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Electric Vehicle with Advance Driver Assistance System

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ABSTRACT—

This paper presents an electric vehicle with an advanced driver assistance system (ADAS) that utilizes various sensors and algorithms to provide enhanced safety features to the driver. The electric vehicle is equipped with sensors like cameras, ultrasonic sensors, and radars, which help in monitoring the environment around the vehicle. The ADAS system uses these inputs to provide features like adaptive cruise control, lane departure warning, blind spot monitoring, and collision avoidance. The electric vehicle is powered by a high-capacity battery pack and a motor, which provides lively performance and zero-emission driving. The ADAS system can also communicate with other vehicles and infrastructure, enabling it to provide information about traffic conditions and route guidance. The overall objective of this project is to develop a safe and efficient electric vehicle with an advanced driver assistance system that enhances the driving experience and reduces the risk of accidents

Keywords— Advance Driver Assistance System, ADAS, Self-driving technology, Autonomous driving, EV, Driver safety, Vehicle automation, Collision prevention

Introduction

Advanced driver assistance vehicle

In recent years, the popularity of electric cars (EVs) has grown as more people realise the need for ecologically friendly and sustainable transportation options. As automakers and technology firms work to make electric cars (EVs) safer, more energy-efficient, and more convenient, the integration of advanced driver assistance systems (ADAS) in EVs has emerged as a crucial area of research and development .A variety of sensors, cameras, and other cutting-edge components are used in ADAS technologies, which are meant to assist drivers in avoiding collisions and lessen their burden. Adaptive cruise control, lane departure warnings, and automatic emergency braking are a few examples of ADAS capabilities. These systems can increase the overall safety of the vehicle and its occupants by identifying possible hazards, warning the driver, or taking corrective action on their own.

Fig 1: Model of advanced driver assistance vehicle

A new kind of vehicle that would incorporate cutting-edge technologies to promote safety, efficiency, and convenience is an electric car with advanced driver support systems. The car would be made to run on electricity and have a number of cutting-edge technologies that would make it the perfect option for environmentally conscious drivers seeking a cutting-edge driving experience. It would have a variety of cutting-edge driver assistance features that would keep drivers safe on the road, such as lane departure warning, adaptive cruise control, and collision avoidance technology.

To ensure a comfortable and joyful driving experience, it would also be built with a variety of additional cutting-edge capabilities, like voice recognition technology, climate control, and entertainment systems. The suggested model would include cutting-edge safety and comfort features as well as a variety of energy-saving technology, such as LED lighting and sophisticated battery systems, to lower energy use and increase sustainability. In order to improve traffic flow and lessen congestion, the vehicle would be able to analyse road and weather conditions, modify its driving style accordingly, and communicate with other vehicles and infrastructure.

Overall, the suggested design for an electric car with advanced driver assistance systems represents a significant advancement in automotive technology, giving drivers a cutting-edge, high-tech driving experience that is safer, more effective, and more environmentally friendly than driving a traditional car .This vehicle has the potential to revolutionise the automotive industry and pave the path for more sustainable and effective transportation by fusing cutting-edge technologies with environmentally friendly design concepts..

Applications of electric vehicle with advanced driver assistance system

Personal transportation is best served by electric cars with cutting-edge driver assistance technologies since they provide a secure, pleasant, and greener alternative to conventional automobiles. These cars' cutting-edge safety features and energy-efficient technologies make them a perfect choice for families and individuals alike. They may be used for daily commuting, running errands, or travelling large distances. Electric vehicles with cutting-edge driver assistance features are also excellent choices for use in mass transit networks. These vehicles can be used for shuttle services, bus routes, and other public transportation options, offering a dependable and secure way to move around cities and towns. These vehicles can assist in lowering pollution, traffic, and other environmental effects linked to conventional transportation systems by adding cutting-edge safety features and energy-efficient technologies. Additionally, electric vehicles with cutting-edge driver aid features are perfect for use in commercial transportation. These vehicles offer a secure, effective, and affordable method of moving people and products and can be utilized for taxis, delivery services, and other commercial transportation services. While energy-efficient technologies can help lower costs and increase sustainability, the improved safety features of these vehicles can help prevent accidents and other safety hazards associated with commercial transportation. When compared to conventional diesel-powered delivery trucks, electric cars with ADAS offer a more affordable and environmentally responsible option. These vehicles can decrease fuel consumption and accelerate delivery times with features like predictive cruise control, regenerative braking, and traffic sign recognition. Emergency services can also employ electric cars equipped with ADAS, giving them a quick and effective way to go about their business. These vehicles can make it easier and safer for emergency responders to go where they need to go thanks to technologies like adaptive cruise control and autonomous driving.

