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CSE 204 - Digital Logic Design

Report: Line Following Robot (LFR)

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Line Follower Robot

Abstract:

Line following robot is basically a machine that can detect and follow the line drawn on the floor. The path is often predetermined and either visible—like a black line on a white surface with a high contrasted color. Certainly, this type of robot should detect the line using its infrared ray (IR) sensors, which are mounted beneath the robot. The data is then sent to the processor through certain transition buses after that. Therefore, the CPU will choose the appropriate rewards, transmit them to the driver, and the line follower robot will then follow the course.

Introduction:

A line follower robot is a robot designed to follow a "line" or path set by the user. This line or path can be as simple as a physical white line on the ground, or it can be a complex path marking scheme. Embedded lines, magnetic markers, laser guide markers. Various detection schemes can be used to detect these specific markers or "lines". These schemes range from simple, low-cost line-capture circuits to large-scale image processing systems. The choice of these schemes depends on the required detection accuracy and flexibility. From an industrial perspective, line following robots are being implemented in semi-autonomous to fully autonomous plants. In this environment, these robots act as material carriers to deliver products from one production point to another where rail, conveyor, and gantry solutions are not possible. In addition to the ability to follow lines, these robots must also be able to navigate intersections and decide which intersections to turn and which to ignore. This requires the robot to turn 90 degrees and requires the ability to count intersections. In addition to problem complexity, sensor placement also plays a role in optimizing robot performance for the a forementioned tasks. Line following robots with pick and place capabilities are commonly used in manufacturing plants. They travel specific paths to pick up components from specific locations and place them where desired. Line following robots are autonomous robots that recognize and follow lines drawn on the ground. The way to go is indicated by a white line on a black surface. The control system used must be able to perceive the line and manoeuvre the robot to stay on course, constantly correcting incorrect movements using feedback mechanisms. This creates a simple and effective closed-loop system.
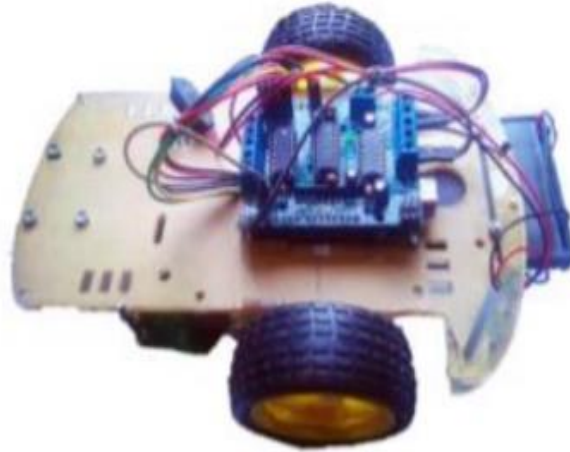
Figure 1:Line Following Robot

Proposed System Methodology:

This system is based on an Arduino Uno microcontroller board. The system operation is forward, left and right the direction of the robot car by rotating five DC motors attached with three wheels. The motion of the robot car depends on sensing of Infrared (IR Array of 5 TCRT-5000) sensors. LFR senses black line by using IR sensor and then sends the signals to Arduino. So, five IR sensors are used for path detection. These sensors attached at the front end of the robot. When IR sensors transmit the signal and it reflect the surface area and receive from surface area as the receiver. The electrical signals from Arduino Nano flow into the data pin connected with it. To work the signal flow into the motor driver card. As the line following robot is contracting to pass on the black line, it passes as its line. testing results of the system are shown that are the direction of line following robot, forward, left, and right. According to the testing of line following robot, the speed of the motors can change the limitation.
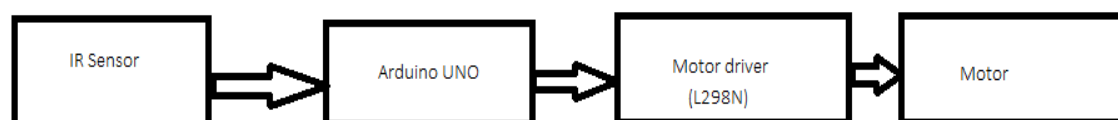

Figure: Block Diagram of the system.

