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AUTONOMOUS REMOTE CONTROLLED CAR USING MACHINE LEARNING TECHNIQUES

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Abstract: As an autonomous car, a car that can move on its own without being dependent on human outputs. In the automotive sector, there has been a huge advancement that brings fresh innovations every day. We addressed the implementation of the autonomous car using machine learning methods in this paper. We used a remote-controlled car with a Raspberry Pi module and a Raspberry Pi camera module installed on top. The camera module would provide pictures required to train the neural network and in the automated mode in the training mode would provide the pictures to the qualified template to estimate the car's motions and orientation.

Keywords: Automation; Raspberry Pi module; self driving; sensors; prototype.

I. INTRODUCTION

Integrated circuit and series, the microcomputer, were significant considerations in the growth of automotive electronic control. It is impossible to overemphasize the significance of the microcomputer as it is the brain that regulates many processes in today's vehicles. For instance, the rider establishes the required speed in a cruise control system and allows the device to push a button. A micro-computer then uses information from speed detectors to monitor the vehicle's real speed. Compared to the required speed, the real speed is adjusted by the controller as needed.

A fully automated car is one where a machine conducts all the duties that would usually be performed by the human conductor. Ultimately, this would imply going into a vehicle, getting into a laptop at the location, and allowing the system. From there, without human feedback, the vehicle would take over and ride to the target. The vehicle could feel its surroundings and create adjustments in steering and speed as needed. This situation would involve all of the above-mentioned automotive techniques: lane detection to assist in crossing lighter vehicles or leaving a highway; barrier detection to find other vehicles, pedestrians, livestock, etc.; adaptive cruise control to ensure secure speed; collision prevention to prevent traffic barriers; and lateral control to preserve the stance of the vehicles on the road.

In addition, to guarantee secure driving speeds, sensors would be required to alert the vehicle to street or climate circumstances. For instance, in cold or snowy circumstances, the vehicle would have to slow down. While riding, we conduct many duties without even thinking about it. Automating the vehicle completely is a difficult job and a lengthy way off. In the individual systems, however, progress has been made [1].

Over the last century, the motor / vehicle sector has encountered turmoil with developments such as driver assistance frameworks and cross breed / electric vehicle frameworks developed in the areas of mechanical independence and equipment progressing into a sector surrounded by fossil-fueled cars with limited understanding. This upheaval then again is a long way from being accomplished with electric cars still to create critical strides in the company industry and mechanical utility restricted to helping frameworks used to assist the rider and compensate for their shortcomings. Car racing has seen the enhancement of countless powered developments throughout the historical background of vehicle travel, as there has been minimal traverse with automated technologies as the focus of most rivalries is on streamlining innovation, driver skills and team organization.

The advancement of the Autonomous Car is fundamentally aroused by the enormous capacity for inspection into control frameworks, information preparation calculations and tactile processes that make this car conceivable as an exploring phase. This exhibition depicts the development of such a phase, as well as a small amount of conceivable structures that can be manufactured and attempted to foster the field of flexible mechanical engineering. But usual dashing cars are believed to be at the cutting edge of development and have seen enormous mechanical developments that have divided into more normal transport frameworks, and it is anticipated that the same will happen in the sector of self-ruling driving. Google-Car, one of the world's finest initiatives using top-level technology, influences us. The car figure 1 of Google Self-Driving. Google is a project involving the creation of autonomous car technology. The item that drives cars from Google is Google Chauffeur. Lettering for each car acknowledges it as a "self-driving car" [2].

Figure: 1 Google car

II. Literature Review

Autonomous vehicles include driverless vehicles. The cars are driven by the battery. The authors presents an automated police car intended and deployed with the aim of avoiding collision and detecting speeds above the specified boundaries, as well as detecting vehicles when abruptly altering routes without signaling and tailgating. The system processes information obtained from ultrasound and LiDAR detectors and regulates motor performance, displays and sends emails, using GPS and GSM modules, as well as sms and data to alert officials to traffic infringements. The paper creation enables decrease accidents and deaths, thereby improving human health [3].

