

REAL-TIME CAR NAVIGATION AND OBSTACLE AVOIDANCE

1st Elumalai Govindarajan 2nd Kanishya Anandhan 3rd Abirami Shanmugasundaram
 Professor , Dept. of ECE UG Student, Dept. of ECE UG Student, Dept. of ECE
 Panimalar Engineering College Panimalar Engineering College
 Panimalar Engineering College
 Chennai, Tamil Nadu, India Chennai, Tamil Nadu, India
 Chennai, Tamil Nadu, India

4th Dharshini Kaliyaperumal Manoharan
 UG Student, Dept. of ECE
 Panimalar Engineering College
 Chennai, Tamil Nadu, India

5th Gowsika Surulirajan
 UG Student, Dept. of ECE
 Panimalar Engineering College
 Chennai, Tamil Nadu, India

Abstract - Numerous recent technologies have been explored for the development of self Driving car yet this technology has not been implemented as of now. There are several drawbacks that have to be addressed before the full fledged implementation of autonomous car. The two main technologies that serve this purpose are Artificial Intelligence [AI] and Internet of Things [IoT]. AI is based on training the Machine according to predefined dataset, just like how the neural system in humans works. Here Camera act as the input device to capture in real time .If any fault occurs in camera, then the total system gets collapsed . To avoid such tremendous loss, IoT can be used as an alternative where several sensors can be employed in the vehicle to serve its purpose like Ultrasonic sensors for object detection and avoidance. Though IoT seems to solve this issue, making the sensors entirely active consumes large power demanding for more power supply and also there might occur fault in sensors as well. Integrating these two technologies by having the change in control from AI to IoT in case of fault might solve these issue some extent. So in this paper we will be implementing both these technologies together in the self driving car and also traffic sign detection and implementation in real time without the use of camera will be implemented in this paper.

Keyword – Real time car navigation, autonomous car, Artificial Intelligence (AI), Internet of Things (IoT).

I. INTRODUCTION

Nowadays, a car goes beyond an engine and some tyres. They have very advanced computer networks that operate and monitor a variety of sensors, as well as machine learning and computer vision algorithms that do mathematical calculations to keep you and your passengers as secure as possible from any risk or unforeseen circumstance.

The development of completely autonomous vehicles on open streets is a question of time as self-driving car technology continues to advance. Nearly every significant automaker, ride-sharing business, and tech giant from Google to Apple has invested in the driverless car sector. New developments in this field occur almost daily.

Although the market is still a long way from the widespread use of totally fully independent vehicles, there appears to be an uptick in initiatives to create driver support systems. The growing market for safe electronic systems in vehicles that passengers, as well as drivers, can rely on is the cornerstone of self-driving cars, and it is defining the future of automated driving. Earning the Automation begins with dependable

electronics, which enable systems to be economical, dependable, durable, and safe in all conditions. The goal is to make cars safer, possibly safer than human drivers, and more efficient, which will help people with greater road safety, rational traffic management, advanced navigation aids, passenger entertainment, and much more.

II. LITERATURE REVIEW

In 2022, Fatima Hasan et al... A concrete plan for implementing self-driving cars had been developed. Artificial intelligence, computer vision, and neural networks were all used in this proposed study. Here, a vehicle with autonomous lane changes, parking, and U-activations has been created using a number of tools, including mapping, monitoring, and local environmental planning. The dataset was processed using the Houghman transform, CNN was utilized to develop the model, and algorithms like Decision Matrix Algorithms, Pattern Recognition Algorithms, and Cluster Algorithms were used to execute the model. This document only defines a full-fledged model generation and its execution. [1]

In 2022, Bindu S.J, et al... developed a self-driving car has been created that can detect traffic signs and signals, identify road lanes, and go to the appropriate GPS coordinate on its own without the assistance from a driver. In order to monitor the surroundings, cameras and ultrasonic sensors have been installed. These sensors are connected to the raspberry pi, which serves as the microprocessor coordinating the connected devices. [2]

In 2022, Kunjal Agrawal et al.. Describes traffic sign detection and its implementation has been well stated. This paper is based on Deep learning where the Convolutional Neural Network CNN is used for building a model and the loss function used is "sparse_categorical_crossentropy" with the use of "Adam optimizer" for accuracy of classification. But before building the model the data has to be collected and processed and the processing techniques used are specified here. After building up

the model the model has to be trained and tested accordingly for better and accurate results and its split for training and testing are also considerably taken to be valid for accurate results. [3]

