International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

OBSTACLE DETECTION AND AVOIDANCE ROBOT

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ABSTRACT

This project describes about an obstacle avoidance robot vehicle which is controlled by IR sensor. The robot is made using IR sensor and it is controlled by Arduino microcontroller. IR sensor and IR sensor fixed in front portion of the robot vehicle. IR fixed on right if obstacle detected then robot will take left diversion. IR fixed on Left if obstacle detected then robot will take Right diversion. The sensor gets the data from surrounding area through mounted sensors on the robot. The sensor is sensing the obstacle and deviate its path to choose an obstacle free path. The sensor will be sending the data to the controller is compared with controller to decide the movement of the robot Wheel. The robot wheel movement and direction will be based on the sensing of the IR sensor and using a wheel encoder. This vehicle is used for detecting obstacle and avoiding the collision.

Keywords: Obstacle detection, IR sensor, Obstacle avoidance.

1. INTRODUCTION

The project is designed to build an obstacle avoidance robotic vehicle using IR sensors for its movement. An Arduino uno is used to achieve the desired operation. A robot is a machine that can perform task automatically. Robotics is generally a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions. The project proposes robotic vehicle that has an intelligence built in it such that it guides itself whenever an obstacle comes ahead of it. This robotic vehicle is built, using an Arduino uno. An IR sensor is used to detect any obstacle ahead of it and sends a command to the Arduino. In today's world robotics is a fast growing and interesting field. Robot has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot. The IR sensor is one of the best technique which is used for sense for obstacle. The IR sensor module "HC-SR04" works on "Echo" concept which is something you get when sound reflects back after reaches the surface. The travelling time of IR waves is 343m/s. This much of speed is meticulous for MCU's in microcontroller to measure accurately. Practically the waves reflect back from the surface located 4 meters away in 15 ns. The IR wave does not affect the humans. The IR sensor is mostly used for distance measurement application. These sensors are able to detect the barriers present in front of them. IR sensors generate sound waves with higher frequencies that humans cannot perceive, making them ideal for quiet environments. They do not consume much electricity, are simple in design, and are relatively inexpensive. With the advance of technology in term of speed and modularity, the automation of robotic system comes into reality. In this paper an obstacle detection robot system explained for different purposes and applications. an obstacle avoidance robot vehicle which is controlled by IR sensor. The robot is made using IR sensor and it is controlled by Arduino microcontroller. IR sensor fixed in front portion of the robot vehicle. The sensor gets the data from surrounding area through mounted sensors on the robot. The sensor is sense

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2. LITERATURE SURVEY

The application and multifaceted design of flexible robots are step by step building up every day. They are consistently advancing into authentic settings in different fields, for instance, military, clinical fields, space examination, and customary housekeeping [1]. Development being uncritical characteristic of adaptable robots in obstacle avoiding and way affirmation significantly influences how people react and see an independent structure. PC vision and range sensors are basic article recognizable proof systems used in versatile robots' ID. to operate an obstacle recognition system began as precisely on time as the barrier recognition system. 1980's [2]. Regardless of the way that, in the wake of testing these advances it was contemplated that the radar development was the most suitable for use as the other two advancement choices were slanted to environmental restrictions, for instance, storm, ice, vacation day, and earth. The measuring device approach was furthermore a monetarily sensible development each for this and what is to come back [3]. The sensors don't seem to be restricted to recognisable evidence of an obstacle. Different sensors can be used to eliminate various features for plant representation in plants, allowing a self-administering robot to provide the right fertiliser in the most ideal way, indicating different plants as explained by [4][5]. There are different IOT innovations in cultivating which incorporates gathering of ongoing information on current climate that incorporate nuisance invasion, mugginess, temperature, precipitation and so forth. At that point information that is being gathered can be utilized to mechanize the cultivating methods and can be educated on choice to extemporize amount and quality to decrease danger and squander, and limit the activities expected to keep up the harvests [6]. For model, ranchers currently can screen soil dampness and temperature of ranch from distant region and even apply the activities required for exactness cultivating [7]. 2. Methodology and Implement The procedure examined in this paper makes out of following stages. Furthermore, the detected information is taken care of two Arduino board lastly prepared by the Arduino programming [8]. The framework advancement required an Arduino UNO for handling the sensor (Echo IR sensor) information and flagging the actuator (DC engines) to impel. The Bluetooth module is required for correspondence with the framework and its parts [9].

