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A Line Follower Robot for Manufacturing Industry

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ABSTRACT

One of the most crucial parts of robotics is line following. An autonomous robot known as a Line Follower Robot (LFR) can follow a line painted in either black or white on a surface with a contrasting colour. It is made 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 perform desired tasks in unstructured conditions without constant human supervision.

The knowledge of mechanical, electrical, and computer engineering has been merged into this design. Design and fabrication 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 sensors to recognise the line, helping it maintain its position on the track. DC motors are used to power the robot and steer the wheels.

Keyword: Robot, Line Follower Robot, White Line.

1. INTRODUCTION

The line follower robot is made to be able to move along a ground-level black line without veering too far from it. Two sensors are mounted beneath the robot's frontal area, and two DC motors power its forward-moving wheels. Two sensors' input signals are used by an internal circuit to control how quickly the wheels rotate. The motor is controlled such that it slows down or even stops when a sensor detects a black line. Then, because of the difference in rotational speed, turns are feasible. For instance, if the sensors detect a black line on the right, the wheel on that side would slow down and the robot would turn to the right.

The sensors used for the are Reflective Object Sensors, OPB710F that are already ready in the Electronic Lab. A NPN Darlington phototransistor and an infrared emitting diode make up the single sensor. Depending on the amount of infrared light, output current is generated when light emitted from the diode bounces off an object and back into the phototransistor, triggering the base current of the phototransistor.

In my situation, a lack line reflects significantly less light than a white background, therefore we can somehow identify the black line by measuring the current. We repeatedly turn on and off DC motors with a set voltage applied to the motors rather than applying a constant voltage across the motors. This is accomplished by turning on and off a power MOSFET using trains of PWM pulses. The motors then experience average voltage, which is dependent on the PWM pulses' duty cycle. The average voltage has a direct relationship with rotational speed. It is simpler to control DC motors with PWM than it is to change the voltage across them. The only thing left to do is regulate the pulse width, or duty cycle. A power MOSFET also uses very little power when switching.

An LFR is a path following unimpressive robot. But it includes a wide variety of design ideas and gives scholars a variety of possibilities. For instance, it must automatically operate and follow the queue. It reflects a typical event in life: moving from one place to another along a predefined route, and it exemplifies mechanization. Semi-autonomous mobile robots have been created using this idea. Second, the robot is given a "brain" based on control theory so it can self-correct while travelling a path.

The purpose of using robots is to boost productivity while delivering convenience and safety. LFR can be useful and provide a good concept, as demonstrated by the development of autonomous car technology. For an autonomous vehicle to reach its destination, a path must be taken. Second, one must consider the state of the economy. It controls the speed and position of the robot. Many LFRs must work slowly because they cannot smoothly correct the divergence without an advanced control architecture. The bulk of LFRs employ PID, which while effective has many drawbacks. A higher level of LFR development is required. For instance, if a car is moving too quickly on the road before a turn, it must slowdown in the real world. However, the speed control and position control constraints of the robot make it difficult for the majority of LFRs to efficiently brake or halt. In robot designs, the motor speed management element is frequently overlooked.

2. LITERATURE SURVEY

Line Follower Robot from CPP Robotic Club:

The line follower from the CPP Robotics Club is an example of a line following robot that has been created by others and is shown in this chapter as a result of its widespread use. Due to its open loop system, this line-following robot will readily stray from the black line that has been drawn on the floor. The robot's movements will be jerky as a result of this issue. Even though the motion of the line follower robot can track the black line, it needs to be improved. Applying a closed loop system with a digital PID programme can therefore smooth the tracking motion. It is because PID control is a closed-loop system that will quickly correct any errors that do arise.

Design and Development of Autonomous Line Tracking Robot Using Microcontroller (UTEM):

Problem statement:

A very challenging job is designing and creating an autonomous line tracking robot. Numerous factors, including mechanical systems, electrical circuits, and microprocessor code, need to be taken into account. These elements must be completely integrated with one another. so that the autonomous robot can complete the duties that have been given to it with perfect functionality.

