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DESIGN AND FABRICATION OF LINE FOLLOWER ROBOT

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ABSTRACT Line follower is an intelligent robot which detects a visual line embedded on the floor and follows it. The path is predefined and can be either visible like a black line on a white surface with a high contrasted color or the path can be a complex such as magnetic markers or laser guide markers. In order to detect these lines various sensors can be employed. Generally, infrared Sensors are used to detect the line which the robot has to follow. The robot movement is automatic and can be used for long distance application. Line follower can be modified by giving obstacle detection capability to it. If any object is placed on the path, then a normal line follower will try to push the obstacle and hence it gets damaged. By using ultrasonic sensor, the line follower can detect an obstacle and can stop till the obstacle is removed. This type of robots can perform lot of tasks in industries, like material handling. These robots can be used as automated equipment carriers in industries replacing traditional conveyer belts. They also have domestic application and one of the interesting applications of this line follower robot is in health care management. As this smart line follower robot has obstacle detection capability it will not be damaged easily as it stops it motion till the obstacle is removed or till the path is changed. This ability of the robot increases it application especially in industries because obstacles are common in any workplace and if the robot is not able to detect the obstruction it will get damaged, so this gives an added advantage wherever this intelligent line follower is used.

Keywords: Aurdino, Ultrasonic Sensor, IR Sensor, Comparator

1.INTRODUCTION

The main aim of any robot is to reduce human effort. According to the purpose different types of robots are designed for practical applications. In any work environment proper monitoring is always needed for better results. This smart and intelligent line follower robot can be used in industries for carrying goods from one place to another. The main reason why this robot can be employed for transportation of goods is its fit and forget ability which means that once the robot is placed on the desired path the working of the robot is totally automatic, there is no need for controlling the robot manually. This is what makes the line follower robot more efficient and useful when compared to other conventional robots. A traditional obstacle avoiding robot cannot help in transportation of goods because there is no particular path for the robot. It will move randomly by avoiding the obstacles and will not reach the required decision. The movement of obstacle avoiding robot cannot be controlled. A WIFI controlled

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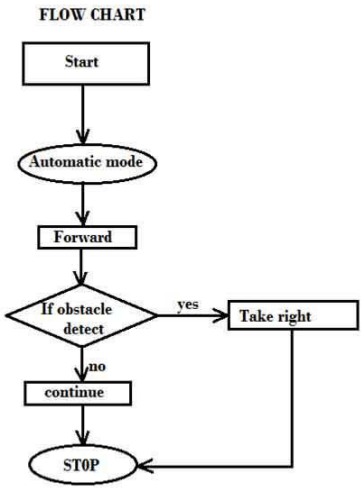
robot is also not helpful in real time applications because it needs manual operation. It can go in any particular direction and to any destination, but the main problem is it needs continuous manual commands, which limit its applications in all the workplaces. This conventional line follower robot can be made smart and intelligent by giving it the ability to detect obstacles. This improves the working of the line follower robot, because in any work environment obstacles are common, so if the line follower is not able to detect any obstacles on its path it will collide with it and will be severely damaged. Adding the features of obstacle avoiding robot to a traditional line follower robot prevents any damage to the robot. This intelligent robot can also be installed for health care management in hospitals, which decreases the human effort in monitoring patients and delivery things or medicines. The workers can be used for other tasks instead of transporting goods from one place to other which can be carried out with this smart and intelligent line follower robot.

2.WORKING PRINCIPLE

The ultrasonic sensor library has to be installed in Arduino IDE. In the program the both the IR sensors have to initialized. Four output pins of the motor have to be initialized. Three variables have to be declared, two for both the IR sensors and one for the ultrasonic sensor. [4] The two variables which are declared for the IR sensor will read the value of IR sensor1 and IR sensor2. The variable which is declared for the ultrasonic sensor checks for any obstacle till a mentioned distance. If the ultrasonic sensor detects any obstacle in its path all the motors should stop, the four output pins of the motor drive should be programmed as LOW, which means they should stop working. So, when an obstacle is detected by the ultrasonic sensor then the motors will stop, and the robot will stop till the obstacle is removed from its path. When no obstacle [5] and no black line is detected then the robot should move forward



FLOWCHART OF WORKING OF ROBOT

One pin on either side of the motor will be HIGH and the other two pins will be LOW. This makes the left and right motor to rotate in clockwise direction and hence the robot moves forward. When only left IR sensor detects black line then the robot has to turn left, for that only right motor has to work. When the left motor stops and the right motor is rotating in clockwise direction the robot will turn left. One pin of the right motor should be HIGH, and all the other pins should be LOW. When only right IR sensor detects

