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Original Article

Centaur - A Self-Driving Car

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Abstract *- The world had moved further from the time when Benz first introduced the first production car to the whole world, which at that time was not less than a miracle. As time passed, the cars have evolved, but one thing remained the same, the need for a driver to drive the car around. Be it a luxury car, a wonderful speed car or a day to day commuter, it could not be driven without a driver. Even in today's world, a car is just a marvel of modern mechanics sitting in your garage being useless without a driver and of course, be it any country you need a valid Driving License if you want to be eligible to drive a car according to the law and can't be used in times of emergency if a trained and learned driver is not available. Self-driving vehicles are cars or trucks in which human drivers are not required to take control to safely operate the vehicle. Also known as autonomous or driverless cars, they combine sensors and software to control, navigate, and drive the vehicle. Our goal is to make Centaur be able to work on the principle of a convolutional neural network, which is, in turn, a class of deep neural networks. Also, it uses Computer Vision which helps in object classification and lane detection, correction and lane change. It also uses a variety of sensors to collect data and improve drivability, all of which are powered by batteries. This Paper deals with how it can be done and proposes a system for the same.*

Keywords *- Convolutional Neural Network, Object Classifiers, Computer Vision, Sensors, Data Collection.*

I. INTRODUCTION

Self-Driving cars is not a new concept. A lot of ideas have been proposed, and some of them are implemented. The motivation for building a self-driving car came from the road accident census in India[1], which gives an estimate of 3.68 million cars sold by the year 2016 and, as reports suggest, 1214 accidents happen every day in India. Similarly, in the US, NHTSA [2] reports stated that 37,150 people died, and 94% of the crashes happened due to human errors. We need to also consider the fact that global warming is rising due to greenhouse emissions out of cars. We are also aware of the depletion of fossil fuels. Lastly, we can't ignore the heinous crimes committed by taxi drivers.

These types of self-driving cars can add $7 Trillion USD to the global economy by adding jobs and will create new types of employment for those working on or for it. It will help secure, save and improve human lives, and it will also be one of the key factors in saving the environment by cutting the greenhouse emissions and saving fossil fuels for the coming generations. It'll mark a new era for automobile advancements. In this paper, we deal with making the car fully autonomous, as in where no driver is required to drive the vehicle around.

This Paper focuses on the strategies used for various self-driving car projects [8]. Further Section 2 summarizes the literature survey done by us, and Section 3 demonstrates the design and implementation of the proposed system. In the end, we discuss how we plan to take our proposed work further, and the conclusion is prepared in the last section.

II. LITERATURE SURVEY

The number of papers published in Self-Driving cars has certainly increased with time. Paper [3] proposed that traffic signals and signs can be read using deep feature-based learning using computer vision via various algorithms, and another paper [4] helps us in understanding the concept of how to detect lanes and curves in a road.

The next year saw many more of the implemented systems, but as we read in an article[5] published in 2015 that removing the driver may pose a problem that who might be controlling the code and as auto manufacturers demanding to remove the driver controls on automated vehicles and have demanded the same from NHTSA[6], and another paper which states that it's safer to have a car with no driver controls.

III. DESIGN AND IMPLEMENTATION

The car uses an onboard computer, sensors and a camera. The camera captures the image from the viewfinder and sends it to the onboard computer frame by frame, which then analyses the frame for

any traffic signal or sign. It also takes continuous data from the on-board sensors, which provide the information about the environmental data [7] present around the vehicle, for example, if a vehicle is standing in front of our vehicle, then with the help of the sensors, we can estimate the size and distance between the two vehicles. The main sensor here is the ultrasonic sensor which uses sonar to find the distance between two objects as the footage from the camera alone is not sufficient to make a decision on the movement of the vehicle.

A. System Architecture

The system that we have designed basically runs on the principles and libraries of OpenCV (Open Computer Vision) and C++ language as an interface between OpenCV and the system. Here Fig [1] shows the architecture of the self-driving car and shows various elements which are needed to develop a self-driving car.