Since the development of first robot by George Devol in 1954, robotics has been evolved so far rapidly in many fields. There are vast applications of robots in industrial and military work hence reducing manpower with the help of IOT and AI. In recent years robotics is also applied in security purpose or as surveillance robot in industries and military applications. According to the P. Parameswari et.al., 2014 [1], Zigbee transmitter and receiver was used to create a wireless robot. AT89S52 was the key microcontroller to control all the other sensors. LCD display was used to show the output. According to Jayant Patil, 2017 [2], Raspberry Pi was used to control the sensors, motor driver, LCD display and an external camera, while external wife module was used to create a Wi-Fi network. According to M. Ashok Kumar et.al., 2018 [3], Arduino UNO was used as the core microcontroller to control the devices while Nodemcu ESP8266 was connected to send the data of the sensors to cloud database. According to G. Anadravisekar et.al., 2018 [4], Arduino UNO was the controller used to control Wi-Fi module, sensors, camera and dc motor. External power supply was generated of 12 volts by connecting two 6-volt batteries. The evolution of the project was observed from microcontrollers to Arduino IDE and from Bluetooth module to ZigBee module further

extending to Wi-Fi module. We found that the Wi-Fi module would provide added security and added range of distance. The Nodemcu Esp8266 was found to be useful to be used as a Wi-Fi module and also the sensors can be integrated on it. While ESP32 cam which has integrated camera can be used for surveillance as well as for controlling the motor driver to control the directions.

Robot navigation problems can be generally classified as global or local, depending upon the environment surrounding the robot. In global navigation, the environment surrounding the robot is known and a path which avoids the obstacles is selected. In one example of the global navigation techniques, graphical maps which contain information about the obstacles are used to determine a desirable path. In local navigation, the environment surrounding the robot is unknown, or only partially known, and sensors have to be used to detect the obstacles and a collision avoidance system must be incorporated into the robot to avoid the obstacles. The artificial potential field approach is one of the well-known techniques which has been developed for this purpose. Krogh, for example, used a generalized potential field approach to obstacle avoidance. Kilm and Khosla used instead harmonic potential functions for obstacle avoidance. On the other hand, Krogh and Fang used the dynamic generation of sub goals using local feedback information. [5] During the past few years, potential field methods (PFM) for obstacle avoidance have gained increased popularity among researchers in the field of robots and mobile robots. The idea of imaginary forces acting on a robot has been suggested by Andrews and Hogan and Khatib. In these approaches' obstacles exert repulsive forces onto the robot, while the target applies an attractive force to the robot. The sum of all forces, the resultant force R, determines the subsequent direction and speed of travel. One of the reasons for the popularity of this method is its simplicity and elegance. [6] This paper introduces histogram inmotion mapping (HIMM), a new method for real-time map building with a mobile robot in motion. HIMM represents data in a two-dimensional array, called a histogram grid, that is updated through rapid in motion sampling of onboard range sensors. Rapid in-motion sampling results in a map representation that is well-suited to modeling inaccurate and noisy range-sensor data, such as that produced by IR sensors, and requires minimal computational overhead. Fast map-building allows the robot to immediately use the mapped information in real-time obstacle-avoidance algorithms. The benefits of this integrated approach are twofold: (1) quick, accurate mapping; and (2) safe navigation of the robot toward a given target. [7] Real-time obstacle avoidance is one of the key issues to successful application of mobile robot systems. All mobile robots feature some kind of collision avoidance, ranging from primitive algorithms that detect an obstacle and stop the robot short of it in order to avoid a collision, through sophisticate algorithms, that enable the robot to detour obstacle. The later algorithms are much more complex, since they involve not only the detection of an obstacle, but also some kind of quantitative measurements concerning the obstacle's dimensions. In our system the IR sensors are continuously sampled while the robot is moving. If an obstacle produces an echo, the corresponding cell contents are incremented. A solid, motionless obstacle eventually causes a high count in the corresponding cells. Misreading, on the other hand, occur randomly, and do not cause high count in any particular cell. These methods yield a more reliable obstacle representation in spite of the IR sensor's inaccuracies. [8]. Many definitions of the Internet of Things exist, but at the most fundamental level it can be described as a network of devices interacting with each other via machine to machine (M2M) communications, enabling collection and exchange of data [9], [10], [11]. This technology enables automation within a large range of industries, as well as allowing for the collection of big data. Hailed as the driver of the Fourth Industrial Revolution [12], Internet of Things technology has already found commercial use in areas such as smart parking [14], precision agriculture and water usage management. Extensive research has also been conducted into the use of IoT for developing intelligent systems in areas including traffic congestion minimization structural

