INDUSTRIAL BASED LINE FOLLOWER USING MACHINE LEARNING

MINI PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

This is to certify that the project work entitled "LINE FOLLOWER BOT FOR INDUSTRIAL PURPOSES" is a bonafide work done by MOHANKUMAR.K [REGISTER NO:20TH0164],VISHAL.V [REGISTER NO: 20TN0024], RAGURAM.R [REGISTER NO: 20TN0018] in partial fulfillment of the requirement for the award of B.Tech Degree in DEPARTMENT OF ARTIFICIAL INTELLINGENCE AND MACHINE LEARNING by Pondicherry University during the academic year 2022-23.

PROJECT GUIDE

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Problem Definition

Classical line following robot is slow response to the error occur will easily leave its track that drawnon the floor. This problem will result the motion of the robot to be unsmooth and sometimes robottends to move out of the track. Although the line following robot can follow the black line, itsmotion still needs to be improved, so to overcome that problem, we need a better controller to make robot follow the line smoothly and make less error. The motion of line following robotcan be

improved by using feedback mechanism which forms an effective closed loop system. In thisproject, we are using PID controller because of easy implementation on autonomous robot.

Abstract

Line Following is one of the most important aspects of robotics. A Line Following Robot is an autonomous robot which is able to follow either a black line that is drawn on the surface consisting of a contrasting color. The main idea is to move automatically and follow the line. The robot uses arrays of optical sensors to identify the line, thus assisting the robot to stay on the track. The array of four sensor makes its movement precise and flexible. The robot is driven by DC gear motors to control the movement of the wheels. The Arduino Uno interface is used to and implement algorithms to control the speed of the motors, steering the robot to travel along the line smoothly.This project aims to implement the algorithm and control the movement of the robot by proper tuning of the control parameters and thus achieve better performance. In addition the LCD interface is added in order to display the distance travelled by the robot. It can be used industrial automated equipment carriers, small household applications, tour guides in museums and other similar applications, etc.

Introduction

A line follower bot is an autonomous robot that is designed to follow a line on the ground or a surface. It is a popular and widely used robot in the field of robotics and automation. Line follower bots are commonly seen in various applications, including industrial automation, warehouse logistics, and even in educational settings.

The primary objective of a line follower bot is to track a contrasting colored line and navigate along its path. It does this by utilizing sensors, such as infrared or light sensors, to detect the line and make necessary adjustments to stay on course. The bot's movement is controlled by a microcontroller or a similar processing unit, which receives input from the sensors and makes decisions based on the detected line's position.

The line follower bot operates on the principle of feedback control. It continuously senses the position of the line, processes the sensor data, and adjusts its movement in real-time. By maintaining a feedback loop, the bot can make precise corrections to stay on the line and navigate complex paths.

Line follower bots are often used in competitions, where their speed, accuracy, and ability to handle intricate tracks are put to the test. They provide an exciting platform

for enthusiasts and students to explore the concepts of robotics, programming, and control systems.

The design and complexity of line follower bots can vary, ranging from simple single-sensor bots to more advanced ones with multiple sensors, obstacle detection capabilities, and advanced algorithms for efficient line tracking. Regardless of the complexity, the fundamental principle remains the same – following a line using sensor feedback and controlling the bot's movement accordingly.

Overall, line follower bots are fascinating and practical examples of autonomous robots that demonstrate the integration of sensing, processing, decision-making, and actuation. They have a wide range of applications and continue to inspire and engage individuals interested in the field of robotics and automation.

EXISTING SYSTEMS:

There are several existing systems of line follower bots that have been developed and implemented by researchers, hobbyists, and companies. Here are a few examples:

