OBSTACLE AVOIDING CAR USING RASPBERRY PI 3B+

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ABSTRACT:

The trajectory scheme is one of the most important points of choosing and positioning the tasks performed by robotic manipulators. In this work, we have introduced a robot, which is compact, autonomous and fully functional. This robot or a smart car is designed to feel any obstacle in its path, to avoid it and to restart it, involving pre-computation of an obstacle-free path. Ultra-sonic sensors were adopted to implement a real-time obstacle rescue system for wheeled robot, so that the robot could continuously detect the surroundings, avoid obstacles, and move towards the targeted area. The model has tremendous applications in vacuum cleaners, hidden paths, parking systems, automobile assembling and chemical industries, in scientific exploration, emergency rescue and other isolated environments. We use a Raspberry Pi 3B+ with a motor shield with DC motors to make the car, and for sensing we include an ultrasonic sensor that accurately and efficiently detects any obstacle in the path of smart car. Detects from. The Raspberry Pi is coded such that the smart car moves backwards when interrupted with a maximum limit of 50cms in ideal test conditions. During the making of this model, we educated ourselves with the Raspberry Pi coding language, motor shield functionality and largely an ultrasonic.

Keywords— Machine Learning, Robotics, Ultrasonic Sensors.

I. INTRODUCTION

[1] The Raspberry Pi has the ability to interact with the outside world using its GPIO pins, USB, Ethernet, HDMI, LCD and camera. Here we are using Raspberry Pi 3B+ which has a 64-bit ARMv8 quad core processor with 1 GB LPDDR2 SDRAM as well as Wi-Fi and Bluetooth. The ultrasonic ranging module, HC-SR04, was used in this project. It offers 2 cm - 400cm non-contact measurement function, with accuracy up to 3 mm. This module consists of an ultrasonic transmitter, receiver, and control circuit. [7] An infrared sensor is an electronic device that is used to sense certain characteristics of its surroundings by detecting and / or emitting infrared radiation. [6] Infrared sensors are also capable of measuring the heat emitted by an object and detecting motion. The distance measuring range is 10 cm to 80 cm. The L293D driver module allows the DC motor to run in any direction. It can control a set of two DC motors simultaneously in any direction. This means that it can control two DC motors with one motor controller IC.

The L293D receives a signal from the Raspberry Pi and delivers the relative signal to the motors. The L293D switches its output signal according to the input received from the microprocessor. [2] [9] Two 200 rpm and 12 V DC gear motors are used for obstacle detection and avoidance. The motor used has a 6 mm shaft diameter with internal holes. The internal holes are for easy mounting of the wheels using screws. A low-cost motor is easy to use for robotics applications. [9] This project is mainly focused on Robotics which is new and growing technology for this generation. There are many studies and projects related to this branch and there is a great deal of content on the Internet. The potential of the robotics sector is huge and attractive Because it is a combination of mechanical engineering, electrical engineering and computer science. [9]

The motivation to work on a project involving a robot was This project has the potential to work as much as it can and with the same enthusiasm Robot. We also want to work on the field of robotics and want to work on and artificial intelligence and it is an opportunity to get my hands on such project and gain experience .

II. RELATED WORK

This section of the related work eventually reveals some facts based on thoughtful analysis of many authors work as follows.

Design of Low-Cost Self-Navigation Rover Based On IOT [11].

In this paper, author proposed that, A robot is a machine capable of functioning autonomously or semi-autonomously as directed by a micro-controller. Many industries are using robots to perform tasks with high accuracy. Accordingly, the task of sensor integration is achieved in light of the need and purpose of use. The rover proposed in this research work is capable of detecting obstacles in the travel path of the rover under dynamic environment. To understand the constraints of ultrasonic sensors, the camera module was integrated on a Raspberry Pi board. The open source computer vision library is used for image processing and video processing work.

A Literature Survey on Obstacle Detection and Their Movement for Automobiles [12].

Road safety is not an issue that will resolve itself, every citizen is responsible for one action. In this survey they Commit to their combined knowledge, data, technology and networks to promote security. Between 25 The percentage of global accidents and 33 percent are interrelated and 36 percent are occupational deaths. Road accidents occur worldwide. Therefore, accident Avoidance systems and equipment help the driver and Help the vehicle escape faster Collision. This literature survey applies a Security subsystem, adaptive cruise control (ACC) using ultrasonic sensors. this system Uses an ultrasonic set to allow the vehicle Slow when approaching another vehicle or obstacle And when the pre-determined speed is again Allows traffic.

