SMART OBSTACLE AVOIDANCE IN ROBOT CARS UTILIZING RASPBERRY PI

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ABSTRACT

Real-time obstacle identification and avoidance are important problems in autonomous cars. The hardware, software, and communication contexts for the design and implementation of a robotic automobile with real-time obstacle recognition and avoidance have been demonstrated. The system has been implemented using web apps, Wi-Fi technologies, and the Raspberry Pi platform. The development of this robotic gadget used web-based interactivity. The brain of the robot is a Raspberry Pi. Among the several hardware parts of the robot are an ultrasonic sensor, DC motors, relays, capacitors, resistors, transistors, and voltage regulators. It also includes the web application-using software component. The user of the robotic automobile can choose the preferred direction or mode via a web application. The user has two options: either put the robot in automatic mode and let it drive itself, or use his or her own clever device to direct the motions of the robot. As a result, the robot can recognise living objects and escape from the obstruction.

The purpose of this project is to alert the civilian and military to potential terrorist attacks especially in military areas with live detectable sensors.

I. INTRODUCTION

From its initiation in the 1950s, modern robots have come a long way and routed itself as an immutable aid in the advancement of humankind. In the course of time, robots took many forms, based on its application, and its size varied from a giant 51 feet to microscopic level. In the course of technological developments of robots, one aspect remained instrumental to their function, and that is mobility. The term “Wi-Fi controlled” is now used in modern robotics to denote the capability of robot to navigate over an unknown environment without having any collision with surrounding objects. Obstacle avoidance in robots can bring more flexibility in maneuvering in varying environments and would be much more efficient as continuous human monitoring is not required.

This project developed a Wi-Fi controlled robot which can move without any collision by sensing obstacles on its course with the help of ultrasonic distance sensors. Robots guided with this technology can be put into diversified uses, e.g., surveying landscapes, driverless vehicles, autonomous cleaning, automated lawn mower and supervising robot in industries. The robot developed in this project is expected to fulfill the following objectives:

• The robot would have the capacity to detect the obstacles in its path.

• After detecting obstacles, the robot would change its course to a relatively center of the road lane by making autonomous decision.

• It would require no external control during its operation.

• It can measure the distance between itself and the road lane in real-time.

• It would able to operate effectively in unknown environment.

This would help vehicle to move even if it loose connection with its source and it can complete its task without any dependency from outside it.

Need:

When we drive, we use our eyes to decide where to go. The lines on the road that show us where the lanes are act as our constant reference for where to steer the vehicle. Naturally, one of the first things we would like to do in developing a self-driving car is to automatically detect obstacle using an algorithm. The places which need this model are likely to be, it is very helpful in spying field where it can spy places without any support from environment i.e., it can run in dark places as well.

II. Block Diagram:

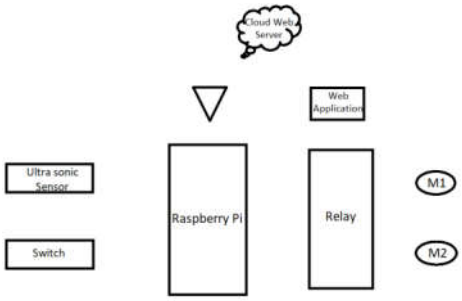

Figure1.1: Block Diagram of Obstacle Avoiding robot Car

2.1 Raspberry Pi Pico W:

Raspberry Pi Pico W brings wireless connectivity to the best-selling Raspberry Pi Pico product line. Built around our RP2040 silicon platform, Pico products bring our signature values of high performance, low cost, and ease of use to the microcontroller space with a large on-chip memory, symmetric dual-core processor complex, deterministic bus fabric, and rich antheral set augmented with our unique Programmable I/O (PIO) subsystem, RP2040 provide professional users with unrivalled power and flexibility.

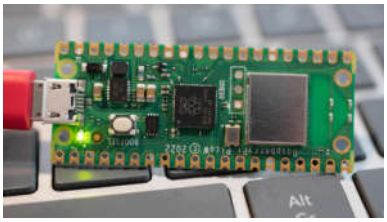

Figure 2: Raspberry Pi Pico W

Offering detailed documentation, as polished MicroPython port, and a UF2 bootloader in ROM, it has the lowest possible barrier to entry for beginner and hobbyist users. RP2040 is manufactured on a modem 40nm process node, delivering high performance, low dynamic power consumption, and low leakage, with a variety of low power modes to support extended duration operation on battery power.

Raspberry Pi Pico W offers 2.4GHz 802.11 b/g/n wireless LAN support, with an onboard antenna, and modular compliance certification. It is able to operate in both station and access-point modes Full access to network functionality is available to both C and MicroPython developers.

Raspberry Pi Pico W pains RP2040 with 2MB of flash memory, and a power supply chip supporting input voltages from 1.8-5.5V. It provides 26 GPIO pins, three of which can function as Analog inputs, on 0.1- pitch through-hole pads with castellated edges Raspberry Pi Pico W are available as an individual unit, or in 480-unit reals for automated assembly.

2.2 Ultrasonic Sensor:

The ultrasonic sensor is an electronic device used to measure distances. Because, measuring distance is an essential factor in many applications such as robotic control, vehicle detection etc. Sensors such as optical and sound are the most helpful.