In 2022, Fuad Aliew et al... developed a IoT based obstacle avoidance technology been explained. This paper is about accurate distance measurement using the ultrasonic sensor for the application of self-driving cars. From this paper, we came to know about the two main methods for distance measurement with ultrasonic sensors (i.e) The pulse-echo method and the continuous-wave method and how these two methods can be implemented in measuring the distance using an ultrasonic sensor to achieve accuracy. Here accurate detection of obstacles in the environment can be achieved just with the ultrasonic sensor. [4]

In 2021, Abeed Hasan et al... focuses on the design and implementation of the self-driving car prototype. Here, a simplistic self-driving automobile was created and launched into service. It was capable of recognizing traffic signs and making the appropriate turns. To put the system into action, the analyzer computer was wirelessly attached to the car's body. This allowed the analyzer computer to use the TCP/IP protocol to evaluate the feed video frame by frame. The analyzer computer may be easily placed on a board or microprocessor in a real automobile for real-time application. [5]

In 2020, Victor Ciuntuet et al.. discuss about every autonomous vehicle that is allowed to use public roads must include a system for recognizing and categorizing traffic signs. This study combines a combination of neural networks and conventional image-processing techniques to classify traffic signs. For triangle signs, one neural network was used, and for circular signs, another. By doing template matching and conducting a colour consistency check, the identified traffic sign was verified. By following the machine learning detection technique with a filtering algorithm,

detection, and classification accuracy were improved. [6]

In 2020, Irfan Ahmad et al... focuses on the implementation of autonomous vehicles by using both computer vision and IoT. Computer vision is mainly concerned with recognizing traffic signs, lanes, and objects along the road and is being realized by using the camera as an input device. The acquired images are trained by the convolutional neural network, and the methodologies for its implementation were specified in this study. IoT is realized using sensors, networks, and cloud platform access. [7]

In 2020, Suhas Dangre et al... focuses Ultrasonic sensors were used to construct a real-time obstacle rescue system for wheeled robots, which can very well be used for self-driving cars. This system allows the robot to continually scan its surroundings, avoid obstacles, and go in the proper direction. The Hoover cleaner industry, hidden tunnels, parking garages, the chemical and auto industries, scientific research, search and rescue operations, and other isolated locations may all benefit greatly from the concept. A Raspberry Pi 3B+ and a motor shield with DC motors are used to build the vehicle, and an ultrasonic sensor is added for sensing. This sensor accurately and effectively detects any barrier in the way of the smart car. [8].

In 2019, Zeyu et al... A critical element of any autonomous vehicle is the technology for avoiding obstacles. Unmanned vehicles must operate in a secure environment while recognizing and avoiding adjacent obstacles. The planning of the route and acquiring environmental data were the main topics specified in this paper. Designing the route and becoming knowledgeable about environmental data collection is essential. Here, a two-wheeled robot that acts as an autonomous guided vehicle is constructed with a laser-based avoidance system. The created system can rapidly receive information about obstacle distances, successfully avoid obstacles, and choose a new route and path. The Raspberry Pi is employed as the edge platform for local processing, which enables the navigation of the

vehicle. [9]

In 2019, Mrs. J. Aruna Jasmine et al... focuses on the design of an IoT-based self-driving car with the aid of computer vision. The Hardware components used are some sensors connected to an Arduino board, and Raspberry pi for computer vision-based program execution. The web page is also created for having a user interface. Software necessary are some of the python libraries especially open cv or yolo, Arduino ide, HTML, CSS, and javascript execution platforms. [10]

In 2019, Manoj Kr. Pal et al... implemented collision avoidance system in Autonomous cars. This paper focuses on such system design with the help of a Microcontroller, speed sensors, Ultrasonic sensors, Display unit, GPS, and wifi module. In this proposed work, the probability of collision is determined with the help of GPS data received via the wifi module and if its probability is one, then the message will be displayed to the user else it continues to sense till there is a change in the probability. [11]

In 2019, Akshaya U Kulkarni et al... discussion based on object detection from a distance with the help of an Ultrasonic Sensor (HC-SR04) acting as RADAR. It is an IoT-based technology that can be used in an autonomous car to detect obstacles. The Servo Motor (SG90) is attached to the HC-SR04 so that it may rotate or move in order to sense in all directions. The SIM808 module is also used to send the intended recipient a message or SMS when an item is detected. For the processing in order to identify and alert the user of the object, these components are linked to the Arduino Uno and Raspberry Pi3. The Raspberry Pi is used to interface the entire system to a laptop and be loaded on an SD Card. The Ultrasonic sensor is directly connected to the Arduino. When an item is recognized, the GUI marks it with the colour red. [12]