Obstacle Avoidance Robot Using Arduino [13].

"Obstacle robot with IR and PIR motion Sensor" is designed and developed by their team and It is proposed that the robot platform developed Was not designed for specific tasks but as a general wheel Autonomous platform. so it can be used Educational, research or industrial implementation. Student Using this, microcontrollers can be used to learn programming C ++, Arduino Uno 1.6.5 compiler, IR and PIR sensor Characteristics, motor driving circuit and signal status circuit design. Research on obstacle rescue robot's Polytechnic level can help students develop Communication, technical skills and teamwork. Design of Such robots are very flexible and can have different methods Optimized for another implementation. [7] This shows that While PIR sensors are more sensitive than IR sensors To find a human being. implemented by using sensors to Robot stage. Path planning with obstacle avoidance Provides the ability to generate an optimal path to cover environment with low cost.

Design and Implementation of Autonomous Car using Raspberry Pi [14].

In this work they are saying that, With increasing accidents day by day, it has become important to handle Human errors and helping mankind. It can all end with self-driving Cars that need to know the bus destination and then passengers are required to continue with their work. This will not only saveDay to day activities for small items also provide a self- relief for minor accidents.in their work they aims to build a monocular vision autonomous car prototype using Raspberry Pi as a processing chip. A HD Cameras with an ultrasonic sensor are used to provide the necessary data from the real world to the car. This carAble to reach a given destination safely and intelligently thus avoiding the risk of human errors. SeveralExisting algorithms such as lane detection, obstacle detection are added together to provide the necessary control in the car.

Path Planning and Obstacle Avoidance Scheme for Autonomous Robots using Raspberry Pi [15].

It in review Literature is saying that, Path planning and obstacle avoidance in a dynamic Problems of interest in environmental forum Robot module generation. Path plan is the search route goes through places in the atmosphere and A field of interest is a set of location points that the robot Need to cross. Due to path planning it enables determination of static barriers in the environment and Propose a solution that is possible in a stable environment. The obstacle avoidance approach is obstacle detection. Environment and the ability to evacuate them. Barrier prevention Can be classified into two types as static barrier avoidance and dynamic barrier avoidance. Static barrier can be avoided Path planning is

used by strategy and dynamic Barrier prevention can be PROPOSED SYSTEM

A. Objectives and Project scope:

1. Objective:

Objective of this project is mainly focused on the Robotics which is new and growing technology for the current generation and [6] to make the real time Obstacle Avoiding Car using Raspberry Pi and Distance sensors. [7] Which avoids obstacles during the travelling using the sensors and It helps to prevent accidents and gives the safe ride. This Hardware and Software description provides a complete description of all the functions and constraints of the **"Obstacle Avoiding Car Using Machine Learning".** The document describes the issues related to the system and what actions are to be performed by the development team in order to come up with a better solution.Our proposed project puts forward [6] an obstacle avoider robotic vehicle that uses ultrasonic sensors for this purpose. The system uses a Raspberry Pi to achieve this functionality.The robotic vehicle is designed to first track and avoid any kind of obstacles that comes its way. [7] The vehicle achieves this smart functionality with the help of ultrasonic sensors coupled with a Raspberry Pi and motors. The entire system combined gives the vehicle an intelligent object detection and obstacle avoidance scheme.

2. Project scope:

1) [6] Develop a barrier avoiding car with onboard sensors and microcontrollers.The designed car will be able to avoid the obstacle completely like a program.The car consists of two wheels with two DC motors at the back.

2) Develop an algorithm of potential field method to avoid the obstacle. The algorithm will be implemented in the Raspberry Pi Microcontroller. Input of the algorithm is a reading scan by an ultrasonic sensor in front of a car [7]. with this Method, the mobile robot can avoid the obstacle without collision.

3) Develop the output of this system which is a [6] DC motor that can reflect with the input from the sensor. When an interrupt is detected, the main controller will trigger an input DC motor to turn the steering wheel inthe right direction. Thus, the barrier will be ignored.

B. Assumptions and Dependencies:

1. Assumptions:

1) Limited number of sensors can use for a single machine.

2) Car will follow a straight path until any obstacle is encountered.

2. Dependencies:

1) [7] Surface of floor.

2) Car will not move until the external power supply is given.

3) Car Speed.

C. Functional Requirement:

1) Obstacle Avoiding Algorithm: Input- Sensor data, Priority-high.

2) [1]Obstacle Detection Algorithm: Input- Pi Camera, Priority-high.

