Self-Driving Car based on Image Processing with Machine Learning

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Abstract - *Artificial Intelligence's creation has acted as a catalyst in the area of technology. Things that were once just a figment of our imagination can now be realized. The birth of self-driving cars is one of these innovations. Days have come when you can do your work or even sleep in your car and still get to your destination without ever touching the steering wheel or accelerator securely. This project proposes a working model of a self-driving car that can drive from one place to another, or on various types of tracks such as curved, straight, and straight followed by curved tracks. Along with the Raspberry Pi, a camera module is mounted on the top of the vehicle. The images from the real world are sent to the Convolutional Neural Network via Raspberry Pi. The machine then forecasts one of the following ways. Right, left, forward, or stop are the options. After that, a signal is sent from the Arduino to the car's controller, and the car moves in the desired direction without any human interference.*

***Key Words*: Artificial Intelligence, Self-driving car, Convolutional Neural Network, Raspberry PI, Arduino.**

1. INTRODUCTION

Self-driving vehicles are one of the most talked-about technologies in the modern era. What was once just a dream has become a reality. A self-driving vehicle (also known as an autonomous car or a driverless car) operates without human intervention and can sense its surroundings. Various sensors are combined and used to distinguish the road, barriers, pedestrians, and other objects in the environment. Reduced costs due to less fuel waste, increased protection, increased mobility, increased customer loyalty, and so on are all advantages of having a driverless car. We would see less traffic accidents, a lower accident rate, less deaths, and lower insurance rates as a result of the safety benefits. By providing proper routine mobility from source to destination, automated cars may improve traffic flow. Kids, the elderly, the disabled, and the poor who are unable to control non-autonomous vehicles will benefit from this service. Travelers may reduce their stress from driving and navigation problems while visiting an unfamiliar city, reduce the need for parking space, reduce fuel consumption, and make transportation more convenient by using services such as converting existing vehicles such as taxis, trains, and buses to fully automated vehicles .We have a wide variety of vehicles that are categorized in these SAE ranges, ranging from manually operated vehicles (SAE Level 0) to fully autonomous vehicles (SAE Level 5).These are known as semi-automated vehicles. These were created before complete automation was possible. These were iterative approaches to semi-automating a vehicle, such as automating some parts. These semi-automated vehicles could have some of the characteristics of fully automated vehicles while still allowing the driver to control the vehicle. Since the cars primarily depend on a preprogrammed code. The traffic light, sudden pedestrians contact on road, is secondary data they need to process. Hence, they tend travelling slower for processing these extra scenarios. The vehicle sometime might have difficulty when determining certain objects such as light debris, trash, when humans such as police officers are signaling the vehicle to stop; spotting potholes on the road is also sometimes difficult hence avoiding them becomes not possible difficult As a result, preventing them becomes impossible. As a result, preventing them becomes impossible. Higher speed limits and smoother drives are possible benefits because these vehicles have greater driver control and can see a wider distance than a person can. This can improve highway capacity and minimize(reduce) traffic congestion created by less safety gaps between vehicles. Travelling at a faster pace Currently, drivers on highways maintain distance of 40 to 50metres (130 to 160 feet) from the vehicle in front of them. These increases in highway capacity are often one of the most significant reasons for traffic congestion, particularly in urban areas, where highway congestion is more severe in some places. The authorities' attempts to control traffic flow normally result in increased traffic congestion; however, with more data and the ability to predict people's driving behavior we can combine these two details to reduce traffic congestion on the road while eliminating the need for traffic police and even road signs. According to online surveys, manual-driven vehicles are only used 4–5% of the time, while being parked and unused for the remaining 95–96 percent of the time. Autonomous vehicles, on the other hand, are continuously used even after it has travelled from some source to some destination for a given person. This could lead to reduce the need for parking space.

