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Obstacle Avoiding Robot: A Review

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Abstract: ***In today's world Robotics is a fast-growing and very interesting field. The concept of Robotics is now used in every sector whether it is in manufacturing industry, medical, transport etc. Obstacle avoidance is one of the features that is needed for the automated mobile robots. In this there is a robot that consist of Arduino UNO (Microcontroller) and sensor that detect presence of obstacles. Programming is done by the Arduino software. The ultrasonic sensor is highly accurate in detecting obstacles in the surroundings. This is a wheeled robot.***
Keywords: Obstacle, Robotics, Avoidance, Detection, Wheeled robot.

I. INTRODUCTION

Robotics is a part of today's communication & communication is a part of advancement in technology. There are different mobile robots that can be divided into several categories. These consists of wheeled robot, crawling robot and legged robot. This project consists of wheeled autonomous robot. Obstacle avoidance is the primary requirement of any autonomous robot. Obstacle avoidance allows robot to navigate in an unknown environment by avoiding collisions. Obstacle avoiding robot senses obstacles in its path, stops and then avoids it by turning in another direction. It then runs in that direction.

Robot navigates using various methods which are wall-following, edge detection, line following. One of the commercial systems uses the method of wall following for a floor cleaning robot for long hallways. A more general and commonly employed method for avoidance of obstacle is based on edge detection. There is one disadvantage of obstacle avoiding by using the method of edge detection which is that the robot has to stop in front of an obstacle in order to provide a more accurate measurement. Obstacle avoiding robot senses obstacles in front of it using sensors. A variety of sensors are available for this purpose which includes Infrared sensor, Ultrasonic sensors etc. Ultrasonic sensor is used to detect an obstacle ahead of it, and then it sends information to the Arduino (microcontroller). Its cost is low. If we use IR sensors, it detects the object's distance with infrared radiation. When the beam detects an object, the beam returns to the receiver. However, infrared sensors are sensitive to external light conditions. Their detection range is short.

II. LITERATURE SURVEY

"Obstacle avoiding robot-A promising one" has been developed by Md. Saddam Khan, Rakesh Chandra Kumar, Dinesh Kumar, Sarmistha Mondal, Rajesh Birua and Manas Kumar Parai. They proposed a robot that is able to do the basic walking movements using two gear motors. It is easily capable to sense the obstacle and by processing the signal it perfectly avoids the obstacle coming in between the path [1].

"Obstacle avoidance robot using Arduino" has been developed by Pavithra A C, Subramanya Goutham V. They developed a robot that detects and then avoids obstacles in its path which runs on Arduino platform for data processing. For obstacle detection, three ultrasonic sensors were used that provide wider field of detection. The robot is fully autonomous [9].

"Moving obstacle avoidance of a mobile robot using a single camera" has been designed and developed by Jeongdae Kim and Yongtae Do. They developed a moving obstacle detection method which is based on vision for the safe navigation of a mobile robot. The method can quickly detect movable obstacles like walking humans in an indoor space using a single camera. The camera is mounted on the robot for vision [4].

"Line follower and obstacle avoider robot" has been designed and developed by Darshan S, Chinnapu Charan Teja Reddy. They proposed to design a line follower and obstacle avoiding robot for autonomous navigation along a black line using the concept of IR sensors and Ultrasonic sensors. In case crossover comes, the robot will be able to choose the free path. To control the line follower robot, the only way is to change the path. The proposed can be controlled using WIFI module, but the power will be more consumed. So, there will be chances quick drainage of battery [7]. It can be used for very long distance applications with a predefined path.

"An Ultrasonic line follower robot to detect obstacles and edges for industrial rescue operations" has been designed and developed by Vicky Barua, Md. Arif Isteik Neloy, Shahid Uddin Rahat, Mithun Das, Md. Shafiul Islam Joy, Abhijit Pathak and Nazmun Nahar. They developed a prototype of robot for industrial use. Their robot is smart and intelligent and has more benefits as it does

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not consume much power. Their robot follows the pre-defined path(line), intelligently senses the obstacles and edge in its path. Then, it avoids the obstacle and navigates according to the behaviour that have been set for it [3].

"Path following, Obstacle detection and obstacle avoidance for thrusted Underwater snake robots" has been designed and developed by Eleni Kelasidi, Signe Moe, Kristin Y. Pettersen, Anna M. Kohl, Pal Liljeback and Jan Tommy Gravdahl. They designed and developed underwater snake robots (USRs) that can work underwater as the name implies. These robots are more maneurable and have better access capabilities due to their flexible and slender body. USRs are capable of energy transit over long distances, capable of performing light intervention tasks. They also propel themselves using energy efficient motion patterns. They were inspired from their biological counterparts. Thrusters were attached at tail module of the USRs. They have many essential qualities for autonomous underwater operations which includes efficient locomotion, flexible bodies and to perform intervention tasks. Computer vision algorithm is given to USRs to detect and to calculate position of potential obstacles [10].