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health monitoring crash-avoiding cars , and smart grids. While the aforementioned fields appear vastly different to healthcare, the research conducted within them verifies the plausibility of an IoTbased healthcare system. Existing systems in other fields have proven that remote monitoring of objects, with data collection and reporting are achievable. This can therefore be expanded and adapted for monitoring the health of people and reporting it to relevant parties such as caretakers, doctors, emergency services, and healthcare centers.

3. PROPOSED SYSTEM

This project describes about an obstacle avoidance robot vehicle which is controlled by IR sensor. The robot is made using IR sensor and it is controlled by Arduino microcontroller. IR sensor fixed in front portion of the robot vehicle. The sensor gets the data from surrounding area through mounted sensors on the robot. The sensor is sense the obstacle and deviate its path to choose an obstacle free path. The sensor will be send the data to the controller is compared with controller to decide the movement of the robot Wheel. The robot wheel movement and direction will be based on the sensing of the IR sensor and also using a wheel encoder. This vehicle is used for detecting obstacle and avoiding the collision.

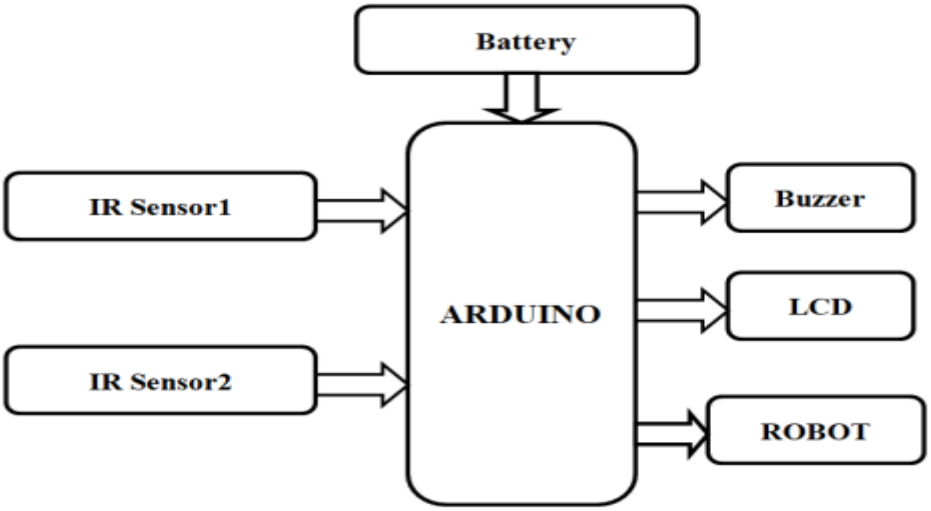


Fig. 1: Proposed system block diagram.

