FABRICATION OF OBSTACLE AVOIDING ROBOT BY USING ULTRASONIC SENSOR

[1]**K. Revanth,** [1]**B. Bala Sesha Sai Ganesh,** [1]**B. Bhanu Sai,** [1]**B. Gowtham Satya Narayana,**

[2]**E. Siva Krishna**

[1]UG students, Department of Mechanical Engineering, NRI Institute of Technology, Pothavarappadu, Eluru District, AP, India, Pin: 521212
[2]Assistant Professor, Department of Mechanical Engineering, NRI Institute of Technology, Pothavarappadu, Eluru District, AP, India, Pin: 521212

Abstract : This project describes about an obstacle avoidance robot vehicle which is controlled by ultrasonic sensor. The robot is to made using ultrasonic sensor and it is controlled by Arduino microcontroller. Ultrasonic sensor fixed in front position of the robot vehicle. 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 ultrasonic sensor and also using a wheel encoder. This vehicle is used for no detecting obstacle and avoiding the collision.
KEYWORDS: Object recognition, neural network, unmanned vehicle, ultrasonic sensors.

I. INTRODUCTION:

The introduction obstacle avoidance is a primary requriment of any autonomous robot. Obstacle avoidance robot is design to aloe robot to navigate in unknown environment by avoiding collision. Obstacle avoidance robot sense obstacles in the path, avoid it and resumes it running. This robotic vehicle is built, using an Arduino uno. An ultrasonic sensor is used to detect any obstacles ahead of it and sends a command to the Arduino. This obstacle avoidance in robots can make them flexible in dangerous environments and continuous human monitoring is not required. And the robot gets the information from the surrounding area through mounted sensors on the robot.

II. LITERATURE REVIEW:

J. Murugananthem, et.al The detection and avoidance can be considered as the central issue in designing mobile robots .this technology provides the robots with senses which it can use to traverse in unfamiliar environments without damaging itself .An avoiding robot is designed which can detect obstacle in its path and maneuver around them without making any collision .It is a robot vehicle the works on Arduino microcontroller and employee IR sensors to detect obstacles[1]. Pavithra A C, et,al The project is design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement. A microcontroller (ATmega328) is used to achieve the desired operation. A robot is a machine that can perform task automatically or with guidance. The project proposes robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path[2]. Vaghela Ankit, et.al Now day's many industries are using robots due to their high level of performance and relibility and which is a great help for human beings. The obstacle avoidance robotics is used for detecting obstacle and avoiding the collision. This is an autonomous robot[3]. BalaKrishna K, et.al Obstacle detection and avoidance is one of the most challenging problems in the design of mobile robots. Without it, a robot movement would be very limited and flimsy. The obstacle detection and avoidance is like a built in intelligence that grants the robot the senses[4]. Sampat Kr. Ghosh et.al.,discussed about Rubbish management is a critical problem that needs to be handled due to the world's population of over seven billion people and the over two billion metric tonnes of waste it produces annually. All of this material needs to be managed to prevent an overflow at the neighborhood's trash cans, which could result in dangerous infections and contamination. In order to solve this issue, we suggest in this study a method for automatically gathering the waste using a line follower robot and disposing of it in the dis [5]. Santhosh Kumar et.al.,according to him In this paper, new developments in patient monitoring are proposed. The healthcare programme has placed a strong emphasis on the continuous monitoring of patient health metrics like body temperature and pulse using a web server so that a doctor can check on the patient's condition on his cell phone while online. If any sensor value reaches a fundamental abnormal value, the doctor can get the data whenever needed from any location without having to be physically there.[6]. R.Vairavan,et.al This project describes about an obstacle avoidance robot vehicle which is controlled by ultrasonic sensor. The robot is made using ultrasonic sensor and it is controlled by Arduino microcontroller[7]. Arjun Varma,et.al The ultrasonic sensor is used to determine the distance of the obstruction using SONAR. Ultrasonic waves are transmitted by the ultrasonic sensor which, when hits an obstruction bounces back.[8]. Marco Claudio De Simone ,et.al Artificial intelligence is the ability of a computer to perform the functions and reasoning typical of the human mind. In its purely informatic aspect, it includes the theory and techniques for the development of algorithms that allow machines to show an intelligent ability and/or perform an intelligent activity, at least in specific areas[9]. Yiran Wang et.al.,according to him An intelligent robot with automatic line patrol, positioning and parking, real-time range, colour recognition, and object block transmission capabilities is introduced in this study. The Arduino MCU controls the H bridge drive motor, enabling the intelligent automobile to

