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Multiple Obstacle Overcome rover with Smart Indicators

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ABSTRACT: Trajectory planning is one of the most important pivotal point in pick and place tasks done by robotic manipulators. In this work, we have presented a robot, which is compact, autonomous and fully functional. This robot or a smart car is built to sense any obstacle in its path, to avoid it and resume its running involving the pre-computation of an obstacle free path and along with smart indications would add on in preventing obstacles and overcoming them smartly. Ultrasonic sensors were adapted to implement a real-time obstacle avoidance system for wheeled robots, so that the robot can continually detect surroundings, avoid obstacles, and moves away from the obstacle free area. This model has tremendous applications in vacuum cleaners, avoiding concealed paths, parking systems and in other isolated environments. We use an Arduino UNO with a Motor Driver L298N, Servo Motor along with DC Motors to make the car, and for sensing we incorporate three Ultrasonic Sensors one at the front and two at the edges which accurately and efficiently detects any obstacles in the smart car's path. The Arduino is coded such that the smart car moves backward when an obstacle arises in front of it and moves away from the obstacle free area. Throughout the construction of this model, we educated ourselves to the Arduino coding language, the Motor Driver functionality, and comprehensively, with the working of an ultrasonic sensor and its features. In conclusion, through this project, we aim to construct a model of a smart car that is beneficial to the quotidian problems of the present generation.

KEYWORDS: Multiple Obstacle Avoidance, Smart Indicators, Path Retaining, More Area Coverage

I. INTRODUCTION

Robotics is part of Today's communication. In today's world ROBOTICS is fast growing and interesting field. It is simplest way for latest technology modification. Now a day's communication is part of advancement of technology, so We decided to work on ROBOTICS field, and design something which will make human life simpler in today aspect. An autonomous robot car is a robot that is capable of moving on its own in an unknown and unstructured environment. An autonomous robot car is equipped with software intelligence to sense its environment, detect obstacles in its path and move around an unknown environment overcoming the obstacles. There are many robotic designs that are employed in designing of autonomous robots. These designs are usually developed considering the physical environment in which the robot has to be deployed. There are autonomous robots like snake robots, walking robots, autonomous drones and autonomous robotic cars or rovers.

This ROBOT CAR has sufficient intelligence to cover the maximum area of provided space. It has an ultrasonic sensor which are used to sense the obstacles coming in between the path of ROBOT CAR.

It will move in a particular direction and avoid the obstacle which is coming in its path. The main motto of designing such type of Robot car or the technology is that this technology can be used in today's very fast transportation to avoid



the accident generally happen in congested by applying emergency break. If we use this technology in the car or any vehicle, it will automatically sense the obstacles then it will take a side to the available free space. An obstacle may be a living things or any object.

Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. Thus, by using this technology in vehicles we make the drive safe.

II. LITERATURE SURVEY

We reviewed different obstacle detecting robot mechanism that have been built by a lot of students and other practitioners that are in existence. For an autonomous robot performing a navigation based task in a vague environment, to detect and to avoid encountered obstacles is an important issue and a key function for the robot body safety as well as for the task continuity. Obstacle detection and avoidance in a real world environment that appears so easy to humans is a rather difficult task for autonomous robots and is still a well research topic in the robotics. In many previous works, a wide range of sensors and various methods for detecting and avoiding obstacles robot purpose have been proposed. Good references related to the development sensor systems and proposed detection and avoidance algorithms can be found. Based on these developed sensor systems, various approaches related to this work can be grouped.

[1] In OBSTACLE AVOIDING ROBOT- A PROMISING ONE of 2013 by authors RAKESH CHANDRA KUMAR, MD SADDAM KHAN, DINESH KUMAR, RAJESH BIRUA, SARMISTHA MONDAL, MANASKR. PARA. It can be concluded that in this paper, authors proposed a promising robot who overcome the obstacle in comes between the robot and the path. To sense the obstacles, they have used Infrared Sensor. It takes Left-Right turns to avoid the obstacle using 2 built gearmotors on the wheels.