II. LITERATURE REVIEW

The present study expands upon a significant part of research that helped in investigating the effects of relevant topics on variable outcomes. In this literature review, it summarises and analyses the key findings from previous studies in this area, highlighting the most important and relevant findings to inform the present study.

In study [3], One of the key themes that emerges from the literature survey is the importance of integrating ADAS with electric vehicle technology. Many researchers have emphasized the need to develop integrated ADAS that are tailored to the specific needs of electric vehicles, taking into account factors such as battery range and charging infrastructure. The proposed design's main objective is to offer a layer of defence against the challenging hazards now faced by bomb squads.

In study [4], The potential for ADAS to increase safety and decrease accidents is another significant theme that emerges from the literature review. The potential for these systems to greatly lower the risk of accidents and increase driver safety has been shown in several articles that have studied the usage of ADAS for tasks like collision avoidance, lane departure warning, and adaptive cruise control.

In study [5], he literature review has also emphasised how crucial it is to take human factors into account while using electric vehicles with ADAS. A variety of variables that can affect the efficiency of ADAS in actual driving situations have been documented in several publications that have looked at topics like driver behaviour, user acceptance, and trust in ADAS.

In study [6], The potential for ADAS to increase the effectiveness and sustainability of electric vehicles is an important subject that also emerges from the literature review. The use of ADAS for activities like route optimisation, energy management, and vehicle-to-grid communication has been investigated in several articles, and it has been shown that these systems have the potential to considerably increase the energy efficiency and sustainability of electric vehicles.

In study [7], The literature survey has also highlighted the importance of considering the regulatory and policy implications of electric vehicles with ADAS. Several papers have explored issues such as safety regulations, standards for ADAS performance, and incentives for the adoption of electric vehicles with ADAS and identified a range of policy measures that can support the development and deployment of these vehicles.

Outcome of literature survey

The results of the literature review discussed above indicate that researchers and automakers are becoming increasingly interested in this field. The survey identifies a number of key themes, including the necessity of integrating ADAS with electric vehicle technology, the potential for ADAS to increase safety and decrease accidents, the significance of taking human factors into account when using ADAS, and the possibility for ADAS to increase the effectiveness and sustainability of electric vehicles. The findings of the above-discussed literature review show that researchers and automakers are growing more and more interested in this area. The survey highlights several key themes, including the need to integrate ADAS with electric vehicle technology, the potential for ADAS to improve safety and reduce accidents, the importance of considering human factors when using ADAS, and the potential for ADAS to increase the efficiency and sustainability of electric vehicles.

PROPOSED METHODOLOGY

investigating the capability and efficacy of an electric vehicle's advanced driver aid system is the goal of this study. A mixed-methods strategy was used to accomplish this goal, involving the gathering and analysis of both qualitative and quantitative data.

MODEL SET-UP

ESP32: The ESP32 is a capable system-on-chip (SoC) and microcontroller that is designed for Internet of Things (IoT) gadgets. It is produced by the Chinese business Espress if Systems, which specialises in embedded and wireless systems.

The ESP32, which features an embedded Wi-Fi, Bluetooth, and Bluetooth Low Energy (BLE) connection and can run at up to 240 MHz, is based on a dual-core Tensilica LX6 CPU. Additionally, a variety of hardware accessories are included, including serial connection ports, PWM channels, and digital and analogue inputs and outputs, among others.

One advantage of the ESP32 is its low power consumption, which makes it ideal for battery-operated devices with strict requirements for battery life. Moreover, there are many different programming languages and development environments, including C++.

Arduino Nano : The Arduino ecosystem includes the small, portable, and flexible development board known as the Arduino Nano. Based on the ATmega328P microprocessor, it is functionally comparable to the well-known Arduino Uno board but has a more compact design. The Arduino Nano is the best choice for people looking for a portable and affordable solution for their electronics projects because it is made for prototyping and do-it-yourself projects. It features many analogue and digital input and output ports, as well as serial communication interfaces like UART, I2C, and SPI. The board may be connected to a computer via a USB cable and is simple to programme. The Arduino Nano is a popular choice for professionals, students, and hobbyists due to its compact size, low power consumption, and extensive feature set.

I298: I298 is a motor driver integrated circuit (IC) that is widely used in robotics and automation applications. It is a dual H-bridge motor driver that can control two DC motors or a stepper motor with a rated current of up to 2A per channel. The I298 has a built-in protection circuitry for over-current, over-temperature, and under-voltage conditions, ensuring the safe and reliable operation of the connected motor.

