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IoT Based Self Driving Car

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Abstract--- **This explores autonomous (also called self-driving, driverless or robotic) vehicle benefits and costs, and implications for various planning issues. It investigates how quickly self-driving vehicles are likely to be developed and deployed based on experience with previous vehicle technologies, their benefits and costs, and how they are likely to affect travel demands and planning decisions such as optimal road, parking and public transit supply. This analysis indicates that some benefits, such as more independent mobility for affluent non-drivers, may begin in the 2020s or 2030s, but most impacts, including reduced traffic and parking congestion (and therefore infrastructure savings), independent mobility for low-income people (and therefore reduced need for public transit), increased safety, energy conservation and pollution reductions, will only be significant when autonomous vehicles become common and affordable, probably in the 2040s to 2050s, and some benefits may require prohibiting human-driven vehicles on certain roadways, which could take even longer.**

Keywords--- **Autonomous, Driverless, Safety, Techniques**

I. INTRODUCTION

Self-driving car (also known as a robot car, autonomous car, or driverless car) is a robotic vehicle that is designed to travel between destinations without human intervention. It is capable of sensing environment and navigate without human input. Autonomous cars must have control systems that are capable of analysing sensor data to distinguish between different cars on the road. The potential benefits of autonomous cars include reduced mobility and infrastructure costs, increased safety, increased mobility, increased customer satisfaction and reduced crime. Specifically, a significant reduction in traffic collisions; the resulting injuries; and related costs, including less need for insurance. Autonomous cars are predicted to increase traffic flow; provide enhanced mobility for children, the elderly and disabled; review travellers from driving and navigation chores; lower level fuel consumption; significantly reduce needs for parking space; and facilitate business models for transportation as a service, especially via the sharing economy. This shows the vast disruptive potential of the emerging technology. In Spite of the various potential benefits to increased vehicle automation, there are unresolved problems, Such as safety, technology issues, disputes concerning liability, resistance by individuals to forfeiting control of their cars, customer concern about the safety of driverless cars, implementation of a legal framework and establishment of government regulations; risk of increased suburbanization as travel becomes less costly and time consuming. Many of these issues arise because autonomous objects, for the first time, would allow computers to roam freely, with many related safety and security concerns.

II. HISTORY

Experiments have been conducted on automating driving since at least the 1920s; trials began in the 1950s. The first truly automated car was developed in 1977, by Japan's Tsukuba Mechanical Engineering Laboratory. The vehicle tracked white street markers, which were interpreted by two cameras on the vehicle, using an analogue computer for signal processing. The vehicle reached speeds up to 30 kilometres per hour. Autonomous prototype cars appeared in the 1980s, with Carnegie Mellon University's Navlab and ALV projects funded by DARPA starting in 1984 and Mercedes- Benz and Bundeswehr UniversityMunich's EUREKA Prometheus Project in 1987. Since then, numerous Companies and research organizations have developed prototypes. In 2015,[1] the US states of Nevada, Florida, California, Virginia, and Michigan, together with Washington, D.C., allowed the testing of automated cars on public roads. In 2017, Audi stated that its latest A8 would be automated at speeds of up to 60 kilometres per hour (37 mph) using its "Audi AI." The driver would not have to do safety checks such as frequently gripping the steering wheel. The Audi A8 was claimed to be the first production car to reach level 3 automated driving, and Audi would be the first manufacturer to use laser scanners in addition to cameras and ultrasonic sensors for their system. In November 2017, Waymo announced that it had begun testing driverless cars without a safety driver in the driver position; however, there is still an employee in the car. In July 2018, Waymo announced that its test vehicles had travelled in automated mode for over 8,000,000 miles (13,000,000 km), increasing by 1,000,000 miles (1,600,000 kilometres) per month.

