Path Follower And Obstacle Avoidance Vehicle

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Abstract

The design and fabrication of a path follower and obstacle avoidance vehicle presented in this paper combines several features including line following, obstacle avoidance, IR remote control and Android application control. The vehicle is built using an Arduino micro controller and various sensors, which are carefully selected to ensure the vehicle's efficiency and effectiveness in performing its tasks. The infrared sensors used in line following allow the vehicle to accurately follow lines on a surface, while the ultrasonic sensors are utilized for obstacle avoidance, allowing the vehicle to detect and avoid obstacles in its path. The ultrasonic sensors used in obstacle avoidance help the vehicle to navigate around objects without collision, providing additional safety and reliability. In addition, the vehicle can be controlled remotely using an IR remote control or an Android application via Bluetooth communication. The Android application provides a user-friendly interface for controlling the vehicle movement and changing modes, allowing the user to control the vehicle's speed and direction, and switch between different modes of operation.

Keywords - Line follower, Obstacle Avoidance, Sensors, Android application

1. INTRODUCTION

The development of path followers and obstacle avoidance vehicles has become a popular topic in recent years, as these have proven to be useful in various fields, including manufacturing, education, and research. To make these vehicles more efficient and versatile, they need to be equipped with multiple functionality. This paper presents the design and implementation of a vehicle that combines several features including line following, obstacle avoidance, IR remote control and Android control. The vehicle is built using an Arduino micro controller and a combination of sensors, such as infrared sensors for line following and obstacle detection and ultrasonic sensors for obstacle avoidance. The use of these sensors enables the vehicle to navigate through complex environments, follow a predetermined path, and avoid obstacles in its path. The vehicle movement is controlled using a combination of ultrasonic sensors, making its movements precise and efficient. The vehicle performance is tested under various conditions, demonstrating its effectiveness in a range of scenarios. Overall, this multi-functional vehicle provides a versatile and efficient solution for educational and practical purposes, making it a valuable tool for robotics enthusiasts, educators, and researchers. The vehicle's performance is tested under various conditions, demonstrating its effectiveness in a range of scenarios.

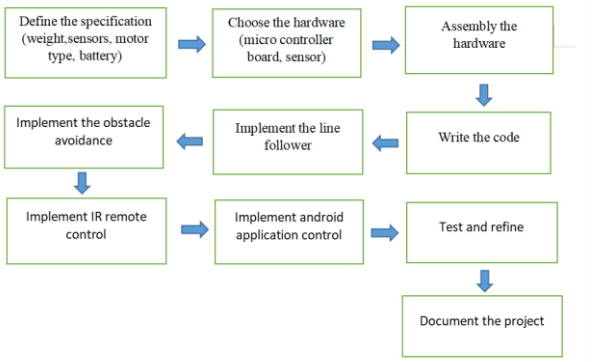
A line follower is a type of vehicle that follows a line drawn on the ground using sensors such as infrared or reflective sensors. It can be programmed to follow a specific path or track and is commonly used in industrial settings for tasks such as material handling and assembly. Obstacle avoidance is the ability of a vehicle to detect and avoid obstacles in its path, using sensors such as ultrasonic or infrared sensors. This allows the vehicle to move around its environment without colliding with objects or people.IR remote control is a method of controlling a robot using an infrared remote control. This is a common method of controlling small robots such as toy cars or drones. IR (infrared) remote control is a method of controlling a device, such as a robot or television, using an infrared signal. Android application control is a method of controlling a robot using an Android application. This allows the user to control the robot using their smart phone or tablet, providing a more intuitive and convenient method of control. Android application control is a method of controlling a device, such as a robot or home automation system, using an Android application on a smart phone or tablet. The Android application communicates with the device over a wireless or Bluetooth connection, allowing the user to control the device's functions and receive feedback from the device.

2. PROBLEM DEFINITION

The line follower and obstacle avoidance robot is designed to solve the problem of automating tasks that require precise movements and navigation. In many industries, such as manufacturing and logistics, there are repetitive tasks that need to be performed with great accuracy. These tasks can be time-consuming and labor-intensive if done manually. By using a line follower and obstacle avoidance robot, these tasks can be automated, saving time and increasing efficiency. The robot can navigate through a factory floor or warehouse, following a designated path while avoiding obstacles that may come its way. A line follower and obstacle avoidance vehicle is a type of autonomous vehicle that is designed to navigate through an environment by following a line and avoiding obstacles. The vehicle is equipped with sensors that allow it to detect the line it needs to follow, as well as obstacles in its path. Obstacles are common, so if the line follower does not detect any obstacles on its path, it will collide with it and be severely damaged. Adding obstacle avoidance features to a traditional line follower vehicle prevents the vehicle from being damaged. If, the vehicle move out of the path to ensure the vehicle to reach its destination, we are adding manual control to the vehicle.

