A REVIEW OF SELF DRIVING CAR USING NEURAL NETWORK

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ABSTRACT

Numerous new innovative advances have assisted with preparing forward for completely independent vehicles. This special issue looks at three aspects of the self-driving car trend. This undertaking fabricates a self-driving RC vehicle utilizing Raspberry Pi, Arduino, and open-source programming. Raspberry Pi gathers contributions from a camera module and an ultrasonic sensor and sends information to a computer remotely. The computer measures input images and sensor information for object location (stop sign and traffic signal) and collision avoidance respectively. On a computer, a neural network model makes steering predictions based on input images. The Arduino receives the predictions and controls the remote control RC car.

Keywords: HC-SR04, Numeral Network, OpenCV3, Streaming, TCP Server

I. INTRODUCTION

Gary Silberg and Richard Wallace send a message. The car industry has been a force for advancement and financial growth for 125 years. Presently, in the early many years of the 21st century, the speed of advancement is speeding up and the business is near the precarious edge of another innovative transformation: "self-driving" vehicles. The innovation could give answers for a portion of our most obstinate social issues is the significant expense of car accidents and transportation foundation, more time consumed in traffic jams, and the wasted urban space offered over to parking garages, just to give some examples. But, if self-driving vehicles become a reality, the ramifications would likewise be significantly troublesome for pretty much every partner in the auto environment. As one industry executive put it, "Everything, from how we move goods to how we move around, is ripe for change"[7]. Speeding is the main source of street deaths in India, representing 64% of all street fatalities. Highways account for 60% of all accidents in India, with speeding being the leading cause. Rajasthan had the most speeding deaths (9,618), followed by Tamil Nadu (9,224) and Kamataka (9,224) (8,714 deaths). In 2018, drivers who were in an accident accounted for 26% of all road injuries. Accident victims lacked a valid driver's license or were driving on a learner's permit. Furthermore, human error is to blame for more than 90% of car accidents. Autonomous vehicles have the potential to mitigate or eliminate these serious issues. On highways or two-lane roads, an obstacle may require a lane change without warning, such as when an animal crosses the road. This abrupt lane change can present a dangerous situation, as vehicles in the opposite lane may be approaching from behind at a much faster pace. Obstacles such as boulders, fallen cars, or road construction can create a lot of traffic because they normally block an entire lane. According to this paper, driverless cars have the potential to address a wide range of issues, including traffic disruptions and crashes caused by driver error.

This project is capable of self-driving on a track, detecting stop signs and traffic lights, and preventing front collisions. The input unit (camera, ultrasonic sensor), processing unit(computer), and remote control (RC) control unit are the three subsystems that make up the device. In this project, self-driving on the track is done by the neural network. Where we wirelessly transmit video and distance measurement over the network from client to host. For this transmission process, we use python libraries, neural network algorithms, and path detection algorithms. For stop sign and object detection, we use Haar feature-based cascade classifiers. This process only focused on stop sign and traffic signal recognition because each object needs its classifier and follows a similar training and position period. OpenCV includes both a trainer and a detector.

A neural network is represented in figure 1. “A neural network is a network or circuit of neurons, or in a modern sense, an artificial neural network, composed of artificial neurons or nodes”[6]. “It consists of three layers: input layer, hidden layer, and output layer”[8]. The Input layer is then applied to the hidden layer and also Weights are given to the hidden layer. After calculation in the hidden layer, there is an activation function that controls the amplitude of the output. In our project, the input layer has 38,400 hubs(nodes), the hidden
The car's steering will be controlled by the output layer, which will include forward, reverse, left, and right.

II. RELATED WORK

In this section, we will take the related work done by people.

"M. V. Rajasekhar, Anil Kumar Jaswal"[1] - They address upcoming developments and their implementation challenges in this article. The paper also discusses existing requirements for autonomous vehicles and contrasts the implementation of autonomous vehicles in India to other markets. However, there are still implementation issues.

"Mrs. Smita Desai, Miss. Shreya Desai"[2] - This paper investigates the advancements and trends in vehicle automation that can regulate vehicle collision detection. Collision alert and avoidance systems are complicated by the fact that they must be able to identify and communicate a potentially dangerous situation to the driver. Human factor issues are extremely important, so a section of this paper was devoted to this subject. This analysis of research on driver assistance systems, collision warning, and avoidance systems is a useful tool for assessing recent research developments in the field. Due to its wide scope, the sensory system deserves its own paper, which is not discussed in this one.

"Mr. Sai Gaikwad, Mr. Shridhar Sanas, Mr. Pradip Kalwankar, Mr. Dnyaneshwar Harale"[3] - This paper explains how to create an Android application that allows you to access your car and provide personalized features that are useful when driving. Horrible incidents occur while driving, as well as other problems. So, to avoid these, we created a car that provides customized functionality, protection, comfort, and luxury travel by using some functionalities, and by doing so, the driver can obey the rules and relax, making driving simple, secure, and effective.