In 2019, Nikolaos Baras et al... Autonomous miniature vehicles are

frequently used to test various algorithm types and imitate real-world driving behavior. In the past 10 years, several approaches to assist self-driving automobiles to avoid obstacles have been developed yet not been implemented in real-time as the camera can't detect the obstacle in low luminescence areas. This paper focuses on offering a dependable solution to this problem, here an autonomous automobile implementation that makes use of a Raspberry Pi and a LIDAR module for interior navigation is used for developing the autonomous vehicle. This vehicle is capable of navigating in new territory and dodging dangers. This car can safely travel in low-light circumstances because, in contrast to other implementations, it employs a single LIDAR sensor rather than Computer Vision (CV) algorithms to detect obstructions [13].

In 2018 Marco Claudio De Simone et.al... focused on obstacle avoidance which is very much a needed concept in an autonomous vehicle. the obstacle avoidance using an ultrasonic sensor. They used proximate detection technology for detecting the obstacle. Basically, proximate detection technology works in how a bat detects an obstacle with the help of ultrasonic sound waves. ultrasonic mainly has two pins trigger and echo in addition to the power supply and ground[14].

In 2018 Vinit P et.al...focused on traffic Sign detection which is an essential concept that has to be implemented when the car is made to travel in the real time road. They designed the robot for detecting and recognizing the traffic sign. They mainly use the camera connected to the raspberry pi is used to capture the image .In the raspberry pi the code for detecting and recognizing the traffic sign is made to run thereby giving commands to the DC Motor of the robot with Motor driver as a intermediate device to drive the motor. [15]

In 2017 Rolou Lyn R. Maata et.al... focused on Client Server Communication and socket communication which act as the basics for

v2v communication that should be implemented in real autonomous cars. they used socket programming in a distributed computing environment. They implemented the concept of Client Server Communication, Communication Protocol, and Socket Programming. the use of a client-server model based on its request-reply protocol. communication protocol using transfer control protocol is a connection-oriented protocol. socket programming is designed by a client-server application[16].

In 2018, Jordan Filteau et.al... focusses on Live streaming. They did streaming by a simple streaming server written in Java that runs efficiently on the RPi and the RPi can support streaming services to multiple devices at once. A lightweight android application that the server can stream to is also developed and also the client and server communicate via JSON. They used some of the protocols like Real-Time Streaming Protocol(RTSP), Apple HTTP Live Streaming protocols are used for streaming, TCP/IP protocol is used for live streaming. [17]

In 2017 Saad ALBAWI et.al...focusses on convolutional Neural Networks which serve as one of the embodiments in the implementation of various detection algorithms using Artificial intelligence technology. It explains what are the different types of neural networks such as ANN, RNN, etc, and also specified when to use CNN, What are the internal operationsthat take place in CNN, What is pooling, and what is internal image processing technique.so according to the percentage of accuracy,No.ofConvolution layer has to be added to the model[18]

In 2017, N Radha Krishnan et.al... focuses on traffic sign detection. they used open CV and CNN to detect the traffic sign .they implemented open CV for image segmentation and sign recognition using neural network specifically convolutional neural network. [19]

In 2017, Jordan Filteau et.al...focus on Live video streaming which is a very needed application in an autonomous car. They used raspberry Pi for live video streaming. This method is offered as a substitute for CCTV. The camera module is linked to the Raspberry Pi, and the Raspberry Pi is linked to a cloud platform from which mobile phones and laptops can access the live stream data. [20]

In 2016, Rohit jadhav et.al....., This paper focusses on CAN bus implementation. In automotive industries CAN bus is the most used serial protocol. CAN can be implemented using a single-board computer. Here single board computer is raspberry pi which has a high-performance processor used to increase speed ability[21]

In 2016, neeloza et.al....., This paper focus on Live streaming. For that they used raspberry pi and FFMPEG USB camera module are used to provide live streaming through a cloud-based surveillance system. With this cloud-based surveillance system, live video streaming may be accessed at any time and from any location. the drawback is cloud can be accessed by many number users so there is no data security which has to be considered for the development of autonomous car[22]

Problem identified:

Numerous recent technologies have been explored for the development of self-driving cars yet this technology has not been implemented as of now. There are several drawbacks that have to be addressed before the full-fledged implementation of the autonomous car. One such problem is concerned with safety.