III. COMPONENTS

A. *Arduino UNO*

Arduino is an open source electronics platform that is based on the easy-to-use software and hardware. Arduino board are able to read inputs (like light glowing on a sensor, a finger touched on a button, or a message of Twitter) and turn it into an output (like activating motors, turning on an LED, publishing some content online). We can tell our board what to do by sending a group of instructions to the microcontroller on the board. Over many years, Arduino has been the brain of hundreds and thousands of projects, from day-to-day objects to complex scientific instruments. It was developed at the Ivrea Interaction Design Institute, which aims to help students without a background in electronics and programming for fast prototyping. Thanks to its simple user experience, Arduino has been used in hundreds and thousands of different projects and applications. The software of Arduino is easy-to-use for beginners and flexible enough for advanced users. It runs on Mac, Windows, and Linux. There are many other microcontrollers and microcontroller platforms other than Arduino available for physical computing. Arduino has simplified the process of working with microcontrollers. It also offers some advantages for teachers, students, and interested amateurs over other systems. Arduino UNO is shown in Fig. 1.

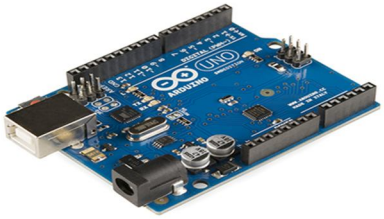


Fig. 1 Arduino Uno

B. *Ultrasonic Sensors*

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic waves, and then converting the reflected waves into an electrical signal. Ultrasonic waves travel way faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the receiver and the transmitter. The transmitter emits the sound using piezoelectric crystals and the receiver encounters the sound after it has travelled to and from the target.

To calculate the distance between the sensor and the object, the sensor measures the time taken between the emission of the sound by the transmitter to its contact with the receiver. Ultrasonic sensors are used firstly and commonly as proximity sensors. They can be found in an anti-collision safety systems and automobile self-parking technology. In comparison to Infrared sensors in proximity sensing applications, ultrasonic sensors are not as susceptible to interference of smoke, gas, and other airborne particles. Ultrasonic sensor is shown in Fig. 2.



Fig. 2 Ultrasonic Sensor (HC-SR04)

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C. Motor Driver IC

A motor driver is an integrated circuit chip. It is mostly used to control motors in an autonomous robot. Motor driver IC act as an interface between the motors in robot and the microprocessors in the robot. L293 series such as L293D, L293NE etc. are the most commonly used motor drivers. These motor drivers are designed to control two DC motors together. L293D consist of two H-bridge. H-bridge is the simplest of all circuits for controlling a low current rated motor. The L293D IC receives signals from the microprocessor and transmits relative signal to the motors. It has two voltage pins, one of which is used to apply voltage to the motors and the other is used to draw current for the working of the L293D. Motor Driver IC is shown in Fig. 3.



Fig. 3 Motor Driver (L298N)

D. Servo Motor

A servomotor is a linear actuator or a rotary actuator that allows for accurate control of linear or angular position, acceleration and velocity. It consists of a sensor coupled with motor for position feedback. It also requires a relatively sophisticated controller, designed specifically for use with servomotors. The servo motor is a simple DC motor. With the help of servomechanism, it is controlled for specific angular rotation. Now-a-days, servo motors are widely used in many industrial applications. In the obstacle avoiding robot, it is used for rotating the ultrasonic sensors. Whenever any obstacle comes in front of it, the robot detects it and stops and then after that servo motor rotates in both left and right directions. Along with the servo motor, the ultrasonic sensor which is mounted on it also rotates. Servo Motor is shown in Fig. 4.



Fig. 4 Servo Motor (Tower Pro SG90)

IV. WORKING

When the robot is powered on, both the motors of the obstacle avoiding robot will run normally and the robot will move forward. During this whole time, the ultrasonic sensor will be continuously calculating the distance between the reflecting surface and the robot. This information is processed by the Arduino from the sensor. If the distance between the robot and the obstacle are less than limit set in the Arduino, the Robot will stop and scans in right and left directions for new distance by using Ultrasonic sensor. If the left distance is more than the right distance, the robot will turn in left direction by commanding the left wheel to move in forward motion and the right wheel to move in backward direction.