Circuit Design:

Here is an overview of a system with an IR sensor shown in Figure 2. This circuit consists of Microcontroller,5 IR sensors,2 motors and motors driver board. When the robot is placed on a fixed path, the robot will follow that path line detection. The direction of the robot is 5 IR sensors placed on track, robot movement forward. When the left sensor leaves the line, the robot move right. Similarly, if the right sensor moves If you leave the line, the robot will move left. Anytime robot left path when detected by IR Sensor. When an infrared sensor sends a signal and reflects it off a surface receive from plain as receiver. Or electrical signals from the Arduino Nano flow to the data pins associated with it. The Enable A (ENA) input is connected to Arduino digital pin 3. Input Enable B (ENB) is connected to Arduino digital pin 5. Input pin 1 is connected to Arduino digital pin 11 . Input pin 2 is connected to Arduino digital pin 10. Input pin 3 is connected to Arduino digital pin 9. Input pin 4 is connected to Arduino digital pin 6. Output pin 1 is Arduino Digital Pin 2 connects to left IR sensor. Output pin 2 connects Arduino digital pin 4 to centre infrared sensor. Output pin 3 is Arduino digital pin 7, connect to right sensor.

To work as a program the motor driver board acts as a signal you can continuously adjust and operate the motor signal flow always. In this project, as a line following robot the subject of the contract is a black line on a white background, or what is taken over bright surface area.
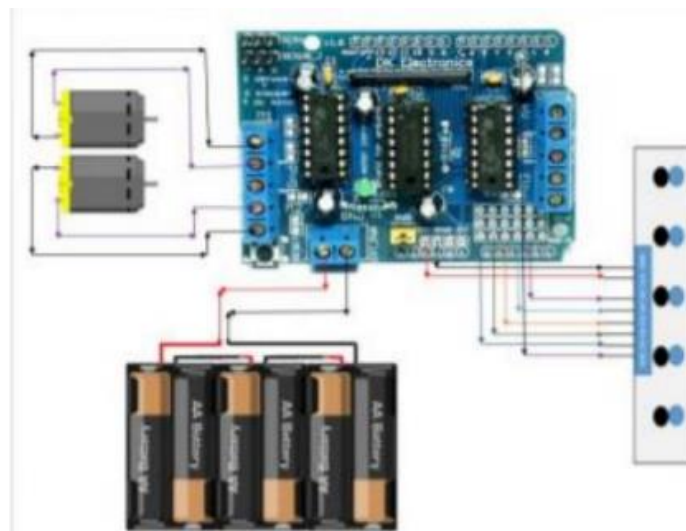

Figure 2:Circuit Diagam

Flowchart of The System:

Here in figure 3 the overall system shown using flowchart. In the first stage, when the central sensor detects a black line, the robot car evolution. Response from the center sensor is high and the response of the other two sensors is poor. Follow arrangement, the central sensor will be on the line and be like the line is black, it will not reflect the emitted radiation sensor response and response will be weak and the response of the other two sensors will be

