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USING AN ARDUINO NANO, AN AUTONOMOUS VEHICLE SYSTEM FOR SPEED CONTROL

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ABSTRACT

The goal of the "Autonomous Vehicle System for speed control" project is to create a cutting-edge autonomous vehicle with remarkable speed and agility for navigating a variety of terrains. By utilizing sophisticated robotics, artificial intelligence, and sensor technologies, the vehicle will be able to maneuver across intricate landscapes, dodging obstacles and instantly adjusting its course. With its unmatched mobility and agility, the Autonomous Vehicle System — which is outfitted with high-performance motors and precise control systems— promises to transform industrial applications, exploration, and disaster relief. This abstract highlights the possible influence of the Autonomous Vehicle System project on a variety of fields in need of quick and dependable robotic mobility solutions. It also describes the project's goals, methods, and predicted results.

Keywords: Internet Of Things, Arduino Nano, Microcontroller, Obstacle Avoidance, Ultrasonic Sensor, Encoder.

I. INTRODUCTION

In a time of technical advancement and unrelenting efficiency pursuits, the "Autonomous Vehicle System" project is a monument to human curiosity and inventiveness. The development of robotics, artificial intelligence, and sensor technologies has made it possible to create autonomous systems that can move across a variety of terrain with previously unheard-of speed and agility. In this regard, the Autonomous Vehicle project is a significant advancement since it aims to create a state-of-the-art autonomous Vehicle that pushes the limits of mobility and autonomy.

Fundamentally, the Autonomous project represents the fusion of cutting-edge robotics and artificial intelligence, utilizing the most recent developments in each discipline to produce a Vehicle that is fully autonomous. The Autonomous Vehicle, outfitted with cutting-edge sensors, precise control systems, and powerful motors, has the potential to completely transform industrial operations, exploration, and disaster relief efforts due to its unparalleled mobility and versatility.

The requirement for effective and dependable robotic systems that can function in difficult situations is what gave rise to the Autonomous Vehicle. Autonomous Vehicle can be extremely useful in enhancing human safety and understanding in a wide range of applications, from exploring far-off planets to traversing dangerous catastrophe zones. Seeing this potential, the Autonomous Vehicle aims to push the envelope of what is conceivable, imagining a time when self-sufficient Vehicles become part of our everyday lives, improving our capacities and broadening our horizons.

The idea of autonomy—the Vehicle's capacity to make deft decisions in the moment, adjust to shifting conditions, and maneuver over challenging terrain with accuracy and efficiency—is essential to the Autonomous Vehicle project's goal.. Every feature of the Autonomous Vehicle, from path planning to obstacle avoidance, is painstakingly engineered to enhance efficiency and dependability, guaranteeing that it can function well even in the most difficult circumstances.

II. LITERATURE REVIEW

Regarding traffic accidents and loved ones' deaths, numerous researchers have made contributions and tried to offer answers for safe travel. We go over a handful of these studies in this section.

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Obstacle Avoidance Robot is an autonomous robotic vehicle, which detects obstacles present on its path through the sensors, avoids them, and takes the decision based on internal code set in it.

Obstacle avoidance on roadways using range data is an autonomous vehicle that detects and locates obstacles present in the road environment for navigation of a robotic vehicle equipped with an active laser-based range sensor.

Valsalan et al. proposes a line follower and obstacle avoidance system, which moves on a specific path, determined by the user and detects the obstacle that comes in its way.

A Real-Time Obstacle Avoidance Method detects obstacles and calculates the likelihood of collision with them.

Modi et al. compares three different methods for obstacle detection and avoidance. The methods used for comparison include a laser scanner, a rotating sonar sensor, and fixed mounting of sonar sensors.

Kim et al. proposes an algorithm that is capable of avoiding obstacle collision for a mobile robot. The vision system approach, as well as the edge detection approach, is used in the system.

Most of the systems observed in the literature [10-14], needed the accuracy for the desired output. While having complex algorithm in concern which are time-consuming because they stop the vehicle in front of an obstacle and decide where to go and with no functionality of looking in surroundings for a better outcome. In the proposed system vehicle is optimized in detecting an obstacle, without stopping vehicle while slowing it down and deciding where to go, it takes less time just like a human driver on driving seat. The proposed system is discussed in the following section in detail.

