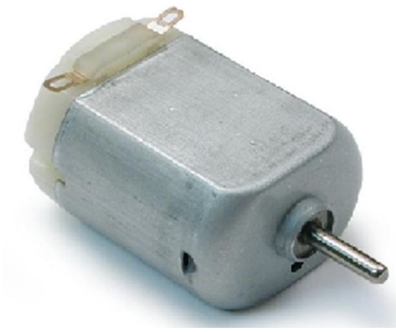

Figure 4. DC Motor

When the current flow through the wire it generates an electromagnetic field aligned with the center of the coil. The magnitude and direction of the magnetic field produced by the coil can be changed with the magnitude and direction of the current flowing through it.

The DC motor consists of stationary set of magnets in stator and armature with insulated wire winded with one or more windings wrapped around the iron core which concentrates the magnetic field. . The windings usually have multiple turns around the core, and in large motors there can be several parallel current paths.

The ends of the wire winding are connected to a commutator. The commutator allows each armature coil to be energized in turn and connects the rotating coils with the external power supply through brushes.

The total amount of current sent to the coil, the coil's size and what it's wrapped around dictate the strength of the electromagnetic field created. The sequence of turning a particular coil on or off dictates what direction the effective electromagnetic fields are pointed.

By turning on and off coils in sequence a rotating magnetic field can be created. When the magnetic field rotates it interacts with the magnetic fields of the magnets (permanent or electromagnets) in the stationary part of the motor (stator) to create a force on the armature which results in it to rotate. In some DC motor designs the stator fields use electromagnets to create their magnetic fields which allow greater control over the motor.

V. DC MOTOR DRIVER L293D

The DC motor driver L293D is a typical Motor Driver IC which allows DC motor to drive on either clockwise or anticlockwise direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in either direction. That means you can control two DC motor with a single L293D IC.

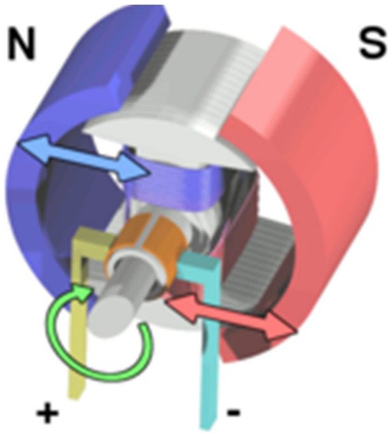

Figure 5. DC Motor Working

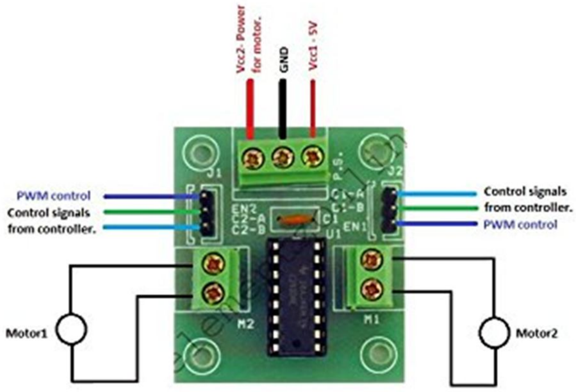

Figure 6. Driver circuit L239D

It works on the H-bridge concept. H-bridge is a circuit that allows the voltage to be flown in either direction. As we all know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction.

Hence H-bridge IC is the best option for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC that can rotate two dc motor independently. As it very small in size it is very much used in robotic application for controlling and driving DC motors. The pin diagram of a L293D motor controller is given below.

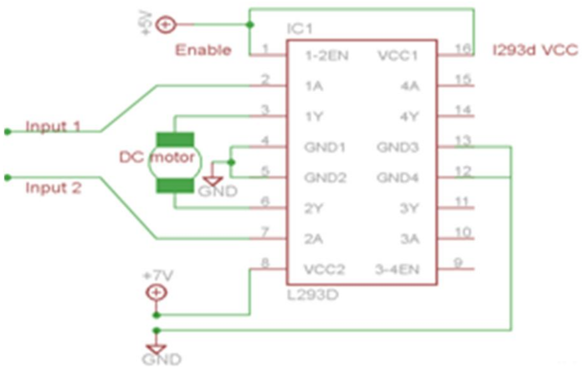

Figure 7 The pin diagram of L293D

The l293d have two Enable pins. Pin 9 and pin 1. To drive the motor, the pin 1 and 9 need to be high. For left H-bridge motor to drive you need to enable pin 1 to high. And for right H-Bridge motor to drive you to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will stop working. It’s like a switch(on/off).