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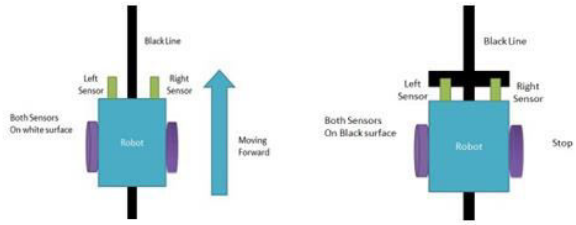
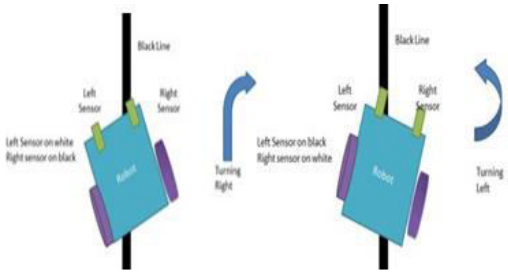
the black line then the robot has to turn right, for that only left motor has to work. When the left motor stops and the right motor is rotating in clockwise direction the robot will turn left. One pin of the left motor should be HIGH, and all the other pins should be LOW.



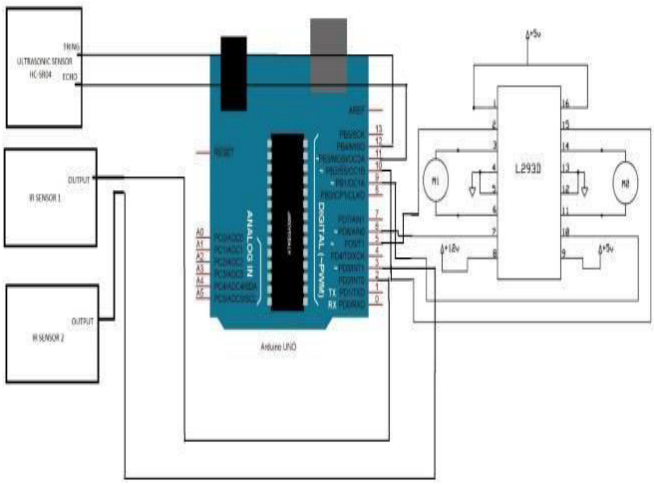
Forward Movement **Stop The Robot**

When both the sensors are on white surface then the robot moves forward and when both the sensors are on black surface then the robot stops. In this case both the sensors will detect the black line but the position where the sensors are located decides whether the robot will stop or will move forward.



Turning Right **Turning Left**

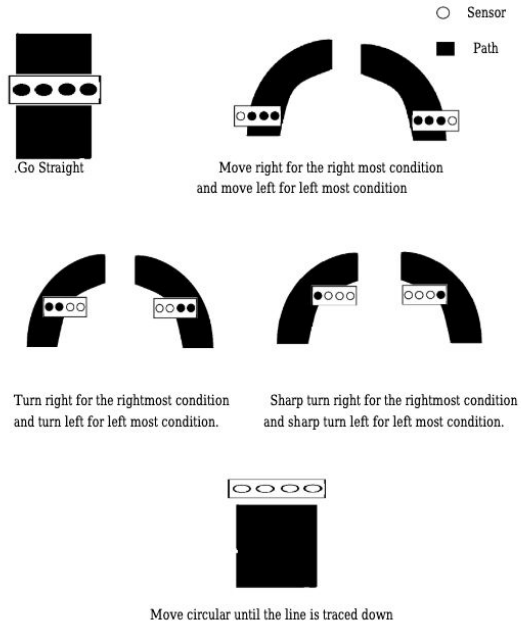
When the left sensor detects the black line and right sensor is not able to detect the black line then the robot has to turn left. When the right sensor detects the black line and left sensor is not able to detect the black line then the robot has to turn right.At any case if there is a black line then rotor has to stop.



Complete Block Diagram of the designed robot

3.PROCESS EXPLANATION

As shown in the data below, is a typical situation involved. At every sampled time the commands executed by the Arduino is also shown. From the below figure, it should be clear about the software requirements [5].