III. BENEFITS OF THE AUTONOMOUS VEHICLE SYSTEM

1. **Enhanced Exploration**: The autonomous vehicle independence opens up previously uncharted territory for exploration by allowing access to dangerous and distant areas.
2. **Increased Efficiency**: The autonomous navigation and task execution improve mission schedules and resource usage, which raises operational efficiency levels.
3. **Risk Reduction**: By reducing human interaction in dangerous areas, exploration and research projects are safer because there is less chance of harm coming to people.
4. **Data Collection**: The autonomous vehicle sophisticated sensor suites make it possible to collect a lot of data, which offers insightful information about different environmental conditions and terrains.

IV. PROBLEM STATEMENT

The goal of the project is to create an autonomous vehicle that can use a sensor to identify and avoid obstacles (bumps) in its path so that it can reach its destination as efficiently as possible. By using an obstacle avoidance system in the vehicle, the driver (or even the vehicle itself) will be automatically alerted to impending obstacles and, depending on technological advancements, may be able to avoid them. This effectively lowers the number of road deaths. Upon entering an unfamiliar environment, the vehicle will cease scanning its surroundings in order to identify any obstacles. The robot can avoid barriers and locate a secure path by using state-of-the-art equipment, which reduces the number of accidents and obstacle avoidance. When a new work is assigned, the autonomous car will use its stored task information to perform even better since it will have an updated perception, which combines its internal state and current perception with data from its knowledge base. To regulate the speed of the vehicle in designated locations in order to prevent and reduce accidents in low-speed areas.

V. OBJECTIVE OF THE STUDY

1. To develop smart vehicle, to detect and avoid dissimilar type of obstacles on its path and can control its velocity base on the network
2. To develop Arduino platform for data processing and its software equivalent to help and to communicate with the car to send unusual parameters.
3. To develop and provide better accuracy and efficiency for previous results.
4. Create an autonomous vehicle that can effectively navigate a variety of terrains.

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VI. PROPOSED METHODOLOGY

6.1. Working Principle

1. The car begins to move when the power supply is connected to the Arduino, causing the motors to rotate. The Arduino code allows the user to select a threshold distance that the car will cross as soon as it approaches an obstacle. The ultrasonic sensor alerts the Arduino if the obstacle's distance is less than this cutoff. The Arduino notifies the motor driver to cease rotating the motors as soon as it receives a signal from the ultrasonic sensor, then, it give the driver another indication to turn the vehicle to the left. And until there are no more obstacles in front of the car, the car is turned to the left. The vehicle begins to drive forward once more and keeps going until it encounters another barrier. Until the power supply is switched off, the aforementioned procedure is repeated.
2. Determining the Best Place to Install the Transmitter:- When determining if a vehicle speed reduction is required, carefully examine the surrounding environment, taking into account any pedestrian traffic, small roads, or school zones.
3. Installation of Transmitters:- Throughout the designated region, place the transmitter in well-chosen spots to guarantee maximum coverage and efficient vehicle communication.
4. Installing Receivers in Cars:- Install the receiver module safely inside the car; it should ideally be included into the electronic system of the car to ensure smooth operation.
5. Setting Communication Boundaries:- Establish a reliable signal reception range of 100 cm around the transmitter by measuring the effective communication range between the transmitter and receiver.
6. Signal Processing and Reception:- The receiver module quickly processes the incoming data to decipher speed control commands after receiving signals from the transmitter.
7. Activation of the Relay Module:- Relay modules are used as an interface between the motor driver/frequency generator system and the receiver to ensure effective and compatible signal transfer.
8. Configuration of the Frequency Generator:- After receiving commands from the transmitter, program the frequency generator to produce precise signals that correspond to desired levels of speed decrease.
9. Integration of Motor Drivers:- Attach the motor driver unit that regulates the vehicle's speed to the frequency generator output.
10. Mechanism of Speed Reduction:- Use the motor driver system's features, such as braking systems and throttle input adjustments, to efficiently control the vehicle's speed.