[2] In OBSTACLE AVOIDANCE ROBOT USING ARDUINO of 2018 by authors PAVITHRA A C and SUBRAMANYA GOUTHAM V. It can be concluded that in this paper, authors built a robot car on the Arduino platform for data processing and control the car without driver. In this system, the robot detects the obstacle and avoid it. They have used 3 ultrasonic sensors which will give them a wider range and servo motor attach to front ultrasonic sensor which rotate it.

[3] In OBSTACLE AVOIDING ROBOT USING ARDUINO of 2021 by authors CH VINAY KUMAR, B RAKESH, S SHYAM, MANJULA. It can be concluded that in this paper, authors proposed the system in such a way Obstacle Avoiding Robot which is runs on Arduino Uno who controls the robot and detect obstacle in its path using an ultrasonic sensor and overcome it. They used servo motor to rotate the ultrasonic sensor.

[4] In AUTONOMOUS OBSTACLE AVOIDANCE ROBOT using IR Sensors Programmed in Arduino UNO of 2021 by authors R V NANDITTA, ATTREYA VENKATESAN, ROHIT R.1, R. GOWTHAM, NAGULASH RAHUL B, NIRAB KUMAR DAS, J DANIEL GLAD STEPHEN. It can be concluded that author proposed system in such way that they built Autonomous Robot who overcome obstacles in its path. They have installed two Infrared Sensors one in left who sense the left side obstacle and vice versa.

[5] In OBSTACLE AVOIDING ARDUINO VEHICLE of 2020 by authors ANITA DUVEY, CHANDESH CHAUBE, SATISH RANBHISE. It can be concluded that in this paper, authors proposed the system in such a way Obstacle Avoiding Vehicle which is runs on Arduino Uno implemented in C++ programming language on Arduino software platform who controls the robot and detect obstacle in its path using an ultrasonic sensor and overcome it. They used servo motor to rotate the ultrasonic sensor.

[6] In OBSTACLE AVOIDING ROBOTIC VEHICLE USING ARDUINO of 2020 by authors AKRATI PITHODE, NEHA VERMA, VAISHNAVI BHANGE, HARSHA WAGADRE, RIYA RATHORE, AMEY JOSHI. It can be concluded that in this paper, authors proposed a robotic vehicle which detects obstacle using ultrasonic sensor and avoid it. The servo motor helps the ultrasonic sensor to cover wider range for detection. They have used 4 DC Motor in their vehicle.

III. PROPOSED METHODOLOGY

The features introduced in our project is that it detects multiple object and overcome it effectively. The Rover have also improved the Accuracy of obstacle detection. As compared to the previous projects it has also increased the obstacle

detection area. We have introduced the new feature in our project i.e. Introduction of Smart Indicators. The Rover retains its original path after overtaking the obstacle is one of the most important benefit in it. The robot is basically Arduino based obstacle detecting robot. At the initial stage the robot starts and follows the path. The obstacle in its path are detected by ultrasonic sensors and robot initially stops. Robot then finds the suitable path to overtake the obstacle. Robot overtakes the obstacle and retains its original path.