perform steering, forward, and backward motions. The article describes the circuit test, hardware debugging, PCB designing, code enhancement, and overall structure design in the design process. The robot is able to carry out standard line patrol, parking, range, colour identification, and block delivery, it is concluded. [10].

III. WORKING PRINCIPLE :

The robot uses ultrasonic sensors to detect the obstacle, as shown in fig.1., and motor drive is used to drive the motor according to the ultrasonic signal.

1. ULTRASONIC SENSORS: The ultrasonic sensor has a signal generator and a receiver. The signal generator generates an ultrasonic wave and transmits in the forward direction. The transmitted Wave strikes any obstacles in the path and a huge part of it gets reflected. It receives the reflected rays. The distance of the object is calculated on the basis of the time taken by the wave in the process of transmission, reflection and collection.

2. ARDUINO: In this project, to avoid the obstacle in the path, a condition is put in the system which says: if the distance between the robot and the object gets below a certain level, stop the robot and take a backward motion and then turn the robot into other direction and continue the loop. This logic is applied to the system by writing the code in the Arduino.

3. MOTOR DRIVE: We now have the conditions set up for the robot car but it needs to be executed/implemented on the hardware. The hardware used is the DC motor. To drive these DC BO Motors, we need motor driver. In this project we are using L293 motor driver.

4. L293 motor driver: We now have the conditions set up for the robot car but it needs to be executed/implemented on the hardware. The hardware used is the DC motor. To drive these DC BO Motors, we need motor driver. In this project we are using L293 motor driver. Motor driver is used to send the commands to motors according to signal received from Arduino.

5. BO Motors: Two motors are used in this process: left motor and right motor. To move the robot car forward, both the motors are turned on. For backward step, both motors need to run in opposite direction. To turn the robot car to avoid obstacle, one of the motor is reversed for a while, keeping the other motor forward.
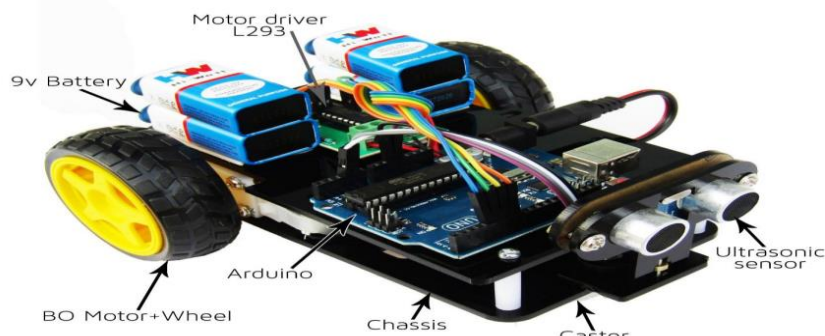

Fig. 1: Description of Obstacle Avoiding Robot

IV. METHODOLOGY :

1.DESIGN AND PLANNING: We determined the specific requriments and specifications for the robot, such as size, weight, power requriments, and sensor capabilities.

2.BUILDING THE ROBOT: Assembled the hardware components and test them to ensure they are functioning properly.

3.PROGRAMMING: We written the code for the robot control system, including the obstacle detection and avoidance algorithms.