1. Arduino-based Line Follower Bot: Arduino is a popular microcontroller platform used in many line follower bot projects. The bot is equipped with infrared sensors that detect the line and an Arduino board that processes the sensor data and controls the motors. It is a widely adopted and beginner-friendly system for building line follower bots.
2. Raspberry Pi-based Line Follower Bot: Raspberry Pi is a versatile single-board computer that can be used as the brain of a line follower bot. It offers more computational power and flexibility compared to Arduino. Raspberry Pi-based line follower bots often use a camera module to capture images of the line, which are then processed using image processing algorithms to track the line and control the bot's movement.
3. PID-controlled Line Follower Bot: Proportional-Integral-Derivative (PID) control is a popular control technique used in line follower bots. In this system, the sensor data is processed using PID algorithms to calculate the appropriate motor control signals. PID control provides accurate and responsive tracking of the line by adjusting the bot's movement based on the error between the desired position (the line) and the actual position.
4. Industrial Line Follower Systems: Line follower bots find applications in industrial automation, particularly in assembly lines and material handling

systems. These systems often employ more advanced sensors, such as laser or vision-based sensors, for precise line detection. They may also include additional features like obstacle detection and avoidance to ensure safe and efficient operation in industrial environments.

5. Advanced Line Follower Bots: Some line follower bots incorporate advanced features beyond basic line tracking. For example, they may include path planning algorithms to navigate complex line patterns or intersections. These bots can handle more challenging tracks and exhibit enhanced intelligence in their navigation capabilities.

These are just a few examples of existing systems of line follower bots. The specific design and implementation of line follower bots can vary widely depending on the application, complexity, and desired functionalities. With advancements in technology, including sensor technology, control algorithms, and computing power, line follower bots continue to evolve, offering improved performance and expanding their range of applications.

WORKING PRINCIPLE:

A line follower bot is a type of robot that follows a line, usually a contrasting colored line on the ground or a surface. It uses sensors to detect the line and adjust its movement accordingly. The working principle of a line follower bot involves the following steps:

1. Sensing the line: The bot is equipped with one or more sensors, such as infrared or light sensors, positioned underneath or in front of it. These sensors detect the contrast between the line and the surrounding surface. When the sensor is over the line, it receives more reflected light, and when it's off the line, it receives less reflected light.
2. Processing sensor data: The sensor data is sent to a microcontroller or a similar processing unit on the bot. The microcontroller analyzes the sensor readings to determine the position of the line relative to the bot.
3. Making decisions: Based on the sensor data, the microcontroller decides how the bot should move to stay on the line. Typically, the bot is programmed with a set of instructions or algorithms to make these decisions. For example, if the right sensor detects the line, the bot may need to turn left to get back on track.
4. Controlling the motors: The microcontroller sends signals to the motor controllers or motor drivers connected to the bot's wheels. These signals control

the speed and direction of the motors, allowing the bot to move accordingly. To stay on the line, the motors are adjusted based on the decisions made in the previous step.

5. Continuous feedback loop: The bot continuously repeats the sensing, processing, decision-making, and motor control steps in a feedback loop. This allows it to constantly adjust its movement in response to changes in the line's position.

y following this feedback loop, the line follower bot can track the line and make necessary corrections to stay on course. The specific implementation and programming may vary depending on the design and complexity of the bot, but the underlying principle remains the same.

SOURCE CODE:

```
int a=6,b=7;
void setup()
{
pinMode(a,INPUT);
pinMode(2,OUTPUT);
pinMode(3,OUTPUT);
pinMode(b,INPUT);
pinMode (4,OUTPUT);
pinMode(5,OUTPUT);
Serial. begin (9600);
}
void loop()
{
if(digitalRead(a)==HIGH)&&(digitalRead(b)==HIGH))digitalWrite(2,HIGH);
digitalWrite(2,HIGH);
digitalWrite(3,LOW);
```

```
digitalWrite(4,LOW);


digitalWrite(5,HIGH);
Serial.printin("FORWARD");delay(1);
}
elseif((digitalRead(a)==LOW)&&(digitalRead(b)==HIGH))
digitalWrite(2,LOW);
digitalWrite(3,HIGH);
digitalWrite  (4,LOW);
digita/Write (5, HIGH)
;Serial.printin("LEFT");delay(1);
}
else if(digitalWrite(3,LOW);digitalWrite(4, HIGH);
digitalWrite(5,LOW);
Serial.printin("RIGHT");delay(1)
;else if((digitalRead(a)==LOW)&&(digitalRead(b)==LOW/))
{
 digitalWrite(2,HIGH);digitalWrite(3, LOW);
digitalWrite(4,LOW);
digitalWrite (5, HIGH);
Serial printin("BACK");
delay(1);
```

SAMPLE PICTURES: