Line Following Robot using IOT Arduino

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Abstract— A line follower robot is a mobile gadget that can recognize and track lines that are created on the ground. The route is usually predefined and may be seen, e.g., as a black line on a white surface with a highly contrasting hue, or unseen, e.g., as a magnetic field. Thus, this kind of robot ought to detect the line using its infrared beam. (IR) sensors mounted under the apparatus. Subsequently, the information is sent to the CPU via assigned Transition buses. In order to enable the line follower robot to follow the path, the CPU will ascertain the proper commands and transmit them to the driver. TABAR's design and testing were done with the intention of competing in the Tabrize line follower robot competition. It does, however, have a few technical and mechanical problems. This article describes the design, implementation, and testing process of TABAR, a miniature line follower robot developed for the line follower robotics competition. Additionally, studies on mechanical and technological issues and problems have been conducted.

Keywords—ARDUINO, infrared sensors, line detection, data sense, robot line detection.

I. INTRODUCTION:

One well-liked effort in the robotics and automation space is the line-following robot. It entails creating and developing a robot that is able to follow a line drawn on the ground on its own. This study describes the goals, procedures, parts utilised, design considerations, execution, and potential future advancements of this kind of robot. In particular, these are often used in industrial regions. These robots must provide excellent efficiency at a low cost in order to be the perfect industrial component. That instance, a robot needs to be able to follow intricate lines, but it also needs to be affordable, straightforward, and simple to use. Aside from everything else, complexity and expense will go down if we use fewer sensors. However, if we lower the sensor, it

To develop an Algorithm through which a line follower robot can detect T-junction, + junction and 90 degree turn accurately with minimum sensor.

Line following robot is a machine that can follow the path. The path can be visible like a black line on white surface or it can be visible like a magnetic field(ref fig 1) .

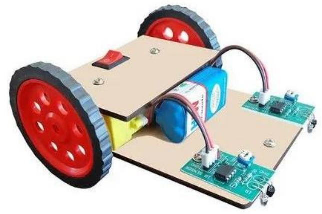

Fig1 : line following Robot design

Line Following Robots are autonomous vehicles designed to follow a predefined path, typically delineated by a colored line on the ground. With the integration of Internet of Things (IoT) technologies([1,2], these robots can be enhanced with remote monitoring, control, and data analytics capabilities. This abstract presents a literature survey on Line Following Robots using IoT, covering existing projects, methodologies, and challenges in this field.

The survey begins with an introduction to Line Following Robots, outlining their applications and basic principles. It then reviews existing projects and research papers on Line Following Robots using IoT, discussing hardware components, control algorithms, and sensor technologies. Integration of IoT technologies into Line Following Robots is explored, highlighting benefits such as remote monitoring and data analytics, as well as challenges related to power consumption and connectivity.

Control algorithms and techniques used in Line Following Robots, including PID control and machine learning, are discussed, along with sensor technologies for line detection such as infrared sensors and computer vision systems. Case studies of real-world applications, such as warehouse automation and agricultural monitoring, are presented to illustrate the practical implications of Line Following Robots using IoT.

Future directions and research challenges in this field are identified, including opportunities for improving energy efficiency and autonomous navigation capabilities. The abstract concludes by emphasizing the significance of Line Following Robots using IoT in addressing real-world challenges and advancing the field of robotics and automation.

II. OBJECTIVE

1. Create and construct a line-following robot that is capable of autonomous navigation along a predetermined course.
2. To precisely locate and follow the line, use sensors and control algorithms.
3. Increase your robot's velocity and nimbleness for effective navigation. Record the undertaking. for instruction and demonstration.