1.1 PROBLEM STATEMENT

Non-autonomous vehicles have been around for a while, and according to an online study, the percentage of accidents caused by human error is very high. Every year, almost 1.3 million people die in road accidents around the world, an average of 3,287 deaths per day. When it comes to India, the number of people killed in road accidents in 2013 alone was 1,37,000. Speeding is a serious offence. The root causes of these injuries are talking on the phone, driving while intoxicated, and violating traffic laws, and the numbers are steadily increasing, posing a serious threat. No matter how hard we try to raise awareness about traffic rules and the importance of maintaining a healthy driving environment, incidents continue to occur without warning. Human mistakes can never be completely removed, but injuries should be avoided. And in this situation, technology has unquestionably saved the day. The development and enhancement of this technology has seen an exponential growth in recent years, starting from the very early radar-based collision detection to today's technology. Self-driving vehicles are one of the most talked-about technologies in the modern era. What was once just a dream has become a reality.

2. RELATED WORK

The work done by Akira Kojima and Yohei Nose [2] is developed using Xilinx FPGA Zynq 7020, which has Programmable Logic part and Processor System part. Image recognition to detect dolls used as humans is implemented on PL as hardware logic. Image processing of lane keeping navigation and motor control are implemented on PS as software programme. The system is using PYNQ environment which can control hardware by Python language. Another research work [3] done by H. Wakatsuki describes implementation of autonomous driving robot with image processing using FPGA. Hough transform which is generally used for white line detection, requires high computing cost. In addition, hardware implementation using Vivado HLS is described. In [1] A. K. Jain proposes a working model of self-driving car which is capable of driving from one location to the other or to say on different types of tracks such as curved tracks, straight tracks and straight followed by curved tracks.

3. SYSTEM ARCHITECTURE

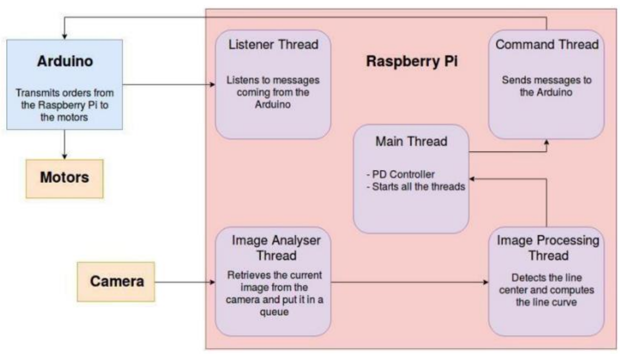


Fig -1: System Architecture

3.1 SYSTEM METHODOLOGY

The proposed model uses a Pi cam connected to a Raspberry Pi in the car to capture a picture. The Raspberry Pi and the laptop are both linked to the same network, and the Raspberry Pi sends the image captured to the Convolutional Neural Network as the input image. The picture will be captured by the camera that was installed in the Raspberry Pi kit's top head; the camera equipment will be linked via a USB port The Linux OS/Raspbian OS programme can capture the image from the attached camera. The extracted image from the camera is sent to the Raspberry Pi pack, which is then used to run python code. Signals are created in the python coding, which come from the execution of the kit and are sent to the car/robot. The Raspberry Pi and the robot car follow each other and effectively detect objects. The SD card, like a hard drive on a computer, is an essential component of the Raspberry Pi board. Before moving the picture to the Neural Network, it is grayscale. The model predicts one of four possible outcomes: left, right, forward, or stop. When a predicted outcome is obtained, the corresponding Arduino signal is triggered, which in turn causes the corresponding Arduino signal to be triggered with the assistance of its controller, assists the car in moving in a specific direction.

How Lane-Detection is done?