weak because they will be on shiny surface. In the second step, when a straight curve is found on the line feedback will change the response of the upper left sensor and the response of the bore sensor will be weak. The wheel control is modified when these data are reached. The right wheel is held and the left wheel is allowed to move freely until feedback from the center sensor becomes high. Afterward The same process is repeated. In the third step, when a left curve is found on the line
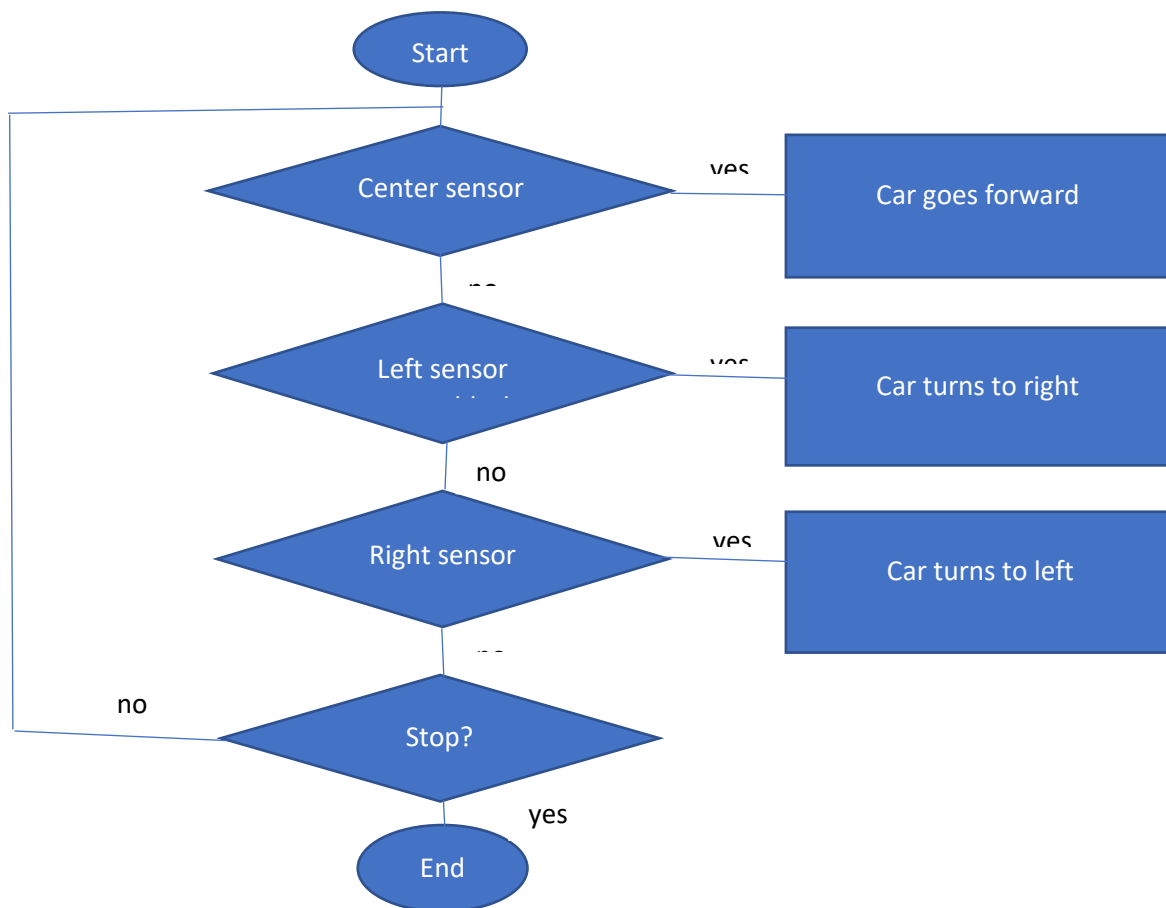

Figure 3:Overall flowchart of the system

Right sensor response will vary from low to high as a sensor. Then the wheel control changed to hold the right wheel and let the left wheel move freely until the center sensor changes it from low to high. The same procedures continue for all turns and robots move continuously until the power goes out. If all three sensors are on a white surface, then they all go below and since no line is detected the robot moves in the direction circular motion until a straight line is found. If no lines are found, circle unit found.

Development & Testing Result & Performance Analysis:

After testing, results of the system are shown that are the direction of line following robot, forward, left, and right. According to the testing of line following robot, the speed of the motors can change the limitation.

Conclusion:

Design and construction of line following robot is based on Arduino UNO. The robot car moves left, right, and forward direction on the black line of white surface by using two DC motors attached with four wheels. The speed of the motors is controlled by L298n (RED) driver. The directions of the robot car are controlled by using IR sensors from Arduino UNO microcontroller. The colour is sensed by using five IR sensors. If the sensing colour is black robot car moves and if the sensing colour is white, robot car does not move.

Reference:

https://www.slideshare.net/rehnazrazvi/line-following-robot-16014541

https://www.electronicshub.org/arduino-line-follower-robot/