IV. FLOWCHART

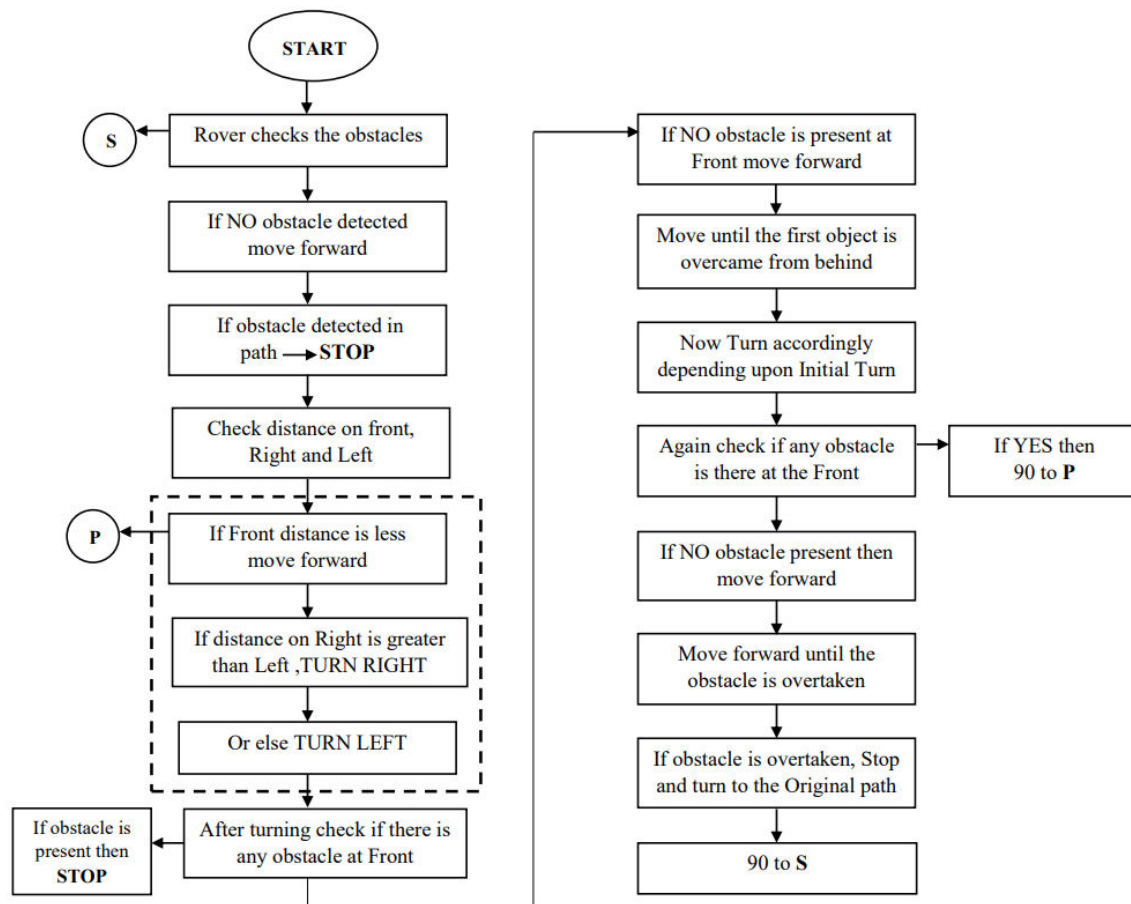


Fig 1: Flowchart of the System

V. ARCHITECTURE DIAGRAM OF THE SYSTEM

The Architecture diagram of the system is as follows which contains the components such as Ultrasonic Sensors, Battery, DC Motor, Switches, Servo Motor, Motor Driver L298N, LED. The main component of our system is Arduino UNO.

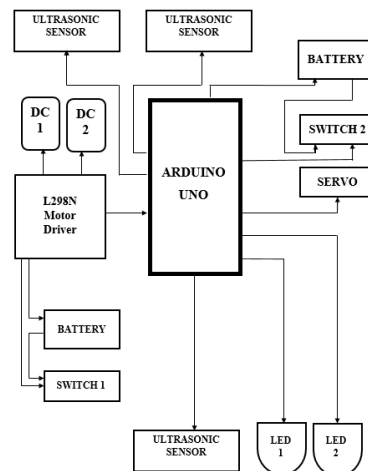


Fig 2. Architecture Diagram of the System

VI. CIRCUIT DIAGRAM

The circuit consists of the Arduino UNO as a microcontroller Connected to the other components such as L298N motor driver, Ultrasonic sensors, a Servo motor, LED's and a battery. The motor Driver is used to drive two 9v dc motors, Ultrasonic sensors are used in order to detect the obstacle at the specified distance, Servo motor is attached with one of the ultrasonic sensor on the top that rotates on the given input angle to cover the maximum area of obstacle detection, and the LED's connected are used as indicators during the turning of rover.

The motor driver has its own connections to the Arduino and to the two 9v dc motors. The Dc motors are connected to the ports provided on the motor driver board. The Dc motors can be controlled using the signals sent to the motor driver by the Arduino depending upon the code uploaded. The Speed control pins ENA and ENB are connected to Arduino pin number 3 and 11 respectively to control the rotation speed of Dc motors on board. IN1, IN2, IN3, IN4 pins on the motor driver are the direction control pins for the dc motor and are connected to the pin number 5, 6, 7 and 8 on the Arduino respectively. The motor driver is powered with a 12v rechargeable battery which is attached to a switch to control the switching of motor driver on demand.