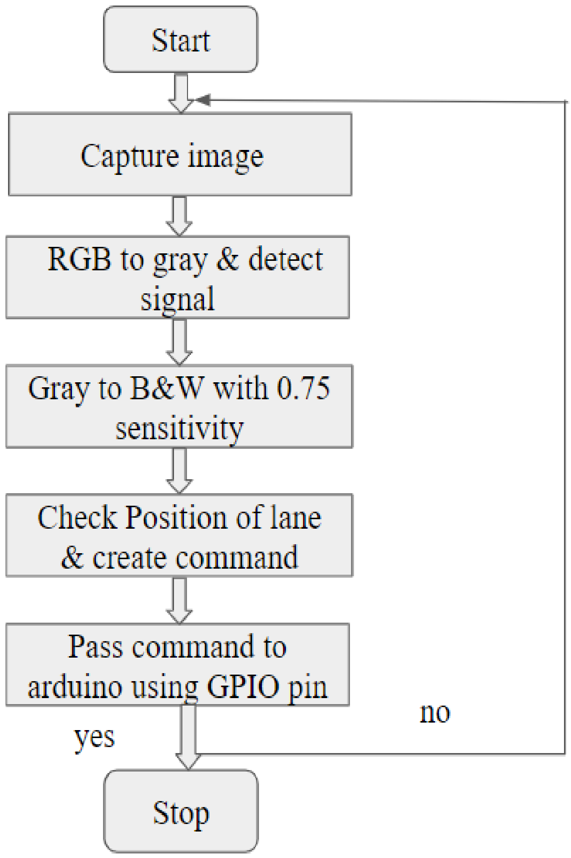
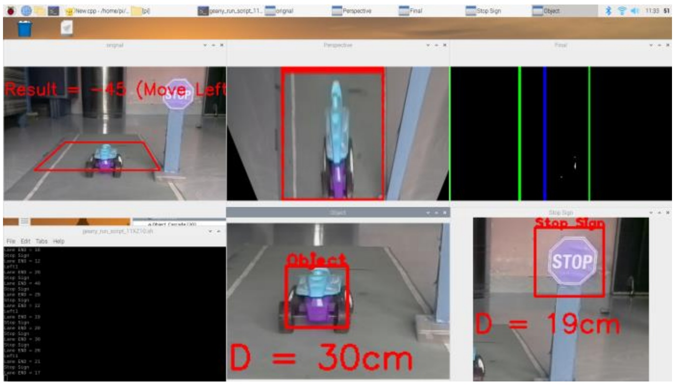


Fig -2: Image Processing sub system flowchart

Converting our pictures to grayscale would be the first step in working with them. (We're combining three pixel value channels (Red, Green, and Blue) into a single channel with a [0,255] pixel value range.) Yellow lane lines are still there Convert to Hue Value Saturation or HSV colour space if the image is black and white. To return the pixels we're interested in, add a mask to the original RGB image. The pipeline for lane detection focuses on what's in front of the driver. To do so, we'll make a new mask called region of interest (ROI). Outside of the ROI, all will be black/zero, so we'll just deal with the related tip. After that, use the Hough transform to get two master lines. We can average our line image with the original, unaltered image of the road to get a clean, smooth overlay once we have our two master lines.

4. RESULT



5. CONCLUSIONS

A method for creating a self-driving car model is discussed in this paper. A effective model was created with the aid of Image Processing and Machine Learning, and it performed as anticipated. As a result, the model was developed, implemented, and tested successfully. The issue of non-autonomous vehicles was discussed with the proposed system that decreases the amount of human effort required to operate the vehicle the creation of a mobile app may be applied to this project in the future. When the vehicle meets two paths to a common destination, the user can communicate with the vehicle through a web app. This app will also provide recommendations for nearby places to visit. The autonomous car would undoubtedly prove to be a blessing to the automation industry, outperforming many conventional methods. They may be used for patrolling and collecting suspect photographs. Since they would not need any drivers, accidents caused by reckless goods carrier vehicles would be minimized, resulting in improved logistic flow. Due to the small number of mistakes, buses for public transportation will be more regulated. As a result, an autonomous car of this kind can be realistic and advantageous for better regulation in the products and people mover's segment due to its greater autonomy and performance.

6. REFERENCES

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