3. PROCESS FLOW CHART

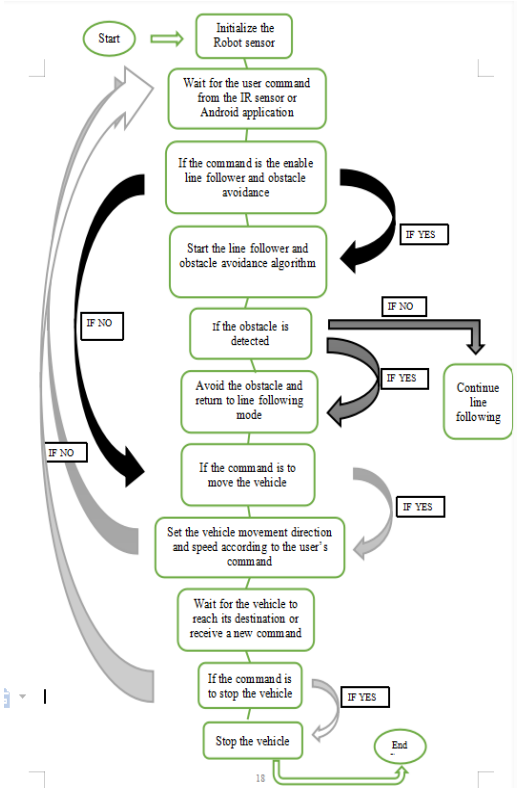
Here is a general process flowchart for a system that combines line follower, obstacle avoidance, IR remote control, and an Android application: Start the system and initialize all the sensors and motors then, Check for input from the IR remote control. If there is a command, execute it (e.g., move forward, turn left, stop). And check the sensor for the line follower. If the sensor detects a line, follow it. And also an obstacle is detected by the obstacle avoidance sensor, stop the robot and determine a new path. Use the Android application to send commands to the robot, End the system.



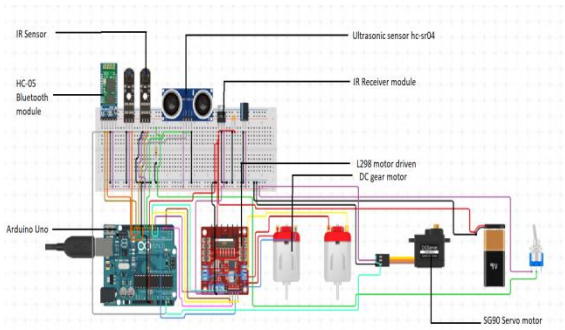
3. BLOCK DIAGRAM

The block diagram for a vehicle that combines line following, obstacle avoidance, IR remote control, and Android application control is a complex system that requires several components to work together seamlessly. The Android application serves as the user interface for sending commands and receiving feedback from the vehicle via Bluetooth.. The Bluetooth module provides wireless communication between the Android device and the Arduino board, which serves as the micro controller that controls the sensors and motors. The remote

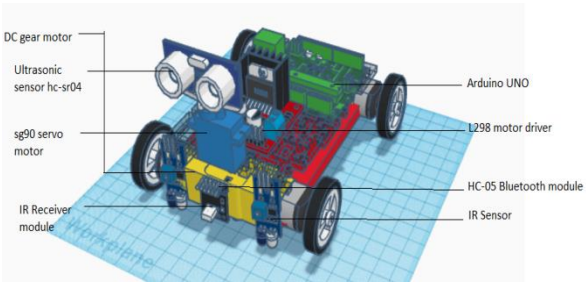
control allows the user to send commands to the vehicle via IR signals.



4. CIRCUIT DIAGRAM



The circuit diagram for a vehicle that combines line following, obstacle avoidance, IR remote control, and Android application control involves connecting several components together to create a complex system. The Arduino board serves as the main controller, and it is connected to various shields and sensors, including the motor driver shield, the line follower sensors, and the obstacle avoidance sensors. The Bluetooth module and the IR receiver are also connected to the Arduino board, allowing the robot to communicate wirelessly with both an Android application and an IR remote control. By combining these components in a circuit diagram, it is possible to create a powerful robot that can navigate its environment, follow a line, and respond to commands from both an Android application and an IR remote control.



3D DESIGN MODEL

The design of this modeling was designed using Tinker cad software.