Similarly, if the right distance is more than left distance, the robot will turn in right direction. The robot will not collapse with any obstacle.

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V. CONCLUSION

This project provides an obstacle avoiding robot that detects obstacles coming in its path and avoids it by moving in another direction. The robot is built with Arduino that processes the information to various parts. For object detection, ultrasonic sensors have been used that provides a wider field of view. Servo motor has been used for rotating the sensor. The robot is able to move by using two geared motors. It is perfectly avoiding the obstacles coming in its path.

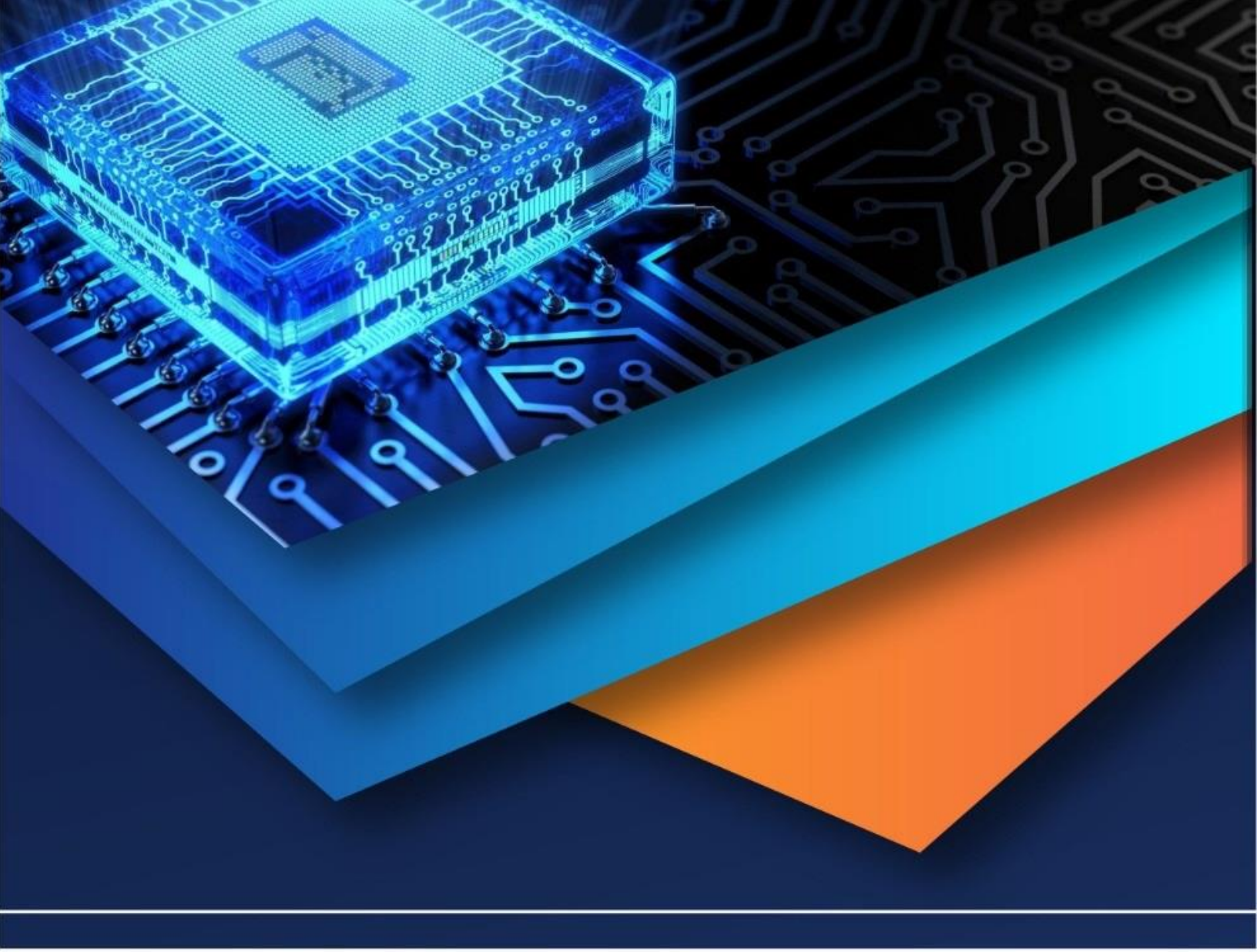
VI. FUTURE SCOPE

In the future, the sensing can be increased. A Bluetooth module and a camera can be attached, so that the user can see the obstacle and take pictures and also can take videos of it. As the sensor can detect only the obstacles with reflective surface, so in future work can be carried out to detect and avoid obstacles of absorbing surface.

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