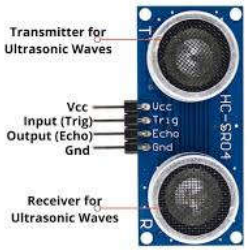

Figure.3: Ultrasonic Sensor

Ultrasonic sensors are used as proximity sensors. They can be found in parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems and manufacturing engineering. Compared to infrared (IR) sensors in proximity sensing applications, ultrasonic sensors are less susceptible to interference from smoke, gases, and other airborne particles (although the physical component is subject to variables such as heat).

Ultrasonic sensors are also used as level sensors to detect, monitor, and control liquid levels in closed vessels (such as chemical plant drums). Most notably, ultrasound technology has enabled the medical industry to image internal organs, identify tumours, and ensure the health of babies in the womb.

2.3 Mode/Slide Switch:

Figure.4: Slide Switch (Mode Switch)

The slide-switch in Arduino moves the slider of the switch from the open position (ON) to the closed position (OFF). It allows the flow of current in the circuit without the need for splice wire. The slide switches are widely used in small circuit applications.

2.4 Relay:

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Figure.5: Relay

2.5 DC Motor:

DC Motor – 30RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.

30 RPM 12V DC geared motors widely used for robotics applications. Very easy to use and available in standard size. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board. The most popular L298N H-bridge module with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC or you can choose the most precise motor diver module from the wide range available in our Motor drivers' category as per your specific requirements.

Nut and threads on the shaft to easily connect and internally threaded shaft for easily connecting it to the wheel. DC Geared motors with robust metal gearbox for heavy-duty applications, available in the wide RPM range and ideally suited for robotics and industrial applications. Very easy to use and available in standard size. Nut and threads on the shaft to easily connect and internally threaded shaft for easily connecting it to the wheel.

Figure 6: DC Motor

III. RESULTS

3.1 Results of Obstacle Avoiding Robot Car:

The hardware kit of Obstacle Avoiding Robt Car Using Raspberry Pi Pico W is as shown in figure 7.

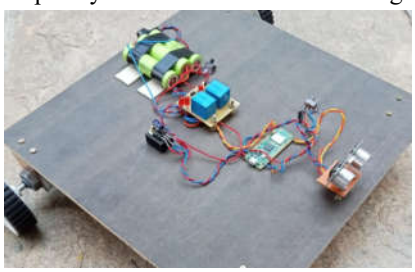

Figure 7: Hardware Kit of obstacle Avoiding Robt Car

When the power supply is given to the kit and run the code using Thonny, we get an IP address, which is used to control the robot using server (Web page) and it is written using HTTP Scripting language. After entering the IP address in google chrome we get the display (i.e., Status is OFF) as shown in figure 8, for first mode.

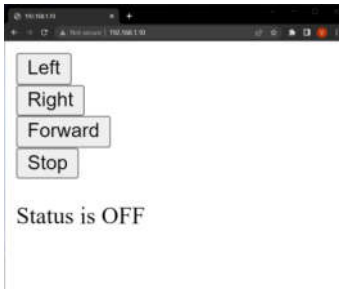

Figure 8: Lookup of Web Page

Figure 9, shows the different status while controlling the robot.

Figure 9: Different Staus of web page

In second mode, by the use of Ultrasonic Sensor it detects the obstacle and changes the direction of the robot if the obstacle is at distance>30 and it displays the obstacle is at what distance in Thonny's shell as showen in figure 10.

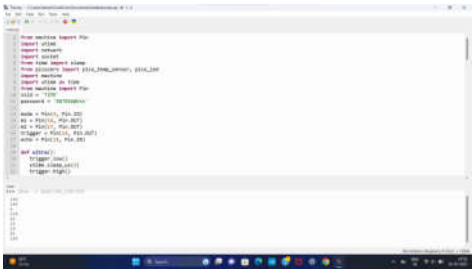

Figure 10: Distance of an Obsatcle

3.2 Advantages of Obstacle Avoiding Robot Car:

• It needs very less human support.

• It is fully automatic hence it doesn't affect by surroundings.

• It is small, so it can reach very congested places.

• I can run in very light places.

5.3 Disadvantages of Obstacle Avoiding Robot Car:

• It is fully dependable on surroundings.

• Its calculation may vary because of different types of roads.

IV. CONCLUSIONS AND FUTURE SCOPE

4.1 CONCLUSIONS:

The "OBSTACLE AVOIDING ROBOT CAR USING RASPBERRY PI" project is conceived and put into action. The process for creating a robot that can drive itself is described. The assembly and other hardware parts are explained in detail. The Raspberry Pi serves as the focal point for all activities and decision-making. The robot is controlled via software called Python IDE. Once the barrier has been identified by the ultrasonic sensor, the robot will be able to move in response to the order. This robot measures the separation between items and makes detours if obstacles are present. The robot may be controlled by the user using HTML (web page). An ultrasonic sensor is used to determine the object's location within its range.

4.2 FUTURE SCOPE: By connecting to the internet, an IP camera mounted on a mobile robot may be linked to a mobile application that allows live streaming of the monitoring area. To extract valuable information, the gathered video footage may be fed into data mining and pattern recognition algorithms. Deep Learning (AI&ML) is capable of doing this.

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