D. External Interface Requirement:

1. User Interface:

For applying different techniques of obstacle avoidance user has to:

1) Login into Raspberry Pi OS (Raspbian in our case) directly or using Remote desktop.

2) [10] For login through remote desktop user has to add a Putty service or VNC service into its local machine.

3) Then open a Raspbian terminal for configuring a Raspberry Pi and for adding a different logic using python program.

2. Hardware Interface:

Our system interacts with hardware components on the following occasions:

1) [6] Sensors will look for obstacles in its path.

2) Then it will send a data to Raspberry Pi for processing.

3) Then Raspberry Pi will trigger the Motors by using L293D Motor Driver IC.

3. Software Interface:

[1] Our system interacts with the Raspberry Pi database while gathering the sensor data and Pi camera data to stored in database.

E. NonFunctional Requirement:

1)Performance Requirement:High Speed and Accuracy. 2)Safety Requirement.

3)Software quality attributes.

F. System Requirement:

1)Operating System Requires Raspbian using Noobs installer, Noobs Version 3.2.1 and Raspbian Version Sept 2019 4.19 2)Required Software platform is Python.

G. Hardware Requirement:

Sr. No.	Parameter	Minimum Requirement	Justification
1	Raspberry Pi	1.4 GHz	Quad core ARMv8 cortex-A53
2	Hard Disk	16 GB	None
3	RAM	1 GB	LPDDR2 SDRAM
4	Monitor, Keyboard and UPS	1	None
5	L293D motor driver	1	None
6	Sensors	1	HC-SR04
7	Pi Camera	1	None
8	Jumper Wires	10	M-M, M-F, F-F

Table 1: Hardware requirement

III. SYSTEM DESIGN

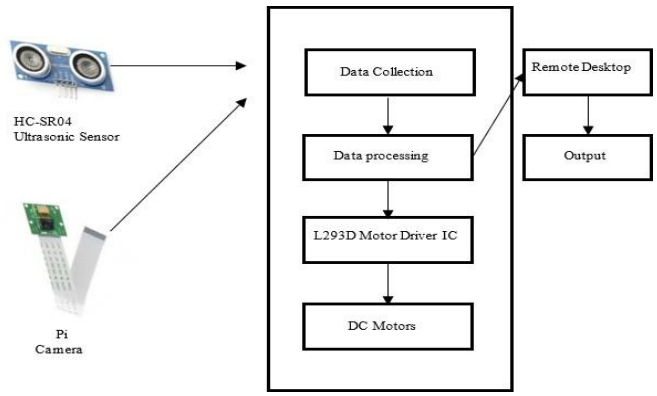


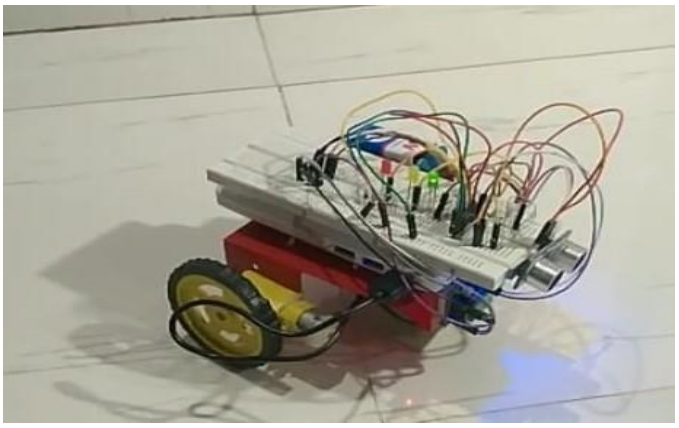
Fig1:System Architecure diagram

This is System Architecture Diagram of our model. In this First collect data after that processing for that data and this apply to L293D Motor Driver IC and last that all stores in DC MOTORS. In this, Data processing is a remote desktop mean that output created this remote desktop through. [1]In this, we use HC-SR04 Ultrasonic Sensor for data collection purpose also use Pi camera for data collection purpose, collecting for that all data we proceed on them.