The 3 ultrasonic sensors that are connected to the Arduino sense the obstacle at the input distance given in the code and the rover acts accordingly. The sensor number 1 is connected to the Arduino with trigpin on pin 4 of Arduino, the echopin on pin 2 of the Arduino digital pins, VCC to 5v of the Arduino and ground to the ground of Arduino. Similarly, for sensor 2 and sensor 3 the echopin and trigpin connections are:

sensor2=>echopin-9, trigpin-10

sensor 3=>echopin-12, trigpin-13

and the VCC and ground connections are similar to sensor 1.

The servo motor is connected to the Arduino on pin number 1 with VCC and ground terminals connected respectively.

The LED 1 is connected to the analog pin A1 of the Arduino and LED 2 is connected to the Analog pin A3 of the Arduino. The ground terminals of both the LEDs are grounded by making the analog A0 and A4 terminals as low due to lesser availability of ground terminals on Arduino board.

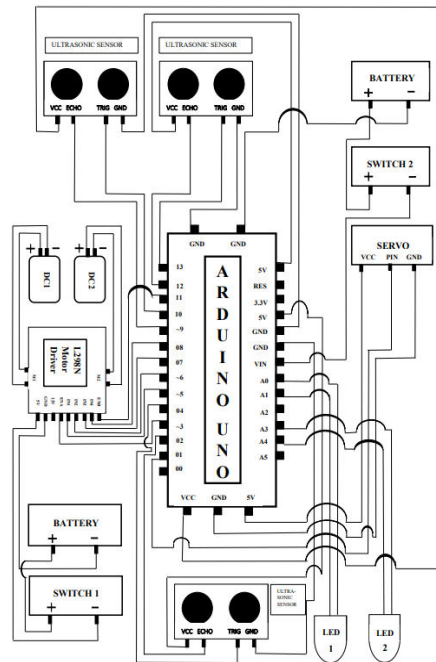


Fig 3. Circuit Diagram

VII. RELATED WORK

1. Multiple Obstacle Overcome (Left Case)

The rover starts on the initial path at the beginning. The rover detects the obstacle in its original path of travel at the distance of 40cm. The rover hence stops on detecting the obstacle. It then checks the obstacles on its right and left. On the right side the rover has the obstacle at the distance less than 0 or equal to 40cm. Hence the rover chooses to travel to left hand side and overtakes the initial obstacle in its path accordingly. Once the rover has travelled sufficient distance to overtake the obstacle, the rover takes the right turn and moves ahead. In its path if the rover detects the obstacle at any point before coming onto its initial path of travel, the rover again follows the same procedure to retain its path. At the end when the rover overtakes the second obstacle the rover turns right and gets back to its original path.

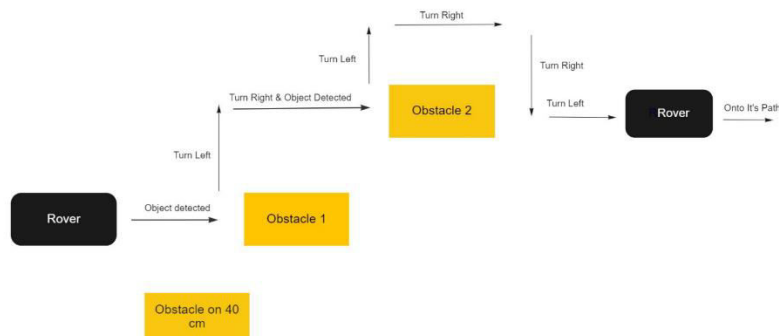


Fig 4: Multiple Obstacle Overcome (Left Case)

2. Multiple Obstacle Overcome (Right Case)

The rover starts on the initial path at the beginning. The rover detects the obstacle in its original path of travel at the distance of 40cm. The rover hence stops on detecting the obstacle. It then checks the obstacles on its right and left. On the left side the rover has the obstacle at the distance less than 0 or equal to 40cm. Hence the rover chooses to travel to right hand side and overtakes the initial obstacle in its path (from behind) accordingly. Once the rover has travelled sufficient distance to overtake the obstacle, the rover takes the left turn and moves ahead. In its path if the rover detects the

obstacle at any point before coming onto its initial path of travel, the rover again follows the same procedure to retain its path. At the end when the rover overtakes the second obstacle the rover turns left and gets back to its original path.