Due to the complexity of the issue, seemingly infinite apps and investment benefit, autonomous driving has been a hot subject with companies like Google, Uber, and Tesla. The brain child of the technology is the autonomous metropolitan task of DARPA from more than a century ago. Few companies were able to apply algorithms to company vehicles with some achievement. These algorithms vary from classical methods to control to deep learning. We will see Deep Learning methods and the TensorFlow structure in this paper with the objective of navigating a driverless vehicle through an urban setting. The novelty in this system is the use of Deep Learning vs. traditional autonomous operation techniques in real-time as well as the implementation of the TensorFlow structure itself. This article offers an application of AlexNet's Deep Learning model to identify driving indices, how to execute them in a true system, and any unforeseen disadvantages to such methods, and how to minimize and solve them [4].

A precise and solid identification of the track is an important element of the near future for independent vehicles. The researchers introduce the development and execution of a solid autonomous driving system using the established technique of track identification for object identification by Viola-Jones. The Viola-Jones technique is used to identify non-road traffic cones as it can be performed in urgent cases. The traffic cone locations are evaluated to provide a highway template. Based on this template, the urgent condition drives a car autonomously and securely. The method submitted is applied on a raspberry pi and assessed using a driving simulator. The implementation period for item identification is less than 218ms for high-resolution pictures with a size of 1920x1080 pixels while a large detection speed is created. In addition, autonomous driving scheduling and implementation needs only 0.55ms [5].

Detection and classification of obstacles on-road are one of the main duties in the self-driving vehicle awareness system. Since monitoring cars includes locating and associating cars between frames, it is essential to detect and classify cars. For this assignment, vision-based methods are common because of the cost-effectiveness and usefulness of vision-related image information. A profound learning scheme based on regional convolutionary neural network trained with PASCAL VOC image dataset is created in this article to detect and classify barriers on the road such as cars, cyclists and livestock. A handling frame speed of at least 10 fps for a VGA resolution picture frame is achieved by implementing the system on a Titan X GPU. This large enough frame level using a strong GPU demonstrates the system's suitability for independent vehicles' road driving. The findings of identification and classification of pictures from KITTI and iRoads, as well as Indian highways, demonstrate the system output invariant to the form and perspective of the object, as well as distinct visibility and weather conditions [6].

The need to process ongoing video information quickly using integrated equipment arises, such as the one required for airborne UAV photography. In this article, we suggested an integrated distributed platform constructed with NVIDIA Jetson TX1 using profound learning methods for real-time video processing, primarily for object identification. This article describes the layout of the integrated real-time computing system centered on Storm and the ran algorithm for object identification centered on convolutionary neural networks. We assessed the document by undertaking real-time object detection on monitoring video taking into account the efficiency of our platform. Compared to NVIDIA TITAN X's high-end GPU processing, our system achieves the same processing speed but significantly reduced energy usage when doing the same job. At the same moment, our platform had an excellent tolerance for scalability and fault, which is appropriate for smart portable apps such as unmanned aerial vehicles or self-driving cars [7].

Detecting tiny highway risks, such as lost goods, is an essential ability to drive vehicles on their own. With a vision system that leverages image, contextual as well as geometric indications, we address this difficult and scarcely discussed issue. To use the appearance and contextual indications, we are proposing a fresh structure for the identification of obstacles based on profound learning. We present a Bayesian structure based on principles to combine the outcomes of linguistic and stereo-based identification. The Stixel mid-level representation is used in a versatile, compact and solid way to portray barriers. On the Lost and Found dataset, which involves very difficult scenes with barriers of only 5 cm in height, we assess our fresh barrier detection system. Overall, we report a significant increase over the state-of - the-art, with a 27.4% increase in results. In specific, for ranges of up to 50 m, we attain a detection level of over 90%. On our self-driving platform, our device works at 22 Hz [8].

Autonomous vehicles use the roles of ego routes to set driving policies. The prior techniques, with powerful geometric assumptions, identify lane points and pick ego paths with heuristic and complicated post processing. We suggest an end-to-end linear transfer training technique to predict straight and individually the left and right self-paths without any post-processing. We redefined an issue of point detection as an issue of region segmentation; as a consequence, the suggested technique is insensitive to occlusions and changes of environmental circumstances as it takes into account the full material of an input picture during practice. We also built a comprehensive dataset for profound neural network learning by gathering a range of street circumstances, annotating and systematically increasing ego paths. Compared to a latest technique centered on profound teaching, the suggested technique showed enhanced precision and stabilization on input differences. Our strategy does not require post-processing, so it is versatile to alter the aim domain [9].