III. CLASSIFICATION

A classification system based on six different levels (ranging from fully manual to fully automated systems) was published in 2014 by SAE International, an automotive standardization body, as J3016, Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems. This classification system is based on the amount of driver intervention[2] and attentiveness required, rather than the vehicle capabilities, although these are very loosely related. In the United States in 2013, the National Highway Traffic Safety Administration (NHTSA) released a formal classification system, but abandoned this system in favour of the SAE standard in 2016. Also in 2016, SAE updated its classification, called J3016_201609.

IV. LEVELS OF DRIVING AUTOMATION

In SAE's automation level definitions, "driving mode" means "a type of driving scenario with characteristic dynamic driving task requirements (e.g., expressway merging, high speed cruising, low speed traffic jam, closed-campus operations, etc.)"

- **Level 0:** Automated system issues warnings and may momentarily intervene but has no sustained vehicle control.
- **Level 1 ("hands on"):** The driver and the automated system share control of the vehicle. Examples are Adaptive Cruise Control (ACC), where the driver controls steering and the automated system controls speed; and Parking Assistance, where steering is automated while speed is under manual control. The driver must be ready to retake full [4]control at any time. Lane Keeping Assistance (LKA) Type II is a further example of level 1 self-driving.
- **Level 2 ("hands off"):** The automated system takes full control of the vehicle (accelerating, braking, and steering). The driver must monitor the driving and be prepared to intervene immediately at any time if the automated system fails to respond properly. The shorthand "hands off" is not meant to be taken literally. In fact, contact between hand and wheel is often mandatory during SAE 2 driving, to confirm that the driver is ready to intervene.
- **Level 3 ("eyes off"):** The driver can safely turn their attention away from the driving tasks, e.g. the driver can text or watch a movie. The vehicle will handle situations that call for an immediate response, like emergency braking. The driver must still be prepared to intervene within some limited time, specified by the manufacturer, when called upon by the vehicle to do so. As an example, the 2018 Audi A8 Luxury Sedan[3] was the first commercial car to claim to be capable of level 3 self-driving. This particular car has a so-called Traffic Jam Pilot. When activated by the human driver, the car takes full control of all aspects of driving in slow-moving traffic at up to 60 kilometres per hour (37 mph). The function works only on highways with a physical barrier separating one stream of traffic from oncoming traffic.
- **Level 4 ("mind off"):** As level 3, but no driver attention is ever required for safety, e.g. the driver may safely go to sleep or leave the driver's seat. Self-driving is supported only in limited spatial areas (geofenced) or under special circumstances, like traffic jams. Outside of these areas or circumstances, the vehicle must be able to safely abort the trip, e.g. park the car, if the driver does not retake control.
- **Level 5 ("steering wheel optional"):** No human intervention is required at all. An example would be a robotic taxi.

V. LITERATURE SURVEY

- **Sushmitha's [1] "LOW COST AND POWER ANN BY DEEP LEARNING SOLUTIONS FOR AUTOMATED DRIVING**"

Automated driving functions, like highway driving and parking assist, are increasingly getting deployed in high-end cars with the ultimate goal of realizing self-driving car using artificial neural network (ANN). For mass-market deployment, the embedded solution is required to address the right cost and performance envelope along with security and safety. In the case of automated driving, one of the key functionality is "finding drivable free space", which is addressed using ANN. These ANN networks pose huge computing requirements in terms of hundreds of GOPS/TOPS (Giga or Tera operations per second), which seems beyond the capability of today's embedded SoC . It covers various techniques consisting of fixed-point conversion, sparse multiplication, fusing of layers and network pruning, for tailoring on the embedded solution. These techniques are implemented on the device by means of optimized Deep learning library for inference. The paper concludes by demonstrating the results of a ANN network running in real time on TI's TDA2X embedded platform producing a high-quality drivable space output for automated driving.

- **THOMAS'S[3] "TIME-TO-CONTACT CONTROL FOR SAFETY AND RELIABILITY OF SELF- DRIVING CARS"**

For safety and reliability of self-driving cars, their control system must use the relative velocity of vehicles. The relative velocity can be estimated by differentiating the measured distance between cars with respect to time. However, inevitable measurement noise in the distance measurements will be amplified by the derivative operation.