4.ESTING AND DEBUGGING: Test the robot in various environment and debug the issue that arise.T

V. MATERIALS:

ULTRASONIC SENSORS: When wanting to measure distance between a moving object and obstacles that may appear around it ultrasonic sensors are a good alternative. Ultrasonic sensors measure distance by transmitting pulses of ultrasonic soundwaves which propagates through the air and is reflected and received by the sensor when there is an object in front of them. If there is an object in front of the sensor, the soundwaves reflect and returns to the receiver. One problem with them is that if the object in front of the sensor is tilted relative to the sensor's transceiver, only such a small amount of the soundwave will be reflected back to the sensor that the object won't be detected as shown in figure 1.1. This can also cause problems with the measured distance, if the area where the soundwaves hit the object is a little bit tilted the distance may be detected as longer or shorter than it. It is divided by two because the time is measured from when the signal is transmitted from the sensor to when it is received and in that time the soundwaves have traveled the distance twice, back, and forth as shown in figure 2.

Fig.2:Ultrasonic sensors

2.SERVO MOTOR: Servo motors are simple electric motors that offers closed-loop position control. They are controlled by a signal, also known as Pulse Width Modulation. PWM is a technique where digital control is used to create a square wave, which is a signal that switches between full on and full off. From PWM you get analog results with digital means. It simulates different voltages between full on and full off depending on the portion of time that the signal spends on versus off. If the on-off pattern is repeated fast enough, it will appear as if the signal is a steady voltage . The servo motor provides control of linear or angular position, velocity and acceleration. They differ from each other in how many degrees they can rotate and how much they can torque. Servo motors have many different applications, such as robotics, printers and automatic door openers as shown in figure 3.

Fig.3: Servo motor

3.MICROCONTROLLER: A microcontroller is a small computer with most of the required support chips available. They are often embedded inside other devices and can therefore control features and actions of the product. The microcontroller controls the device by taking its input and sending signals to different components in the device . The microcontroller consists of a microprocessor and the primary memory connected to a system bus. The microprocessor contains the Central Processing Unit. Microcontroller [cpu] with the Arithmetic Logic Unit (ALU), it is the CPU that executes programs. The cache memory can also be found in the microprocessor, this is where the next operation is stored. The system bus is the primary pathway between CPU and memory, this is where addresses, data and control signals are transmitted. RAM means that access to a memory cell is not sequential, which means that it takes just as long to retrieve the information no matter what memory location it is on. It is a very fast component that temporarily stores information that is needed in the moment and near future these types of memories keep its content regardless of whether or not it has power as show in figure 4.

Fig.4:Micro controller.

VI. FABRICATION:

In this project we make a obstacle avoiding robot by using ultrasonic sensor, first we arranged the 2 motors and inner wheel on the one side (bottom) of the chassis board by using the screws and the connectors.

1. And on the other side (Top) of the chassis board placed the motor driver, Arduino Uno, microcontroller, jumper wires, switch, and batteries -12v(4no's) by using the double-sided tape.
2. In front of the chassis (at the inner wheel side) ultrasonic sensor are placed. Distance between the sensor is depends on tape width.
3. And then given the circuit connection to the motor driver and Arduino Uno by using the jumper wires.
4. And then motor cables and battery cables are connected into motor driver and the IR sensor cables are connected into the Arduino Uno.
5. And totally switch is connected to the battery and motor driver for control the power to the robot as shown in figure.5.

Fig.5: Obstacle avoiding robot.

The following connections have been given to develop and get the robot to function.

1. **Motor Driver connection:**

Vin → 9v Battery (+)ve
G → 9v Battery (-)ve
Motor2 → Left Motor connection
Motor1 → Right Motor connection
M1a and M1b → Arduino 7 and 6 (If motor runs in wrong direction, connection is swapped) M2a and M2b → Arduino 5 and 4 (If motor runs in wrong direction, connection is swapped)

2. Ultrasonic connection:
Gnd: Arduino GND
Echo: Arduino A2
Trig: Arduino A1
Vcc: Arduino 5V

3.Programming Arduino UNO:
1. Download and Install the Arduino Desktop IDE
2. Download and paste NewPing library (Ultrasonic sensor function library) file to the Arduino libraries folder.
• Paste files to the path (Example) - C:\Arduino\libraries 3. Write Arduino code for the robot functioning 4. Upload the code to the arduino board via a cable.