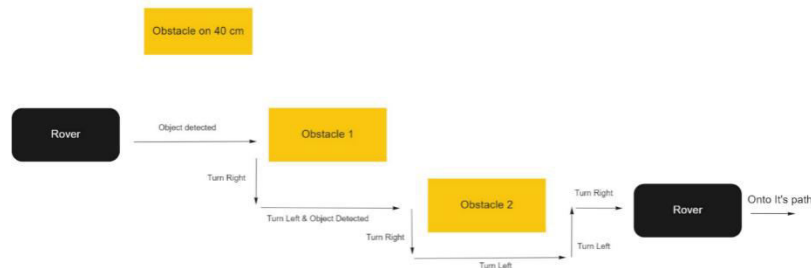


Fig 5: Multiple Obstacle Overcome (Right Case)

3. Single Obstacle Overcome (Left Case)

In this case rover begins with travelling onto its original path. Once the rover detects the obstacle at the distance of 40 cm or less, it stops. After the detection the river then check the obstacles on the right and the left. The obstacle which is at the greater distance, is the side rover chooses to move. In this case the obstacle on the left hand side is the distance greater than 40 cm hence the rover chooses to travel on that path. Once the rover overtakes the initial obstacle from behind the rover takes the right turn accordingly. The rover then travels forward until it has not overtaken the obstacle sideways. Once the obstacle is overtaken the rover turns right onto its original path of travel.

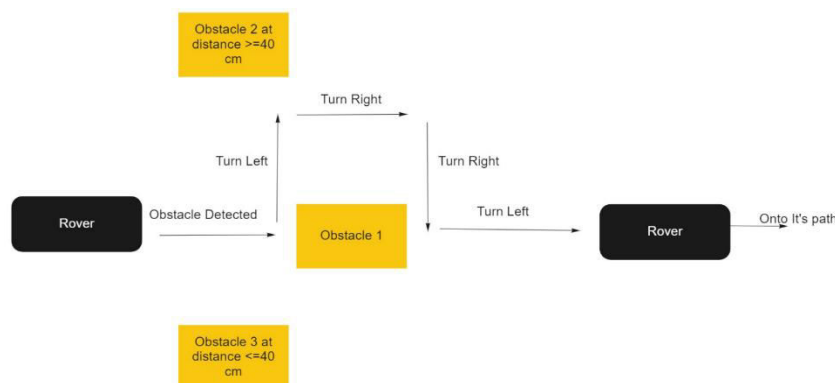


Fig 6: Single Obstacle Overcome (Left Case)

4. Single Obstacle Overcome (Right Case)

In this case rover begins with travelling onto its original path. Once the rover detects the obstacle at the distance of 40 cm or less, it stops. After the detection, the rover then checks the obstacles on the right and the left. The obstacle which is at the greater distance, is the side rover chooses to move. In this case the obstacle on the right hand side is the distance greater than 40 cm hence the rover chooses to travel on that path. Once the rover overtakes the initial obstacle from behind the rover takes the left turn accordingly. The rover then travels forward until it has not overtaken the obstacle sideways. Once the obstacle is overtaken the rover turns left onto its original path of travel.