The difficulties lie in deciding and selecting the best device to be implemented in this autonomous robot system in order to ensure its complete integration. Additionally, there are numerous varieties of driven motors, sensing devices, and microcontrollers available on the market. Each of them has unique capabilities, specifications, and duties. The most difficult challenge is programming the microcontroller using the data collected by the robot's line sensors. In essence, each sensor gives the controller information based on the signal it receives, and the controller decides what to do based on the code that has been loaded.

In the case of a line sensor, the information is dependent on the rate at which the light reflections have been detected by the detector. The rate of light noticed by the detector varies greatly depending on the environment or area's brightness. Strong programming language skills are therefore required to synchronise world changes with the microcontroller programme being executed.

Objectives:

The main aim of this project is to design and develop an autonomous line tracking robot using a microcontroller. This is achieved through the following objectives:

1. To design and develop a suitable mechanical structure for an autonomous mobile robot.

2. To develop electronics hardware that is able to integrate sensors and an electrical motor with the micro controller.

3. To develop a complete program for the microcontroller to achieve the required task of line tracking.

Scopes:

The project scopes must be established in order to help and direct the development of the autonomous line tracking robot using a microcontroller. The following are the major project scopes:

Data collection:

Gather the required information by reading up on the history of automated line tracking robots, microcontrollers, line sensors, driven motors, and circuit design.

Design electronics and mechanical system:

Create a circuit diagram for electronics part and design robot structure.

Integration:

By integrating the mechanical structure and electronics device, a full set of autonomous robots can be built.

Programming and Testing:

Create a complete collection of microcontroller unit programmes and carry out testing on the entire autonomous robot.

Line following Robotic Vehicle using Microcontroller

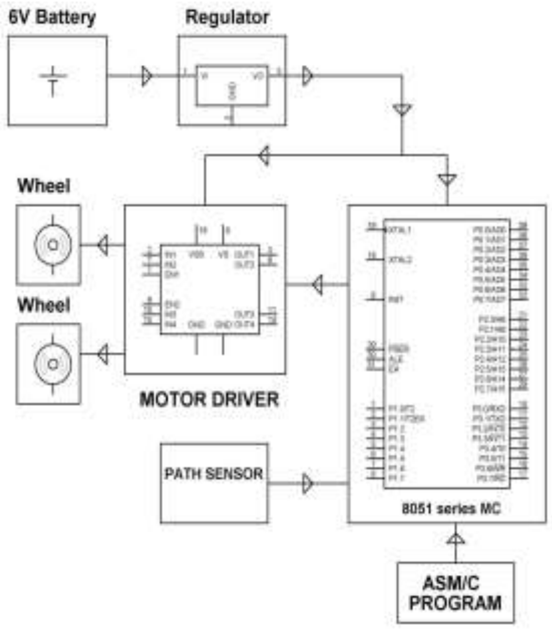
The goal of the project is to create a robotic car that travels along a predetermined route. This project runs on a microcontroller from the 8051 series. The controller is interfaced with a pair of photo sensors made up of an IR transmitter and a photo diode to detect the designated route for its movement.

A useful robot called a line follower robot is used in warehouses, factories, and other locations where it takes a predetermined path. The suggested line-following robot system achieves the desired functionality and provides an example of how it operates. It makes use of two photo sensors, each of which has a photo diode and an IR transmitter.

By sending the microcontroller the proper signals, it directs the robot to follow a predetermined route. A motor driver IC is used to connect two DC motors to the microprocessor. Sensors provide input signals to the microcontroller, which then acts in accordance with the programme it has been programmed with and powers the desired motors.

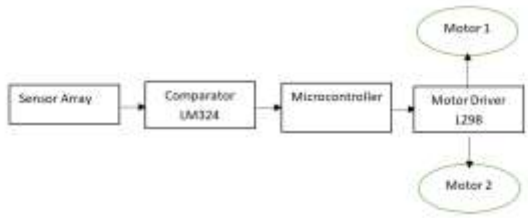
More sophisticated instruments can be added to the project to further improve it. The initiative will gain more features as a result of this. For instance, we can use ultrasonic devices to identify any obstacles in the robot's path and take the necessary action.