VII. RESULTS AND DISCUSSION:

1.Result:

The result is obtained for obstacle avoidance robot using Arduino, if the robot moves forward if any obstacles detect it check for other direction, to sense the obstacle IR sensor is used servo o motor to rotate the IR sensor .the robot is fully autonomous and after the initial loading of the code ,it requires no user intervention during its operation. When placed in unknown environment with obstacle with avoiding all obstacles with considerable accuracy. In order to optimize the movement of the robot ,we have many consideration for improvement However, most of these ideas will cost more money and time as well.

2.Discussions:

The goal of this project was to answer the research questions and to build an autonomous obstacle avoiding robot. Even though some improvements could have been made if we have had more time we are happy with the results. The bottom plate could have been designed in a way that better fits the servo motors. A chassis that fits the bottom plate could have been created to hide the jumper wires and some of the components. This would also give a better overall impression of the construction. If the sensors had been attached closer to the ground, at the same height as the bottom plate or below it, it would have been possible for the robot to identify objects with a height less than 5 cm.

VIII.CONCLUSION:

Obstacle avoidance capability needs to be considered when designing mobile robots for different applications. The low cost ultrasonic sensor for mobile robot is aim to design and implement a helpful tool that improves the ability of mobile robot to avoid obstacle successfully. A series of test were done to check the reliability of the system. In our experiment the ultrasonic distance sensing element was accustomed to offer a large field of detection. Which can be implemented on mobile robots both remotely controlled and also on autonomous mode, once in the autonomous mode, the initial loading of the code needs no user intervention throughout its operation. When it is placed in an unknown setting with obstacles, it runs while avoiding all obstacles with significant accuracy. Result demonstrated high accuracy of the ultrasonic sensor to avoid obstacle.

IX.REFERENCES:

[1] J. Murugananthem, S. Dhivya, S. Nandhini, P. Narmatha, and K. Ramya, "An Obstacle Avoiding Robot Vehicle," vol. 7, no. 2, pp. 305–306, 2021.

[2] A. C. Pavithra and S. G. V, "Obstacle Avoidance Robot Using Arduino," vol. 6, no. 13, pp. 1–4, 2018.

[3] V. Ankit, P. Jigar, and V. Savan, "Obstacle Avoidance Robotic Vehicle Using Ultrasonic Sensor , Android And Bluetooth For Obstacle Detection," pp. 339–348, 2016.

[4] K. Balakrishna, "Obstacle avoiding robotic vehicle with arduino and ultrasonic sensor," vol. 6, no. March, pp. 6888–6898, 2022.

[5] Sampat Kr. Ghosh, Shaikh Sahil Ahmed, Rohit Sunil "Fully Automated Waste Management System Using Line Following Robot" National Institute of Technology Karnataka, Springer, Singapore, Print ISBN 978-981-16-1341-8, Online ISBN 978- 981-16-1342-5, PP no : 330-332, December 2021.

[6] Santhosh Kumar M.S, "Modern Healthcare System Using Line Follower Robot", International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), Vol. 5, Issue 4, ISSN 2394-3777 -Print, ISSN 2394- 3785 -Online, April 201

[7] R.vairavan, S.ajith kumar, L.shabin ashiff, C.godwin jose,obstacle avoidance robotic vehicle using ultrasonic sensor, arduino controller, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 02 |,www.irjet.net p-ISSN: 2395-0072, Feb-2018

[8] A. Varma, A. Ashwath, A. Verma, A. Bagubali, and K. V Krishnan, "Implementation of Obstruction Avoiding Robot using Ultrasonic Sensor and Arduino UNO," no. 4, pp. 7335–7339, 2019.

[9] M. C. De Simone, "Obstacle Avoidance System for Unmanned Ground Vehicles by Using Ultrasonic Sensors," no. 2017, 2018.

[10] Yiran Wang*,Jiaqi Wang, Yu Pu, Xinchen Li "Multifunctional intelligent line-following Robot" Beijing, Vol.7 (2022) 3Rd Publication, Augus Cromell, Guilin city, China, Print ISBN 978-1-62437-509-5, July 2022.