3.1 Arduino Working Logic

Thus totally the microcontroller gets 4 inputs from the sensor circuitry, to the (A3

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– A0) of Arduino to decide what to do when on the line. Below is the complete description about what each input mean and what needs to be done

Input				Output (PWM)		State In	Action
A0	A1	A2	A3	9	10		
0	0	0	0	255	255	All sensor in position	Go straight
1	0	0	0	255	191	Leftmost sensor is out of track.	Move right
1	1	0	0	255	127	Two sensor from the left is out of track	Turn right
1	1	1	0	255	64	Three sensor from the left is out of Track	Sharp turn right
0	0	0	1	191	255	Rightmost sensor is out of track	Move left
0	0	1	1	127	255	Two sensor from the right is out of track	Turn left
0	1	1	1	64	255	Three sensor from the left is out of Track	Sharp turn left
1	1	1	1	0	255	All sensor is out of track	Move circularly Until track is detected

3.2 PROGRAMMING AND SIMULATION

The program code acts as the decision-maker embedded in the micro-controller deciding about the outputs for particular set of inputs. The program is coded using Arduino® 1.65.and is then compiled to form a ".hex" file which can then be burnt into the Arduino. The output is also checked in simulation using Proteus® [6] .

4.RESULT & DISCUSSION

This project is an innovative idea of intelligent system which has basically line detection feature and will provide help in various fields like hospitals and service sectors. The sensors in this system are a type of infrared sensor that senses the line and gives the feedback to the microcontroller unit. The objective of the line following robot is to follow a line on its given path which is obtained for which it uses IR sensors which detects the line and sends the information to LM324 comparator and then to H bridge which controls the working of the wheel's Microcontroller controls the other operations.

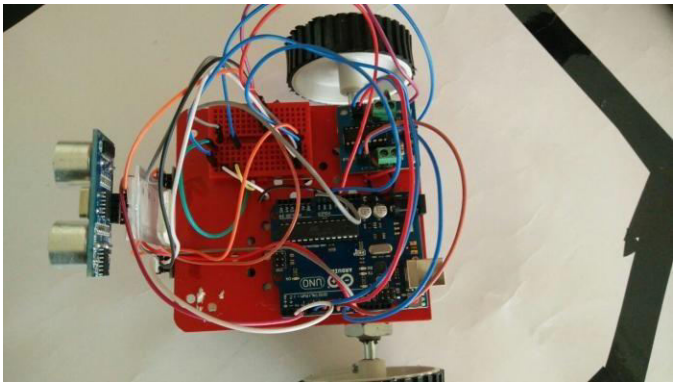

IMAGE OF FINAL PROJECT

The benefits of using the automation techniques in hospitals are as

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follows: The average nurse walks roughly 5 miles per shift of work. Much of this travel time is not spent travelling from one patient to the next to apply hands-on, bedside care. Unfortunately, most of the walking is spent in the pursuit of hunting for and gathering medical supplies, collecting and executing physician orders, and performing registration and discharge tasks. These routine and mundane tasks can be performed by robots now. Thanks to the robot solution, quality of care improves through efficiency.

Nurses can now claim more time during their shift to spend on patient care. In fact, the robot allows for a redefinition of 'patient care.' Whereas historically, gathering supp lies, coordinating meals and medications, and various forms of paperwork and documentation were considered 'patient care', now these administrative and logistical tasks can be defined and assigned to what they truly are. And nurses can get back to the highly-skilled interpersonal clinical tasks that they have been trained for, and that patients really need in order to heal. Quality of care improves through increased staff satisfaction. Medical errors have been a major cost to the healthcare delivery system. First and foremost, there is a human cost. Medical errors have caused death, dismemberment, and minor injuries.

5.CONCLUSION

The applications of the line follower are limited because it cannot be controlled. The only way to control the line follower is to change the path. Using WIFI module to control the line follower robot will not be helpful because more power will be consumed, so the battery will drain out quickly. Apart from these limitations smart and intelligent line follower robot can be used for long distance applications with a predefined path.

The Designed robot has five IR sensors, Arduino microcontroller board, and Adafruit motor shield. Arduino mainly controls the robot to follow the line. This line follower robot is the prototype of robots for industrial use. By studying this one can build line follower robot for industrial use. Performance can be improved by using good materials and great sensing power also improves motor movement. The setup cost of line follower robot majorly depends upon the expensive machinery, land, and building and round the clock staff to maintain and use that machinery. This robot will be able to handle more goods in a manufacturing process in less time with better accuracy as well as lower per capital cost.This smart and intelligent robot has more benefits because it doesn't consume much power. This robotic system can provide an alternative to the existing system by replacing skilled labor, which in turn can perform better tasks with accuracy and lower per capita cost.

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