- **FARID'S[4][2] "END-TO-END LEARNING FOR LANE KEEPING OF SELF DRIVING CARS"**

Lane keeping is an important feature for self-driving cars. This paper presents an end-to end learning approach to obtain the proper steering angle to maintain the car in the lane. The artificial neural network (ANN) model takes raw image frames as input and outputs the steering angles accordingly. The model is trained and evaluated using the comma.ai dataset, which contains[5] the front view image frames and the steering angle data captured when driving on the road. Unlike the traditional approach that manually decomposes the autonomous driving problem into technical components such as lane detection, path planning and steering control, the end-to-end model can directly steer the vehicle from the front view camera data after training. It learns how to keep in lane from human driving data.

- **End-to-end learning for lane keeping of self-driving cars**

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VI. PROBLEM STATEMENT

Most of the Indian rural and sub urban roads are not ideal for driving due to faded lanes, irregular potholes ,improper and invisible road signs. This has led to many accidents causing loss of lives and severe damage to vehicles. Many techniques have been proposed in the past to detect these problems using image processing methods. But there has been little work specifically carried out for detecting such issues of Indian roads. To address this acute problem, the study is undertaken with the objectives like, to suggest the method to detect lanes potholes and road signs and their classification and to suggest automated driver guidance mechanism.

VII. OBJECTIVES

- Tire Pressure Monitoring
- Intelligent traffic signal detection using Image processing
- Fuel Monitoring using level sensors
- Ultrasonic based Breaking System

VIII. METHODOLOGY

This development aims to build a monocular vision autonomous car prototype using Raspberry Pi as a processing chip. An HD camera along with an ultrasonic sensor is used to provide necessary data from the real world to the car. The car is capable of reaching the given destination safely and intelligently thus avoiding the risk of human errors. Many existing algorithms like lane detection, obstacle detection are combined together to provide the necessary control to the car. A neural network model runs on computer and makes predictions for steering based on input images. Predictions are then sent to the Arduino for RC car control.

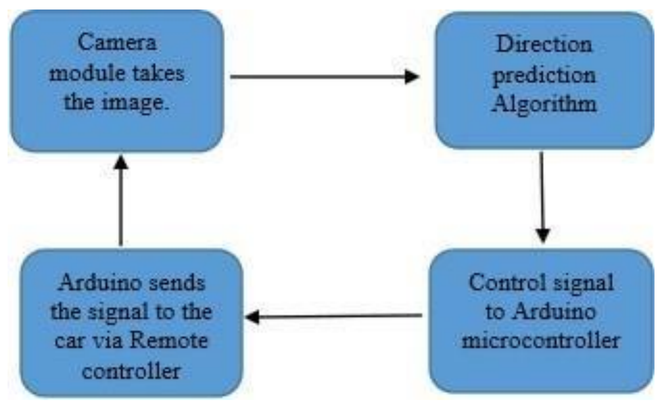

Fig 1 : Block Diagram

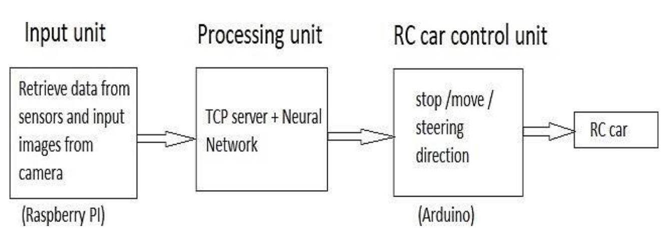

Fig 2: Control Flow Diagram

The proposed model takes an image with the help of Pi cam attached with Raspberry Pi on the car. The Raspberry-Pi and the laptop is connected to the same network, the Raspberry Pi sends the image captured which serves as the input image to the Neural Network. The image is grey-scaled before passing it to the Neural Network. Upon prediction the model gives one of the four output i.e. left, right, forward or stop. When the result is predicted corresponding Arduino signal is triggered which in turn helps the car to move in a particular direction with the helpof its controller.