III. Existing System

Robot devices, including Autonomous Vehicles, generally use a model of "sense-plan-act." Autonomous cars use a mixture of sensors, including LIDAR (Light Detection and Range), radar, cameras, ultrasonic, and infrared, to detect the atmosphere. A mixture of detectors can supplement each other and compensate for any flaws in any sensor type. While robotic devices are very great at gathering information about the surroundings, the most difficult aspect of creating an ultra-reliable Autonomous Vehicle continues to make sense of that information. Technological advances create a continuum between standard, completely human-driven cars and independent cars that drive themselves partly or completely and that eventually involve no driver whatsoever. There are techniques within this continuum that allow a car to help and create choices for a human conductor. These include collision alarm devices, adaptive cruise control (ACC), lane-keeping devices, and technology for self-parking. To solve the above problem, we design an RC car using Raspberry Pi that processes the images to determine the path in which the car should travel in the course of time traveling by car [11].

IV. Proposed System

An autonomous remote controlled car using machine learning techniques with a single concealed layer in this study job. We're going to use a remote controlled vehicle with a Raspberry Pi and a module installed on top of the Raspberry Pi camera. The camera module would provide pictures required to train the cellular network and in the independent mode in the teaching mode; would provide the pictures to the qualified template to estimate the car's motions and orientation as shown in figure 2.

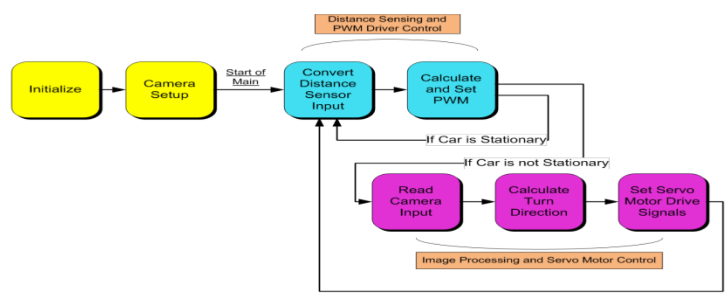

Figure 2: System Architecture

4.1 Advantages of proposed System

- Than human senses, sensory technology recognizes the environment in a much better way seeing far ahead and when it comes to visual aids also identifying small and ultra-fine hurdles, this is also the reason for fewer road accidents.
- It reduces the cost and also saves fuel which constitutes to an efficient travel.
- Autonomous driving benefits in reducing traffic.

- People with accessibility barriers who cannot drive are also benefitted.
- Many of the businesses seeking to introduce driverless cars do so with the objective of using electric vehicles rather than hybrid or conventional vehicles with diesel motors
- Productivity has been increased.

V. IMPLEMENTATION SETUP

In order to link the circuits, we need a remote controlled car, a Raspberry Pi, a power bank, a L293D Motor Driver IC and some jumper cables. We attached a cardboard to the top of the RC car and attached to it the Raspberry Pi and the power bank as shown in figure 3.

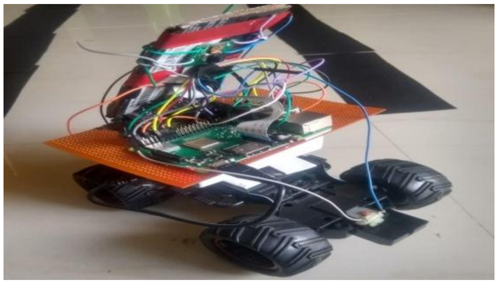

Figure: 3 Remote controlled car setup

5.1 Configuring the Remote Controller

Our original strategy was to use the Raspberry Pi as a radio receiver by using pi-rc to determine the RC car frequencies and substitute the remote control. We embraced this strategy, and until we created somewhat more complex circuits, things went well. Around the spins the car would be too quick and the natural strategy to adopt would be to lower the speed around the bends. We would have had to create changes to regulate the car's DC engines. As the front engine and the engine controlling the forward / reverse path as the back engine, we will refer to the DC engine controlling the left / right path. As shown in the circuit diagram figure 4, an L293D Motor Driver IC is used to regulate the engines. The need for any radio receiver to regulate the car's motion has now been eliminated.