IV. WORKING:

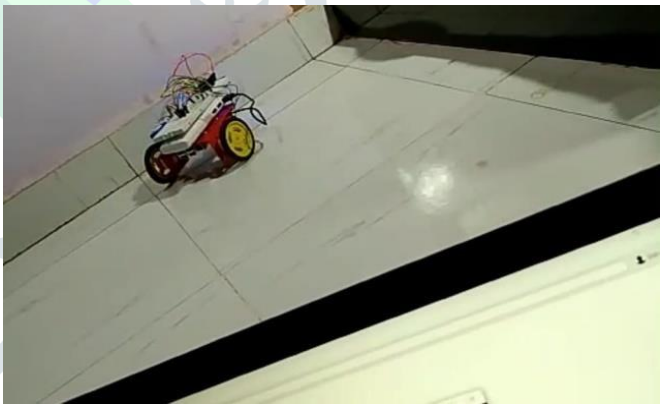
1. All wiress, sensors, motors should be connected before starting a raspberry pi.
2. User has to connect a raspberry pi with external power supply.
3. User has to run the implemented logic in raspberry pi.
4. After running logic, green light led will glow and car moves forward untill any obctacle found by sensors.
5. According to logic, if sensor encountered any obstacle in between 5 – 15 cm range, then yellow light led will glow which is a signal of warning.
6. If any thing comes in range of 0 – 5 cm, then red light led will glow and car will take an appropriate turn. (we can specify a different ranges for avoidance).
7. At the same time user can see the live streaming of cars view through the raspberry pi camera module.

V. RESULT:

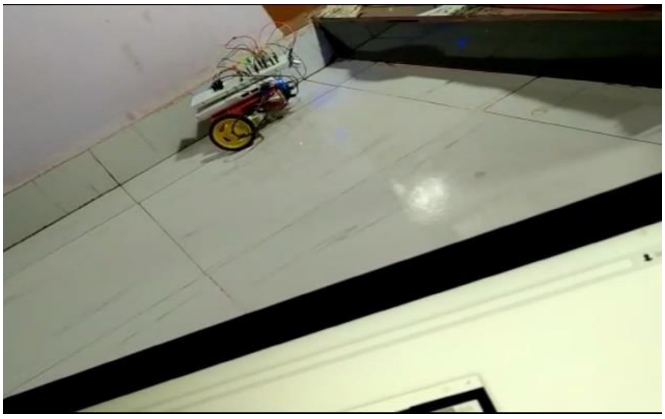


Fig(1)

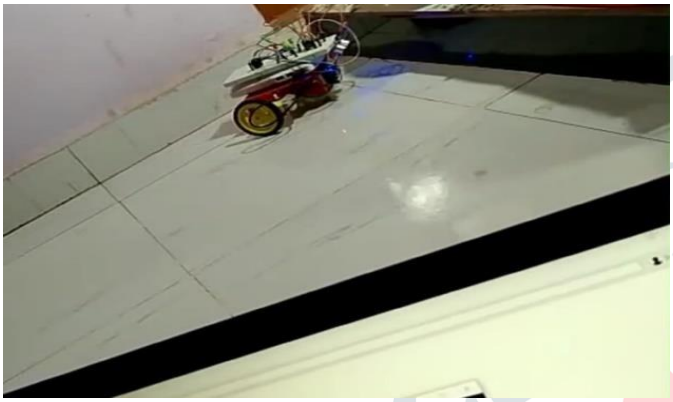
Fig(2)



Fig(3)



Fig(4)



Fig(5)

Fig(6)

VI. ADVANTAGES

1. With the help of of sensor and webcam, the RC car will be able navigate itself through the track by using computer vision and avoid obtscales at the track.
2. This can enhance the knowladge of hardware as well as software of students, by knowning how to establish connection between raspberry pi 3 sensors, webcam and other hardware components.
3. It can be used as a movable surveillance system.
4. It can control remotely.

VII. LIMITATIONS

1. Speed is depend upon types of motors.
2. Not a perfect solution yet.
3. As this a prototype model, it has a limitations. It will only be trained for a specific tracks and will be limited for use.
4. It can only be used for study purpose and not on the road.

VIII. APPLICATION

1. The Obstacle avoiding car will be able to navigates on its own.
2. It will be able to identify by traffic signals.
3. It will be able to stop when it cames across an obstacle.
4. It will give the user the advantage to use the car in both remote contolled and autonomous mode.
5. Health care vehicle.

IX. CONCLUSION AND FUTURE SCOPE:

Conclusion: In this paper, the method of making a self-driving robot car is presented. Various hardware components and their the assemblies are clearly described. All project logic is implemented in raspberry 3 B+. Raspberry pi is used as a central unit for all operations and for dicision making. Using ultrasonic sensors, Collisions with obstacles are avoided. Algorithm mentioned a little has been successfully applied to paper "Obstacle avoiding car using Raspberry pi 3 B+".

Future Scope: In future this system can be develop as readymade API for web service platforms.

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