VI. BLOCK DIAGRAM

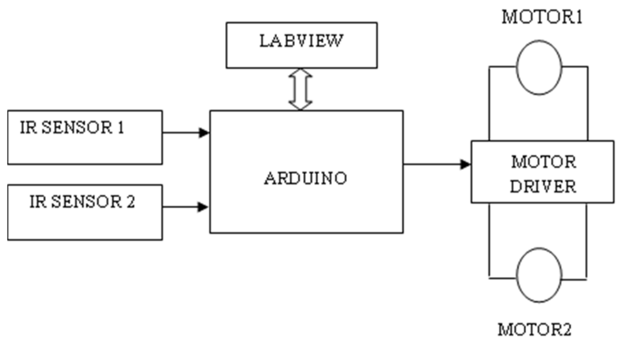

Figure 8.block diagram

The above block diagram shows the components used for the working of the line following robot, they are namely, IR sensors, Arduino board, DC motors and a DC motor driver. Here the arduino board is connected or interfaced with the LabVIEW.

VII. FLOW CHART OF WORKING OF LINE FOLLOWER ROBOT

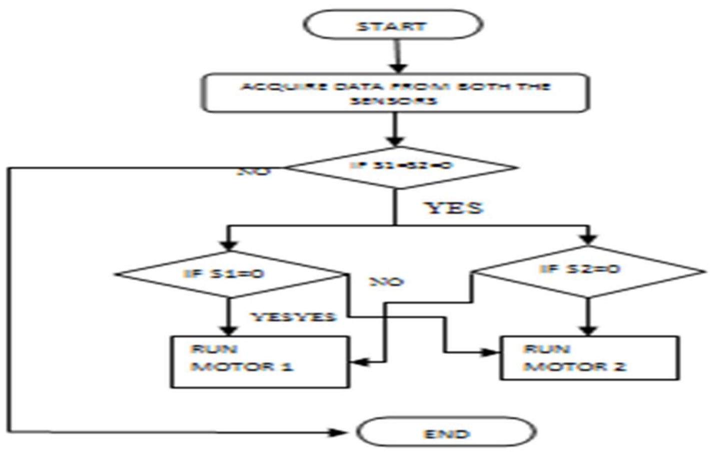

Figure 8.flow chart for working

VIII. ADVANTAGES

- Robot movement is automatic.
- Fit and Forget system.
- Used for large distance applications.
- Defense applications.
- Used in domestic and industrial automation.
- Cost effective.
- Simplicity of building

IX. Applications Of Line Follower Robot

- Industrial Applications: These robots can be used as self guided tool carriers in industries replacing traditional conveyer belts and rails.
- Automobile applications: These robots are also used as automatic cars running on roads with embedded magnetic tools.
- Domestic applications: These can also be used at homes for domestic purposes like floor cleaning etc.
- Guidance applications: These robots can be used in public places like shopping malls, museums etc to provide roots or path for it.

X. Disadvantages

- The range of the width of the black line which is followed by the on a white surface is limited(1 or 2 inches).
- LFR are simple robots with additional IR sensors which detects the IR rays emitted back.
- Needs a path to run either white or black since the IR rays should reflect from the particular path.
- It is slow in speed and instable on different line thickness or hard angles

XI. Conclusion

Thus we conclude that the design of LFR is implemented automatically by using LabVIEW has been achieved. This model is used in various applications like defense, hazardous industry for safety, navigation, surveillance and security purposes. There are many other software which are used for designing the Robot but LabVIEW is the easier one of them all. Is because it uses the drag and drop principle, and no code is needed to run the software since it follows graphical coding.

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