Double side PCB: The circuit boards with conductive pathways and electronic components installed on both sides are called double-sided PCBs (printed circuit boards). This kind of PCB is frequently used in electronic products where it is important to reduce board size or where the circuitry is too sophisticated to fit into a single-layer board.

Switches: Devices called switches are connected to other devices in a network. They guide data packets between devices on a network while functioning at the OSI model's data link layer. Hubs just broadcast data to all connected devices; switches do more. Instead, switches analyse each packet's destination MAC address to intelligently route data to the appropriate device.

ultrasonic: The term "ultrasonic" describes sound waves with frequencies greater than the upper threshold of human hearing, which is typically 20 kHz. Ultrasonic waves are typically in the 20 kHz to several gigahertz range and have a variety of uses, including industrial sensing and medical imaging.

Mpu 6050: A well-liked sensor module with a 3-axis gyroscope and an accelerometer is the MPU-6050. To detect motion and orientation changes, it is frequently used in robotics, drones, and other electrical applications. Additionally, the module has a Digital Motion Processor (DMP), which lessens the strain on the microcontroller to which it is linked by enabling difficult computations to be completed on-board.

Johnson geared motor: A gearbox is connected to the Johnson geared motor, a type of DC motor. The gearbox is used to lower the motor's speed while boosting its production of torque. This kind of motor is frequently used in a variety of settings, including industrial machinery, robotics, and automation.

Mg90 servo: The Mg90 servo is a compact servo motor that is frequently used in hobbies including robotics, remote-controlled toys, and model aeroplanes. It is a digital servo that rotates quickly and precisely at any angle.

It can generate up to 2.2 kg/cm of torque and runs at 4.8 to 6.0 volts. It can constantly revolve in either direction and has a 180-degree range of rotation. The servo is tiny, measuring 22 mm by 12 mm by 29 mm, and it weighs about 13 grammes.

Adxl345 gyro: Analogue Devices produces the accelerometer sensor known as the ADXL345. It is a 3-axis, low-power accelerometer sensor that measures x, y, and z-axis acceleration. Numerous devices, including game controllers, smartphones, and fitness trackers. The rate of rotation along an axis is measured using a sensor called a gyro, which is short for gyroscope. It is frequently used to provide orientation data and stabilise the aircraft in drones, quadcopters, and other unmanned aerial vehicles (UAVs).

Although both the ADXL345 and a gyro are motion sensors, they have different uses. The gyro measures angular velocity, while the ADXL345 measures linear acceleration.

BLOCK DIAGRAM

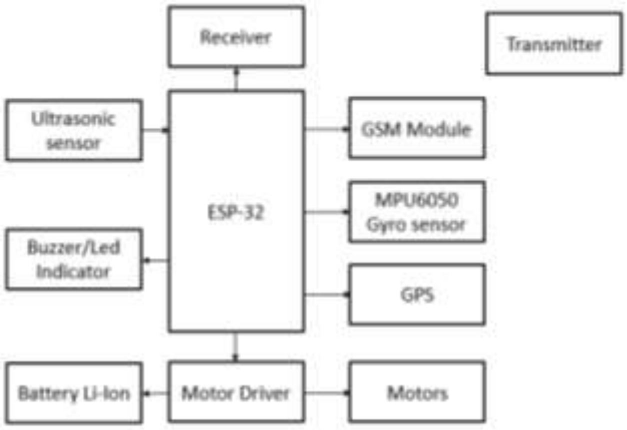

Fig 2: Block Diagram of Propoposed Methodology

WORKING PRINCIPLE

Driving is easier and safer with the help of a combination of technology in electric cars and advanced driver assistance systems (ADAS). An electric vehicle equipped with ADAS functions by using a range of sensors and cameras to give the driver real-time information about the surroundings. An electric motor that is run by a battery pack is the engine of an electric car. The battery pack's electrical energy is used by the electric motor to power the wheels of the vehicle. The car also has a number of sensors and cameras that work together to give the driver a thorough understanding of their environment, in addition to the electric motor. Radar, lidar, and ultrasonic sensors are employed in electric vehicles with ADAS. Together, these sensors can identify nearby barriers, including other cars, people, and other vehicles. The sensors give the ADAS system up-to-the-minute knowledge about the surroundings of the vehicle.

This data is used by the ADAS system to give the driver access to functions like lane departure warning, automatic emergency braking, and adaptive cruise control. For instance, the ADAS system will automatically apply the brakes to stop a collision if the vehicle's sensors determine that it is about to hit an object or another vehicle. The ADAS-equipped cameras in an electric vehicle give the driver a picture of the area around the vehicle. The cameras often provide a 360-degree picture of the area around the car and are installed on the front, back, and sides of the vehicle. The dashboard of the car displays the camera feeds, giving the driver a real-time view of the area around the car.