III. PRAPOSED SYSTEM:

Proposed System Design:

1. Research and Design: Based on robot designs, parts, and control algorithms, research was done on the current line. Project budget, timeline, and resource requirements as planned
2.Parts selection: Choose the right parts, like the frame, wheels, power supply, sensors (like infrared sensors or cameras), motor controllers, microcontrollers (like Arduino), and others.
3.Hardware: The robot body, installed sensors, motors, and electrical components are put together in accordance with the schematic.
4.Software : Using the Arduino IDE or a comparable platform, develop control software. Configure the robot to read sensor data, deduce the line's position, and then modify motor speed to follow the line.
5. Testing and Calibration: To achive optimal performance, multiple tests were conducted to adjust motor speed, sensor thresholds, and control algorithms[2,3].
6. Recording: Preserved design procedures,

Components Used

- A microcontroller, such as the Arduino Uno

Fig 2: Ardino-UNO

Arduino is an open source computer hardware and software company, project and user community that design and manufactures microcontroller based kit for building digital devices and interactive objects that can sense and control objects in the physical work.

- Motor controllers, such as the L298N

The arrangement of motors is known as an H-Bridge.
An electrical circuit known as an H-Bridge allows a voltage to be applied across a load in either direction.
It provides complete circuit control over a typical DC electric motor. That example, an H-Bridge allows a motor to be electrically controlled for forward, backward, braking, and coasting by a microcontroller, logic chip, or remote control.

- Line detection sensors, such as infrared sensors

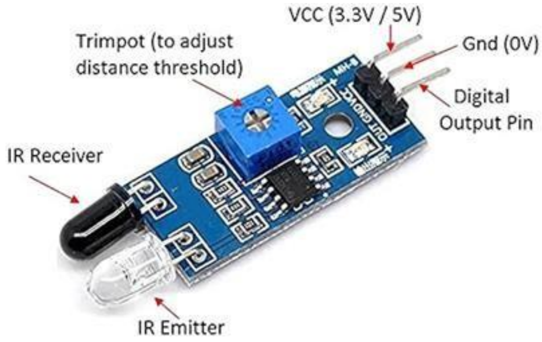

Fig3 : IR sensor[4]

Most used in motion detection sensing, A Passive motion detector its electronic sensor that measures infrared (IR) light radiating from objects in its field of view.

- A robot's body
- Direct current motors

The motor rotate clockwise and anti-clockwise based on the program. In the motor electrical energy convert into mechanical energy. It is commonly use to drive each wheel of robot.

- Tires
- Power supply, such as a DC adapter or batteries
- Jumper wires, test board and other electronic components.

Steps for Design solutions

To Implement method, the process involved is sensing data and detect the line on the ground. This can involve thresholding, edge detection, or machine learning techniques.
Calibrate the sensors to ensure accurate detection of the line under various lighting conditions and surface colors.
1. Sensor placement: Position the sensor at the best angle and in close proximity to the ground in order to detect the line with accuracy.
2. Motor Control: To guarantee a straight line, motor speeds can be adjusted depending on sensors using proportional or PID control algorithms.
3. Power management: preserving portability and usefulness while making sure motors and electronics have enough power.
4. Durability: For components that can survive movement and environmental influences, we create a sturdy frame and fixed mount[5,6].

Working of the model :

The IR sensor detects the light emitted by the transmitter, if the receiver receives light, the wheel of that side will keep on moving, as soon as the receiver stop receiving the light (black colour absorbs the light & thus no light reflected so receiver cannot receive any light) the wheel of that side will be stop.

For turning, the robot stop one motor and runs the second to make the turn possible.

For example; If the robot has to turn light then the motor on right side will stop and left motor will keep on running and thus allowing the robot to turn. following are steps mentioned entire working of model.

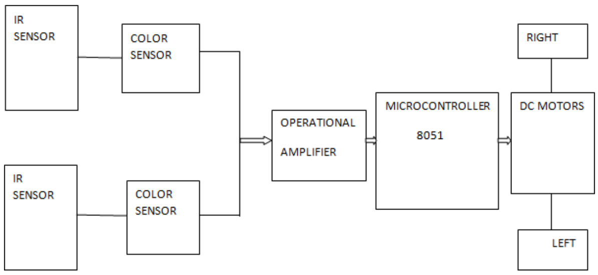

Fig 4: Working Model

1.wheels and engines fixed to the chassis.
2. The robot's front is equipped with line detection sensors.
3. A microprocessor and motor drivers are attached to the motors.
4. Configure the microcontroller to manage motor speeds and read sensor data.
5. Used several line patterns to test the robot and made necessary adjustments to the control parameters and sensor thresholds.
6. Performance adjusted for maximum accuracy and speed.