BLOCK DIAGRAM



4. WORKING PRINCIPLE

Two LED-IR sensors are installed on the sensor module that the robot uses. Semiconductor diodes such as IR and LED, often known as light emitting diodes, are used as light sensors. The module has a transmitter that sends the light and a receiver that takes in or notices the light's reflection. The sensors will reflect light if the colour code underneath them is white (light reflector), but if it is black (light absorber), the light won't reach the receiver, turning the sensor module off.



The left motor is connected to the left sensor module, and the right motor is connected to the right sensor module. The left side motor is turned on when the left sensor module's receiver detects light, and the right sensor module's receiver does the same for the right sensor module's motor. In this manner, when a left turn is approaching, the left sensors continue to focus on the black line, which prevents the sensor receiver from receiving any light. As a result, the left sensor module is turned off, which also disables the left motor. In this manner, the robot's right motor is the only one operating, and it turns left until both sensor modules are active.

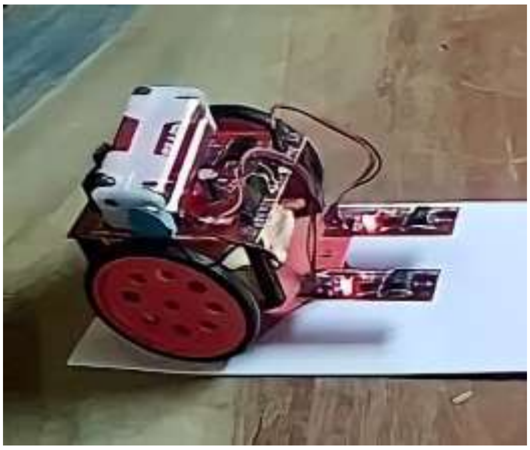
The situation is the same with the robot turning to the right. An IR sensor and high-intensity LED are used by the robot. In this manner, the IR sensor can detect the reflected light since the LED lights the area beneath the IR. When an IR sensor notices light, it will raise resistance, and when it senses darkness, it will decrease resistance. Black surfaces absorb light, while white surfaces reflect the majority of it. This approach makes it possible to follow a line.

5. CONCLUSION

Robotics in its current state is sufficient. Any curve or cycle can be followed by it. Because points are awarded depending on the distance travelled and the overall robot's speed, we must construct a robot that is light and swift. As a result, we used a circuit with two high speed motors and high sensitivity sensors. Additionally, body weight and wheel radius affect speed. The designed robot is lighter. We must construct a robot with two motors and two wheels on the back and a free wheel on the front in order to achieve better manoeuvrability.

Eight infrared sensors are located on the bottom of the robot's design to detect lines. The direction and speed of the motors were controlled by the microcontroller ATMega8 and the driver L298. The microcontroller manages the robot. By sending a signal to the driver IC in response to signals received from the sensors, it changes the direction of the motor.

OUTPUT



6. REFERENCES

1. Pakdaman,M.Sanaatiyan,M.M.,"Design and Implemen tation of Line Follower Robot,", Second International Conference on Computer and Electrical Engineering TCCEE '09, vol.2, pp.585-590,Dec.2009.
2. PriyankPatil,"AVR Line Following Robot," Department of Information Technology K. 1. Somaiya College of Engineering Mumbai, India. Mar 5, 2010.
3. Dean A. Pomerleau; Jay Gowdy; Charles E. Thorpe, "Combining Artificial Neural Networks and Symbolic Processing for Autonomous Robot Guidance," Engng Applic. Artif. Intell. Vol. 4, No. 4, pp. 279-285, 1991.
4. L1U Shi-Cai,L1U Guang-Jun, "Formation Control of Mobile Robots with Active Obstacle Avoidance," Acta Automatica Sinica, Vol. 33, No. 5, 2007.
5. YANG Tian-Tian; L1U Zhi-Yuan; CHEN Hong; PEl Run, "Formation Control and Obstacle Avoidance for Multiple Mobile Robots," Acta Automatica Sinica, Vol. 34, No. 5, 2008.