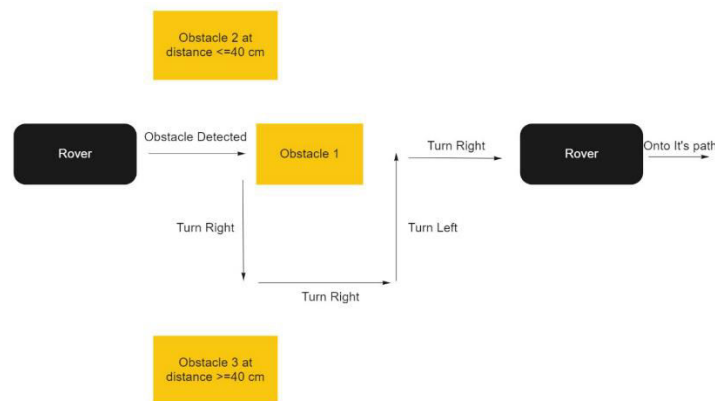


Fig 7: Single Obstacle Overcome (Right Case)

VIII. EXPERIMENTAL RESULTS

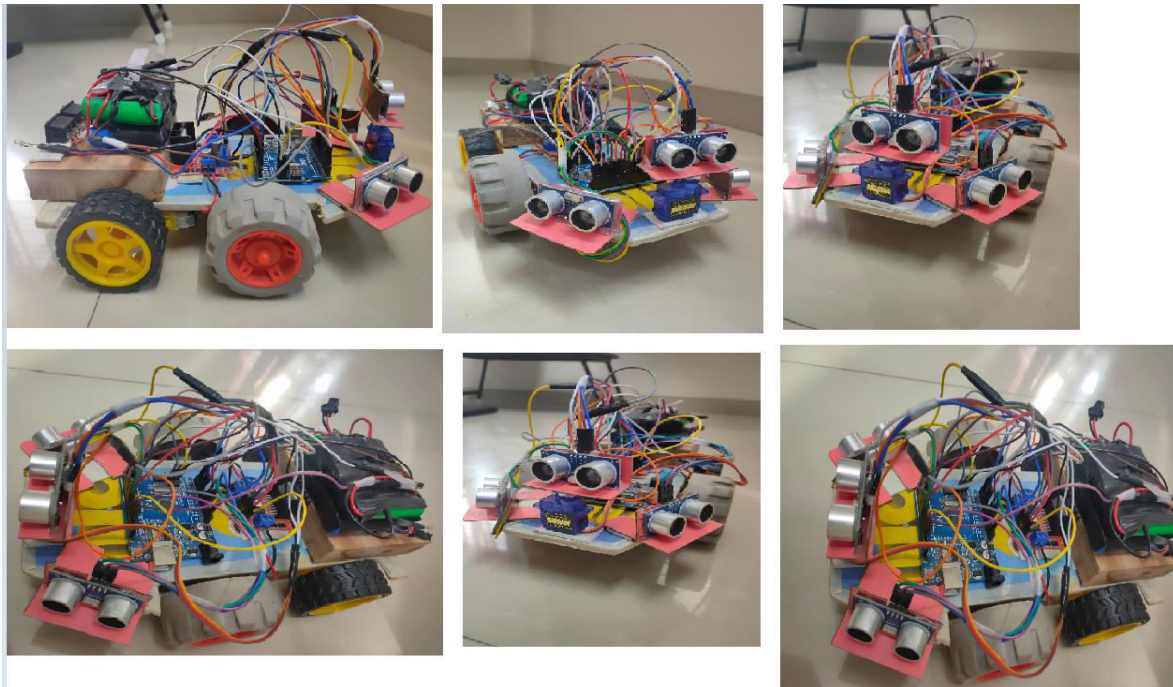


Fig 8: Multiple Obstacle Rover

IX. CONCLUSION

Today we are in the world of robotics. Knowingly or unknowingly, we have been using different types of robots in our daily life. The project is “**Multiple Obstacle Overcome Rover with Smart Indicators**” is practically proved by using the Ultrasonic sensor for sensing the robot, Motor Shield Driver for the driving the dc motors, dc motor is used for the movement of the robot with the help of the Arduino Microcontroller. A lot of factors determined the accuracy of the robot we designed. These factors were the environmental phenomenon in which the robot was tested, the number of obstacles present making the test space crowded or relatively less crowded the type and shape of the obstacle (the robot is designed for a uniform shaped obstacle). These factors majorly affected the sensors. The accuracy of the robot is dependent on the sensors used. Thus, the nature of the sensor and its accuracy defined the accuracy of our robot car.



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