Upcoming Enhancements.

7. The application of obstacle avoidance and detection capabilities. Wireless communication that is integrated for monitoring or remote control, adding navigation features and paths to intricate routes.4, Enhance the personalization and attractiveness of robots.5. Line tracking with advanced control algorithms should be more effective and seamless.

8 Conclusion: The effort to develop and construct a robot was successful in achieving its objective.

Results:

Line following detector detect the black line & follow the path it has various application in healthcare sector, manufacturing Deploy the Line Following Robot in real-world scenarios, such as warehouse logistics or indoor navigation tasks(ref, Fig 5 & 6).

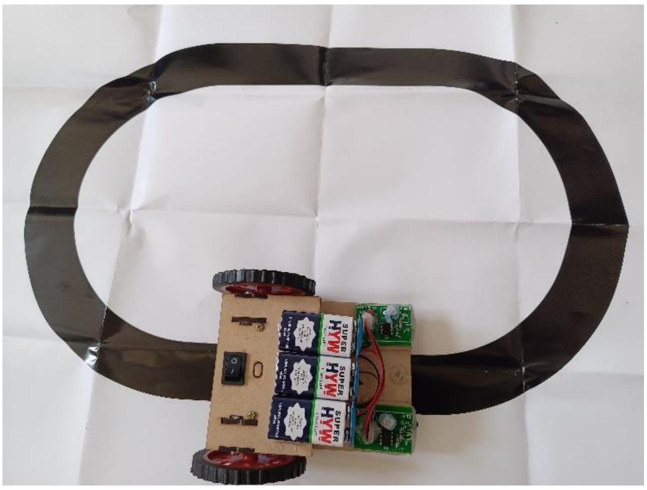

Fig 5 Line following Robot

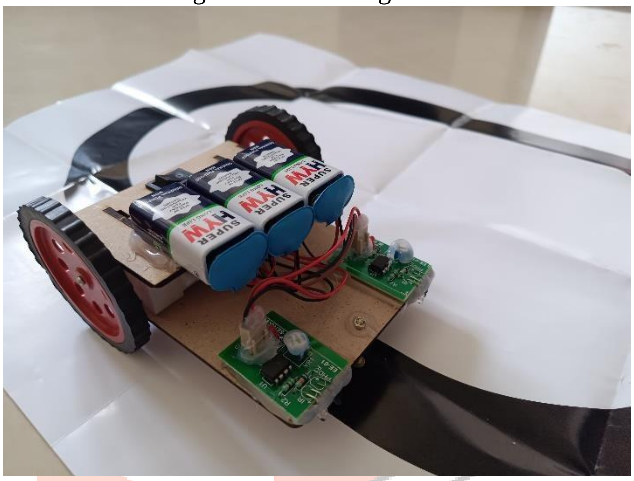

Fig 6 Line following Robot output

Applications

- Industrial automated equipment carries.
- Automated cars.
- Tour guide in museums and other similar applications.
- Deliver the mail within the office building.
- Deliver medications in hospital.
- Wireless communication that is integrated for monitoring or remote control,
- Adding navigation features and paths to intricate routes.
- Enhance the personalization and attractiveness of robot.
- Line tracking with advanced control algorithms should be more effective and seamless.

The effort to develop and construct a robot was successful in achieving its objective.

Conclusion:

The objective of the robot line following project, which was to design and construct an autonomous robot capable of following a line, was accomplished. The meticulous design, component selection, and extensive testing have allowed the robot to operate dependably in a variety of settings. Its usefulness and adaptability for practical, recreational, and instructional purposes can be further enhanced by ongoing additions and modifications.

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