In all these papers, AI is used for the implementation of a self-driving car with the predominant use of the camera as the real-time input device. if any fault occurs with the camera, then the total system will get collapsed. Moreover, we can't totally rely on Iot as making the sensors

predominantly active consumes large power So measure has to be taken to encounter such a problem

III. CONCLUSION:

We came up with a dependable solution for this problem by integrating AI and Iot technologies together. If any fault occurs with the camera then the control automatically switches to IoT technology enabling ultrasonic sensors for avoiding obstacles

We also developed a traffic sign detection model using a web page. if the signs are uploaded, then the car is made to act accordingly. In the future, it can be further enhanced by developing an AI-based algorithm to upload the signs automatically depending on the GPS coordinates

We also established v2v communication for controlling the car manually from any remote location and to exchanges details like speed, power etc

REFERENCES

1. Fatima Hasan, Nitika Garg1, Kanakagiri Sujay Ashrith2 "Self-Driving Car to Drive Autonomously using Image Processing and Deep Learning" Research gate 2022
2. Binoj James; Bindu S.J. "GPS and Real Time Computer Vision Based Intelligent Navigation System For Electric Vehicle " IEEE Xplore 2022
3. Kunjal Agrawal " Traffic Sign Classification Using CNN ." Research Gate 2022
4. Fuad Aliew "An Approach for Precise Distance Measuring Using Ultrasonic Sensors" Research Gate 2022
5. Yasir Fathal ,AbeedHasan,AnowarulAzim,H M Ashiqul M Islam . "The Prototype of an Automated Self Driving Vehicle" Research gate 2021
6. Victor ciuntu; Hasan ferdowsi . "Real -Time Traffic Sign Detection and Classification Using Machine Learning and Optical Character Recognition" IEEE Xplore 2020

7. Irfan Ahmad; Karunakar Pothuganti . “Design & implementation of real time autonomous car by using image processing & IoT” IEEE Xplore 2020
8. SuhasDangre; G.H. Raisoni; Suyash Jadhav. “Obstacle Avoiding Car Using Raspberry Pi” JETIR 2020
9. Zeya Ma; Octavian Postolache; Yongsheng Yang. “Obstacle Avoidance For Unmanned Vehicle Based On a 2D LIDAR ” IEEE xplore 2019
10. Mrs.J.Aruna Jasmine, Mr.J Richard Jim Reeves, Mrs.Daya Mary Mathew “Design of an Iot Based Autonomous Vehicle With The aid of Computer Vision ” IEEE Xplore 2019
11. Manoj Kr pal; NilavaDebahuti ; pampa sadhukhan; prolaysharma “A Novel Real Time Collision Avoidance System for On Road Vehicles ” IEEE Xplore 2019
12. Akshaya U Kulkarni “RADAR based Object Detector using Ultrasonic Sensor” IEEE Xplore 2019
13. Nikolaos Baras; Georgios Nantzios; Dimitris Ziouzos; Minas Dasygenis “Autonomous Obstacle Avoidance Vehicle Using LIDAR And An Embedded System” IEEE Xplore 2019
14. Marco Claudio DeSimone ,Zandra Rivera, DomenioGuida “Obstacle Avoidance System for Unmanned Ground Vehicles by Using Ultrasonic Sensors” Research Gate 2018
15. Vinit P. Kharkar “A Road Sign Detection and Recognition Robot using Raspberry-Pi” IEEE Xplore 2018
16. Rolou Lyn R. Maata ,Ronald Cordova . “Design and implementation of Client-Server Based Application Using Socket Programming in a Distributed Computing Environment” IEEE Xplore 2017
17. Jordan Filteau ,SukjinLee,AndrewChangyong Jung “RealTime Streaming Application for IoT Using Raspberry Pi and Handheld Devices ” 2018 Research Gate
18. Saad ALBAWI “Understanding of a convolutional neural network” Research Gate 2017
19. N Radha krishnan,SMaruthi “Realtime Indian Traffic Sign Detection Using Raspberry pi And Opencv ” IJARSE 2017
20. Jordan Filteau,SukjinLee,AndrewChangyong Jung “Live Video Streaming using Raspberry Pi in IOT Devices ” Research gate 2017
21. A Salunkhe,pravin p kamble,rohitjadhav. “Design and implementation of CAN bus protocol for monitoring vehicle parameters ” IEEE Xplore 2016
22. Neel Oza; N.B. Gohil . “Implementation of cloud based live streaming for surveillance” IEEE Xplore 2016