"Rasheed Hussain, Sherali Zeadally"[4] - The current concerns that are impeding the production and implementation of autonomous vehicles on a wide scale are discussed in this paper. It also discusses many issues that must be tackled by designers, implementers, regulators, regulatory organizations, and car manufacturers, as well as autonomous car technologies that will help customers and several other industries. They address current problems that are impeding the production and implementation of autonomous vehicles on a wide scale. It does not provide a solution to problems.

"Carullo, M. Parvis"[5] - “This paper describes an ultrasonic sensor that can determine the distance between selected points on a vehicle and the ground”[5]. However, it does not provide instructions on how to integrate the sensor with other modules or stream data from the client to the host server. In our project, an ultrasonic sensor is used to collect data that is useful for measuring the distance between a car and obstacles.
III. METHODOLOGY

A. Hardware
1. Raspberry Pi board (model B+),
2. Raspberry Pi Camera,
3. Arduino,
4. Dc Motor,
5. Ultrasonic Sensor,
6. Wires,
7. Stop Sign,
8. Computer
9. Radio Control Car

B. Software
1. Develop a C code in Arduino IDE
2. PYTHON 3.8 is used for image calibration and receives data from raspberry pi and drives the RC car based on model prediction.
3. Thonny software is used to stream video frames in jpeg format to the host computer.

C. System Design

a. Input Unit: Input data is collected using a Raspberry Pi board (model B+) with a Pi camera module and an HC-SR04 ultrasonic sensor. On the Raspberry Pi, two client programs stream color video and ultrasonic sensor data to the device through a local Wi-Fi link. Video is scaled down to QVGA (320x240) resolution to achieve low latency video streaming.

b. Processing Unit: Receiving data from the Raspberry Pi, neural network training and prediction (steering), object detection (stop sign and traffic light), distance calculation (monocular vision), and sending instructions to Arduino via USB are all tasks handled by the processing unit (computer).

1. TCP Server: The computer runs a multithread TCP server program to collect streamed image frames and ultrasonic data from the Raspberry Pi. Image frames are decoded into NumPy arrays after being translated to grayscale.
2. Neural Network: One benefit of using a neural network is that once it has been trained, all it needs to do now is load the trained parameters, making predictions very fast. The input layer has 38,400 (320x120) nodes, while the secret layer has 32 nodes. In the secret layer, the number of nodes is selected at random. As shown in figure 2, the output layer has four nodes, each of which corresponds to one of the steering control instructions: left, right, forward, and reverse (though the reverse is not used anywhere in this project, it is still included in the output layer).
3. **Object Detection:** For object detection, this project adapted the shape-based approach and used Haar feature-based cascade classifiers. Beyond detection, some image processing is needed to recognize different states of the traffic light (red, green). The method of recognizing traffic lights is depicted in the flowchart below.

![Flowchart of Traffic Light Recognition Process](image)

**Figure 3:** Traffic Light Recognition Process.

4. **Distance Measurement:** Only one pi camera module can be used on a Raspberry Pi. Using two USB web cameras can add weight to the RC car and is also inconvenient. As a result, monocular vision is preferred. For distance measurement, the HC-SR04 ultrasonic sensor is used.

c. **Control unit:** A control unit portion is included with Arduino. It takes on the role of a host. The input devices that are attached to the Raspberry Pi are the camera module and the ultrasonic sensor. The Raspberry Pi serves as the client. On the Raspberry Pi, two client programs stream color video and ultrasonic sensor data to the device through a local Wi-Fi link. A computer is connected to the Arduino via USB. Using the serial interface, the device sends commands to the Arduino, which reads them and outputs LOW or HIGH signals, simulating button presses to drive the RC vehicle.

**IV. CONCLUSION**

Many people are unsure when autonomous vehicles would be able to help address transportation issues. According to optimists, autonomous vehicles will be sufficiently reliable, affordable, and popular by 2030 to supplant most human driving, resulting in significant cost savings and benefits. With technological advancements, autonomous vehicles can become sufficiently safe, affordable, and popular to supplant most human driving. This paper concludes that we use a neural network to create a self-driving vehicle, and we learned how to wirelessly live stream video from a client to a host using a wifi module. Self-driving cars are used for a variety of reasons, including protection, reducing the number of accidents on the road, and so on.
example, Blind people are capable of self-sufficiency, and highly automated vehicles will assist them in living the life they want. Insurance premiums can be reduced as a result of fewer collisions. It helps to reduce the amount of stop-and-go waves that cause traffic congestion by maintaining a healthy and consistent gap between vehicles. Less traffic saves fuel and reduces greenhouse gas emissions from unnecessary idling. The main benefits include a decrease in traffic fatalities, a reduction in travel time, and an improvement in lane capacity. Until autonomous vehicles will work safely in mixed urban traffic, heavy rain and snow, unpaved and unmapped highways, and where wireless connectivity is unreliable, significant progress is needed.

V. REFERENCES