IX. IMPLEMENTATION

Step 1: Image/video acquisition from the camera
Step 2: Convert video to frames.
Step 3: Store images of each animal as database which is used as training set for our program
Step 4: Compare camera captured frames withthe database.
Step 5: Use imread function to read the image and Preprocessing is done on that image. Perform Blob detection on the frame and blobs are matched with imagesfrom training databaseimages.
Step 6: And check if it is matching or not.
Step 7: To identification of that animal is desired or not. An array is created and program is written for each animal to be identified.
Step 8: Intimation or alert

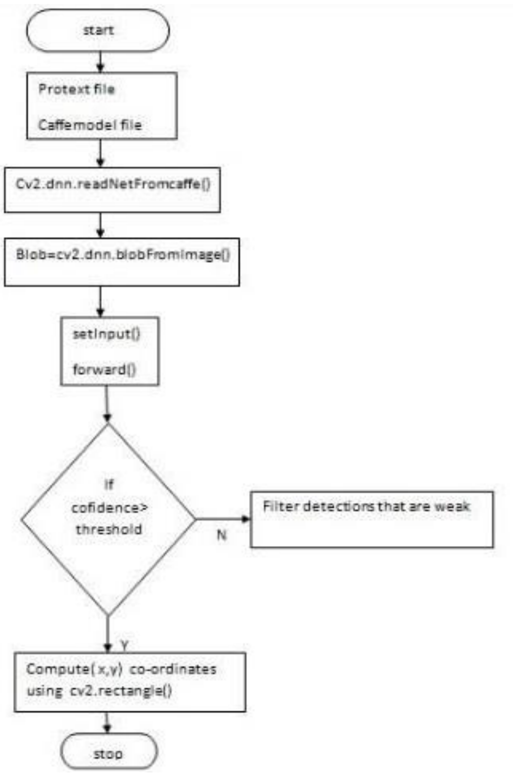

Fig 3 : Block Diagram Of Algorithm

X. X. RESULTS

- Lane Detection
- Animal Detection
- Road Sign Detection
- Hump Detection.
- Pothole Detection.

Reduces Manual Effort and More Convenient

- More Safer
- Road Sign Detection

Road safety has been an issue for as long as cars have been in existence. Over 1.3 million people die of road accidents every year across the globe, most of which are preventable. Ever rising road traffic has led to an exponential increase in commute time. This has a direct impact not only on people's productivity but also on the environment. Recent developments in machine learning and artificial intelligence along with the ever increasing performance of modern day computers have enabled the use of these technologies in developing self-driving cars. These cars have several advantages, as described below:

- Better road safety: Machines are not prone to human-error and distractions, leading to swift and appropriate responses in real-time road conditions.
- Reduced commute time: With cars communicating with each other and using modern GPS systems, commute times can be greatly reduced as self-driving cars reduce the "phantom effect" in modern-day traffic.
- Increased productivity: Reduced commute times mean more time can be spent on what matters more.
- Reduced expenditure: Reduction in accidents will directly lead to reduced expenditure on damages.
- Environment-friendly: Efficient driving styles of the self-driving car will lead to lower emissions.
- Solution to parking problem: Most of the modern cities face parking problems and which can be resolved by this solution.
- Better traffic discipline: Better law enforcement can be achieved and traffic can be managed by capping speed in various regions.
- Potential for a new design: Because a vehicle may eventually function as a self-guided train car, the potential for new car designs is huge. With no need for complicated driving tools, self-driving cars could include new ways to relax or to stay entertained.

The different hardware components along with software and neural network configuration are clearly described. With the help of Image Processing and Machine Learning a successful model was developed which worked as per expectation. Despite the inherent benefits, autonomous vehicle technology must overcome many social barriers. Much like the issue faced by the first automobiles, the influence of metal models can impede the advancement of technology. However new legislation is creating opportunities for these cars to prove their viability. As more states legalise the driverless cars, the social obstruction will give way, allowing for the largest revolution in personal transportation since the introduction of automobiles.

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