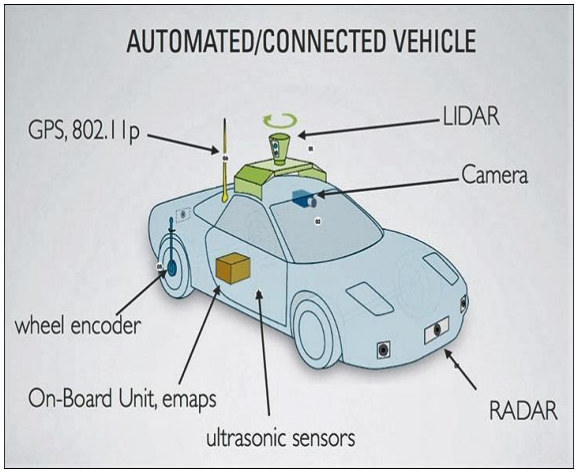

Fig. 1 System Architecture

B. Tools Used

The tools which we have used for our project are C++, raspberry pi 3 model B+, Raspberry pi Cam, Arduino board and various sensors. Fig [2] represents the Geany editor of RaspianOS, which was used to write the code for our car, Fig[3] shows an Arduino board and various sensors used in the car, the Arduino Uno board was connected with the raspberry pi in the master-slave configuration and the various sensors which were used were ultrasonic sensor as Radar, buzzer as horn, Infrared sensor as LIDAR, LDR sensor for turning on the headlights etc. Fig [4] shows a Raspberry Pi model 3 b+, which we used as the main computer for our project connected with a Raspberry Pi camera module 2, which is a 5-megapixel sensor to capture the image frames.

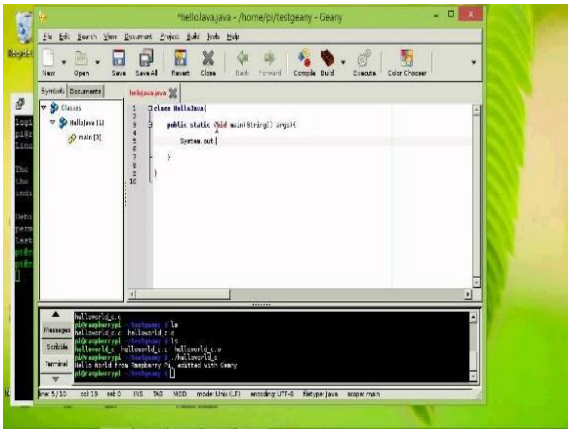

Fig. 2 Geany as C++ IDE

Fig. 3 Arduino and various sensors

Fig. 4 RaspberryPi with camera Module

C. System Overview

When the car is put on the track and the system is switched on, it automatically starts detecting the traffic signals, and the various sensors start doing their assigned work to make the car fully autonomous. Here Fig 4[a] shows the final working module of our project, and fig4[b] shows the final working output given by the module.

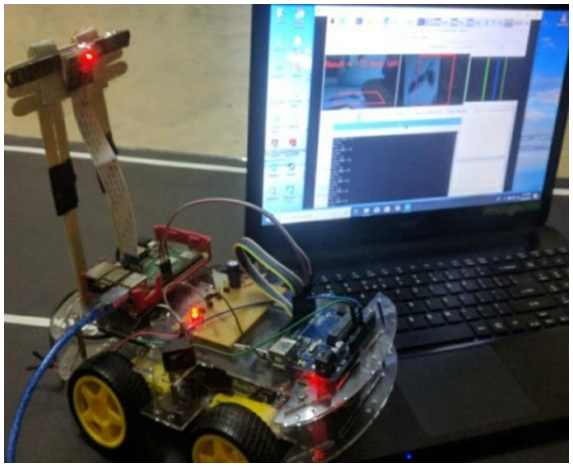

Fig. 4(a) The Working Module Hardware

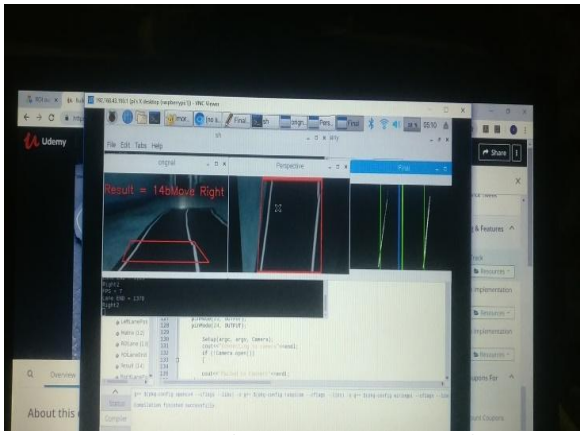

Fig. 4(b) Output of The Working Module Software

IV. CONCLUSION

The self-driving car has been successfully made, and hence module 1 of the proposed system has been implemented. Furthermore, the system would be able to detect lanes, traffic signs, signals and curves in the road and would be able to move accordingly. It would also use the sensors to gather knowledge about its environment to help the system to have better knowledge of surroundings and also to provide the passenger with the best riding experience.

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