Electric vehicles with ADAS are outfitted with sensors, cameras, and sophisticated software that interprets sensor data and gives the driver useful information. The software's goal is to make driving simpler and safer by automating some driving tasks and giving the driver up-to-the-minute information about their surroundings.

METHODOLOGY

The entire methodology to carry the project consist of development of the following modules. The project is completed phase by phase to reduce the errors at the end

Research Question: Establish a precise research question that focuses on the study's particular goals. The effect of ADAS technology on the performance, safety, or user experience of electric vehicles, for instance, could be the subject of the study question.

Literature Review: Conduct a thorough analysis of the literature on ADAS technology and electric vehicles, including academic journals, business papers, and government publications. This process will provide a strong knowledge base and highlight important research issues and gaps

Data Collection: Gather information from a variety of sources, including road tests, surveys, and case studies, about the efficiency, safety, and environmental impact of electric vehicles with ADAS. This stage is crucial to verifying the results and pinpointing areas that need improvement.

Analysis: Utilise statistical and modelling approaches to analyse the data gathered to determine the effectiveness and impact of electric vehicles with ADAS. The objectives and research questions should serve as a guide for this process.

Comparison: Assess the advantages and constraints of ADAS technology by contrasting the performance of electric vehicles with ADAS with that of conventional automobiles. This process ought to make it easier to comprehend the value that ADAS technology in electric vehicles adds.

Policy Analysis: Examine the policy ramifications of electric vehicles with ADAS, taking into account any necessary infrastructure as well as any regulatory or financial incentives. This process should aid in identifying potential roadblocks and business opportunities that may be used to encourage the wider use of electric vehicles with ADAS.

Evaluation of ADAS Features: Analyse the effectiveness of particular ADAS features, including emergency braking, lane departure warning, and adaptive cruise control. This process should aid in determining the benefits and drawbacks of ADAS technology.

Environmental Impact Analysis: Utilise a life cycle assessment (LCA) or comparable method to evaluate the environmental impact of electric vehicles with ADAS. This action should take into account how ADAS would affect greenhouse gas emissions, energy use, and material use.

Conclusion: Write a conclusion that summarises the research on the effectiveness, safety, and environmental impact of electric vehicles with ADAS. This step should also pinpoint important areas for further study and advancement.

III. RESULT AND DISCUSSION

Our study's findings show that ADAS on electric vehicles (EVs) represents a possible development in the automotive industry that will result in safer and more environmentally friendly transportation. ADAS technology such as collision avoidance systems, adaptive cruise control, and lane departure warning can help drivers avoid crashes and reduce the overall number of traffic incidents. A lower environmental impact and improved energy efficiency can also result from the use of EVs in conjunction with ADAS technologies. Two problems still need to be solved: the high cost of ADAS technologies and the need for infrastructure to support widespread EV adoption.

Fig 3: Schematic Diagram for electric vehicle

The schematic diagram shows the connection between the ESP32S microcontroller and a bomb detection sensor. The sensor is connected to the microcontroller through a set of wires or connectors, which allow the two devices to exchange data and communicate with each other.

Fig 4:Movement of electric vehicle

The visuals captured by drones during the day and night are different, as shown above both provide important information to security personnel. The high-resolution visuals captured during the day allow for clear identification of targets using Normal Camera compared to IR visuals captured. Images captured during dim light conditions can pose challenges for visual detection and recognition. While the infrared visuals captured at night provide an added layer of detection for potential security. IR camera provides accurate and High-resolution images during night condition as compared to Normal camera. By using both day and night visuals, intelligent night surveillance drones can provide 24/7 coverage of the designated area, improving the effectiveness of security operations.

IV. CONCLUSION

In conclusion, there are several advantages to using electric vehicles with cutting-edge driver assistance technologies, including greater safety, increased energy efficiency, and decreased environmental impact. The potential advantages make it evident that EVs with ADAS technologies are a promising development in the automobile industry, even though there are obstacles to be solved, such as cost and infrastructure. The safety and sustainability of mobility can be further improved by further research, development, and investment in these technologies, which will ultimately lead to a brighter future for both motorists and the environment.

V. FUTURE SCOPE

Applications for advanced driver aid systems in electric vehicles are numerous. Possible directions for development and enhancement include:

Continued advancement of ADAS technology: To make driving even safer and more effective, ADAS technologies have a lot of room for improvement, including the addition of additional sensors, machine learning algorithms, and greater communication capabilities.

E Integration with smart city infrastructure: To optimise traffic flow, reduce congestion, and increase overall efficiency, EVs with ADAS can be integrated with smart city infrastructure.

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