5. DESIGN CALCULATION

FRICTION CALCULATION

Permeability of rolling, $\mu_{roll} = 0.3$

Mass of the vehicle, $m_{vehicle} = 2$ kg

Acceleration due to gravity, $g = 9.81 m/s^2$

Weight of the vehicle, $w_{vehicle} = 2 * 9.81 = 19.62$ N

The radius of the wheel, $r_{wheel} = 3.25cm = 0.0325m$

Determine the Force of rolling friction using the formula :

$$F_{roll} = W_{vehicle} * \mu_{roll}$$

$$= 19.62 * 0.3 = 5.886 \text{ N}$$

Therefore the force of rolling friction is 5.886 N

Calculate the Torque required to overcome rolling friction using the formula :

$$T_{roll} = F_{roll} * r_{wheel}$$

= 5.886 * 0.0325 = 0.1913 Nm .

DC MOTOR CALCULATION :

Calculate the torque required by the motor to move the vehicle :

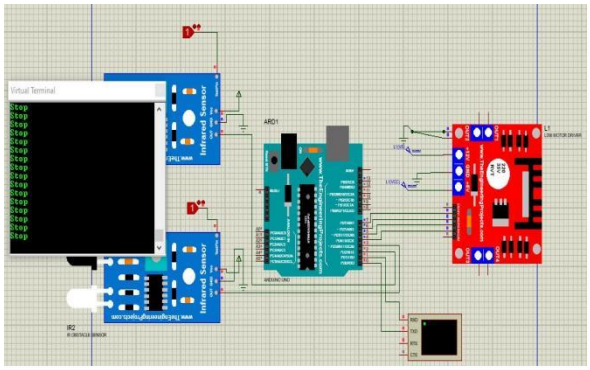
T_{motor} = 1 kg/cm = 0.098 Nm

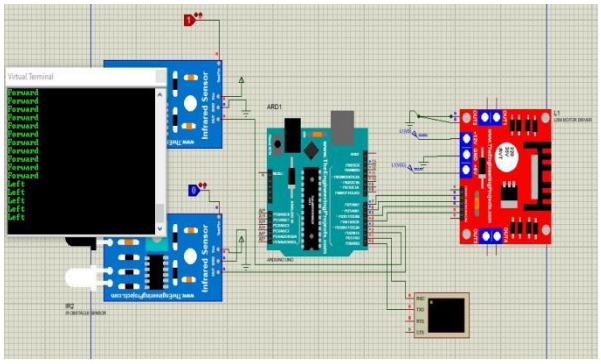
Combined Torque = 4 * T_{motor}

= 4 * 0.098 = 0.392 Nm.

6. SIMULATION

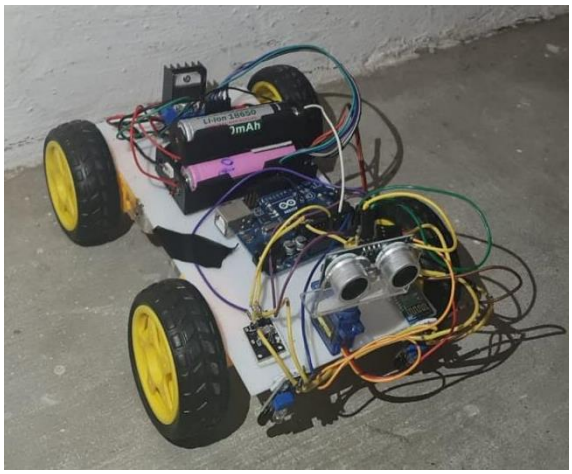
The simulation of the working of the line follower and obstacle avoidance vehicle is used in Proteus 8 Professional software.





8.RESULTS AND DISCUSSION

The results of a project that combines a line follower, obstacle avoidance, IR remote control, and an Android application will depend on the specific implementation and goals of the project. The line follower component of the system allows the vehicle to follow a predetermined path, which can be useful in settings such as factory automation or material handling. The obstacle avoidance component allows the vehicle to navigate around unexpected obstacles, which can be useful in a variety of applications, including search and rescue missions or surveillance operations.



9.CONCLUSION

The combination of line follower, obstacle avoidance, IR remote control, and an Android application is an exciting and useful project with many potential applications. The line follower allows the vehicle to follow a specific path, making it suitable for warehouse automation and transportation systems. The obstacle avoidance feature enables the vehicle to navigate through environments with obstacles, making it suitable for home automation and security. The IR remote control allows users to control the vehicle's movements and actions easily, making it a popular choice for hobbyists and enthusiasts.

The Android application adds another layer of functionality, allowing users to remotely control the vehicle and monitor its status and progress,

making it useful for applications where the vehicle needs to operate in difficult-to-access environments. Together, these features provide a highly adaptable and customizable platform for building autonomous vehicles suitable for a diverse range of industries and applications.

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