6.2. Software Used

In order to make mechanisms work like Autonomous Vehicle System with the help of Arduino Nano, software is used to programming the Arduino IDE.

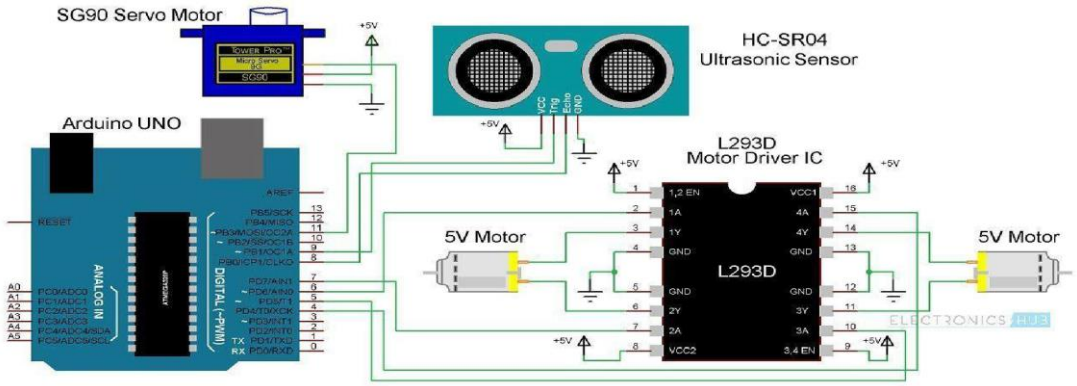

Figure 2: Proposed Hardware Implementation of Autonomous Vehicle System through Arduino Nano

After completing programming we have to upload the sketch to Arduino. To upload the program in there are steps which are following:-

1. Select our port.
2. Select our Arduino board.

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3. Compile our program.
4. To end, we can upload our plan.

6.3. Hardware Used

For this, we have used an Arduino Nano, UltraSonic Sensor, Motor driver, Transmitters, Rf receiver, Relay Module, Frequency Generator, Servo Motor.

6.4. Hardware and Software Used

Table 1

Software Used	Hardware Used
Arduino IDE	Arduino Nano, UltraSonic Sensor, Motor driver, Transmitters, Rf receiver, Relay Module, Frequency Generator, Servo Motor

Table no 1 show which hardware and software parts are required to build an Autonomous Vehicle system.

VII. BENEFITS OF AUTONOMOUS VEHICLE SYSTEM

The Following types of Benefits of the Autonomous Vehicle System project include: The Autonomous Vehicle System project represents the fusion of cutting-edge robotics and artificial intelligence, utilizing the most recent developments in each discipline to produce a vehicle that is fully autonomous.

1. **Enhanced Exploration**: The rover's autonomy enables access to remote and hazardous environments, expanding exploration possibilities beyond human reach.
2. **Improved Efficiency:** With autonomous navigation and task execution, the rover optimizes mission timelines and resource utilization, enhancing overall operational efficiency.
3. **Risk Reduction:** Minimizing human involvement in hazardous environments decreases the risk to human safety, making exploration and research endeavors safer.

VIII. CONCLUSION

This project created a smart car that can recognize and avoid impediments in its path and adjust its speed according to the network. The Arduino platform, which powers the smart automobile, is used for data processing, and its software equivalent facilitated communication between the two devices to transmit movement-guiding parameters. Three ultrasonic distance sensors, which offered a larger field of detection, were employed for obstacle identification. Once the code has been loaded, the car may operate entirely on its own without the need for human involvement. When put in an unfamiliar environment with impediments, it navigated with remarkable accuracy, avoiding every obstacle. We have a lot of things to consider improving in order to maximize mobility. But the majority of these suggestions will also require extra time and money. Future cameras will be able to identify obstacles, however for quick and clear images; it is preferable to use CCD or industrial cameras. Thanks to the unique software, even the ones we stated in the section about the camera holder will be better.

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