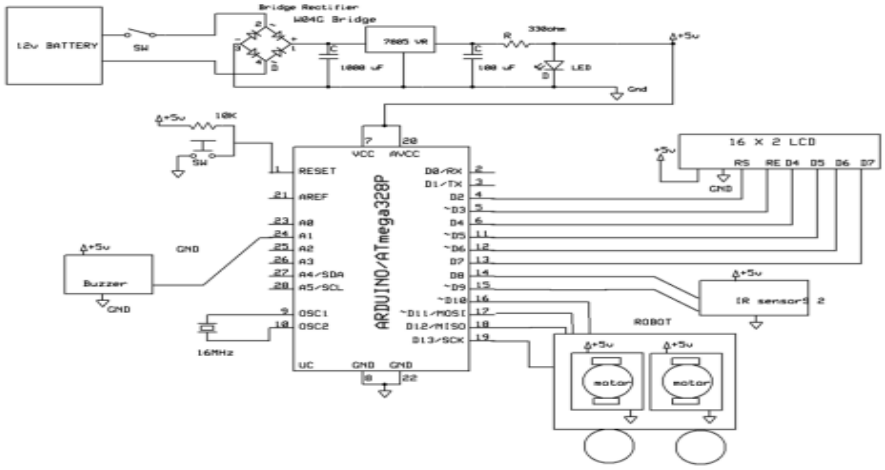


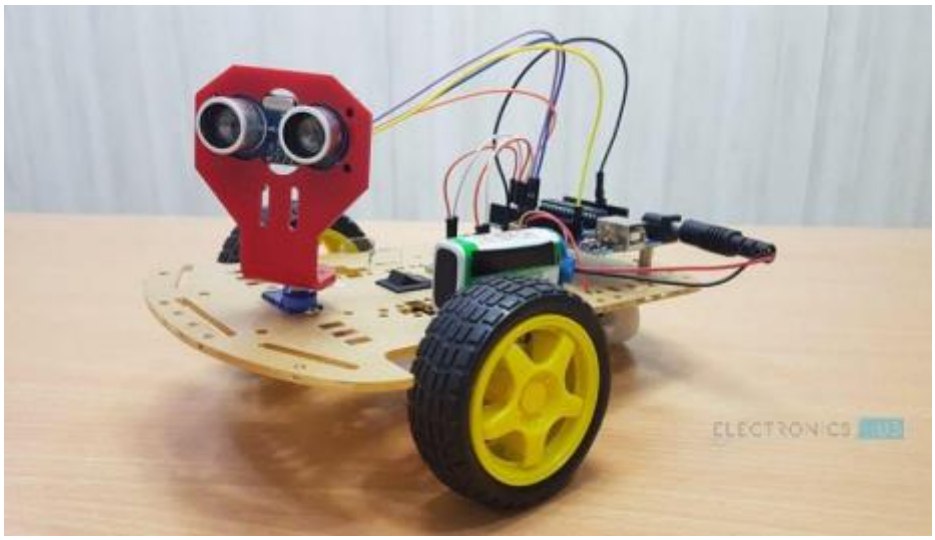
Fig. 2: Schematic diagram of proposed system.

Arduino controller, IR, IR sensors, L293D motor driver and DC motors. All these components are mounted on a motor chassis. If IR detect any object then robot tale turn to right. If IR detect any object then robot tale turn to left.,

The obstacle avoidance robotic vehicle uses IR sensors for its movements. A microcontroller of ARDUINO family is used to achieve the desired operation. The motors are connected through motor driver IC microcontroller.

The IR sensor is attached in front of the robot. Whenever the robot is going on the desired path the IR sensor transmits the IR and IR waves continuously from its sensor head. Whenever an obstacle comes ahead of it the IR waves are reflected back from an object and that information is passed to the microcontroller. The microcontroller 9 controls the motors left, right, back, front based on IR signals. In order to control the speed of each motor pulse width modulation is used (PWM). IR sensor and IR sensor fixed in front portion of the robot vehicle. IR fixed on right if obstacle detected then robot will take left diversion. IR fixed on Left if obstacle detected then robot will take Right diversion. The sensor gets the data from surrounding area through mounted sensors on the robot.

4. RESULTS



5. CONCLUSION AND FUTURE SCOPE

His project developed an obstacle avoiding robot to detect and avoid obstacles in its path. The robot is built on the Arduino platform for data processing and its software counterpart helped to communicate with the robot to send parameters for guiding movement. For obstacle detection. The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacle detect it check for other directions and moves where there is no obstacles it moves in forward direction, to sense the obstacle IR sensor is used.

Future Scope

- Adding Zigbee module
- Adding GPRS and GPS
- Adding Video camera for live streaming
- By connecting Bomb detectors and metal detectors
- Password protection
- Alarm phone-dialer

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