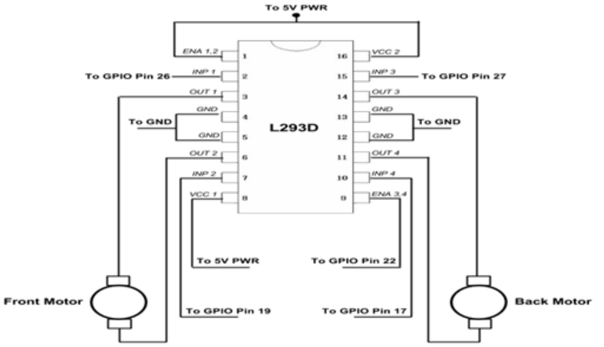

Figure: 4 Circuit diagram for RC Car controller

5.2 Mounting the Camera

The camera module of Raspberry Pi was installed on top of the car figure 5 Captures the pictures needed to train and navigate the vehicle autonomously. The camera unit was connected to a non-sturdy piece of cardboard that would alter the camera's tilt direction. Due to the mismatch between the present viewport and the earlier viewport, a small change in the direction of view would trigger the system educated on the prior collection of pictures to conduct very badly. By installing the camera on a comfortable stand, we solved this problem and also ensured that the camera was centered in this way, giving a very wide perspective.

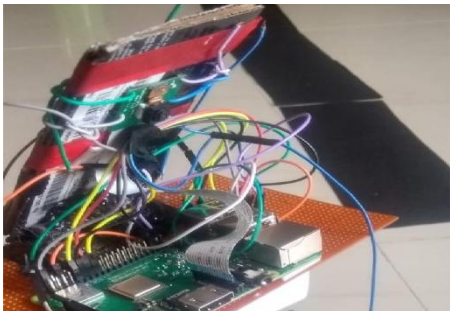

Figure: 5 Camera mounted on the sturdy stand

5.3 Image Capture

The trained models would deliver excellent results on the previous circuit configurations after stabilizing the camera, but it would perform poorly when the configuration of the circuit changed slightly. The fresh camera stance given a stabilized collection of pictures, but there would be data unrelated to the car's navigation in a big region of the fresh picture set. Since parts of the highway needed for the next navigation intervention would be in the lesser part of the picture almost completely as shown in figure 6. We used this as inputs for practice and forecast in the neural network.

Figure: 6 The lower half of the image will be input to the neural network

VI. Conclusion

There are currently many distinct techniques accessible to help create independent car systems. On certain luxury cars, items such as GPS, integrated cruise control and track maintenance aid are accessible to customers. The mixture of these techniques and other systems, such as video-based track assessment, steering and brake actuation mechanisms, as well as the programs required to regulate all parts, will become a completely independent scheme. The issue is to win people's confidence to enable a computer to operate a car for them, which is why study and experimentation must be performed time and time again to ensure a nearly foolish final item. The item will not be adopted immediately, but overtime will understand the advantages of it as the devices become more commonly used individuals. Autonomous vehicle application will raise the issue of replacing people with machines that can do the job for them. There will be no immediate shift in culture, but as they are incorporated into culture, it will become more evident over moment. The shift to an automated transport system will significantly avoid many traffic-related issues. Autonomous car implementation will enable the vehicles to use the highways more effectively, thereby saving time and room. With automated vehicles, tight roads will no longer be a issue and with the assistance of this latest technology, most traffic issues will be largely prevented. Research shows that with the inclusion of independent vehicles, traffic patterns will be more predictable and less difficult.

For numerous transport authorities, smooth traffic flow is at the top of the wish list. In their high-end designs, car companies are already using different driver support schemes and this trend is becoming increasingly prevalent. The early co-pilot devices are anticipated to gradually develop into autopilots as a consequence of this trend. All advances indicate that one day the smart cars will be component of our regular life, but when is it difficult to forecast. Whether or not the government industry will be proactive in taking benefit of this capacity is the most significant consideration. Whether the advantages will arrive earlier rather than later will be determined by the public sector. Because these support schemes are very comparable to the technologies used in independent vehicle prototypes, they are considered to be the key components on the road to completely independent cars being implemented.

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