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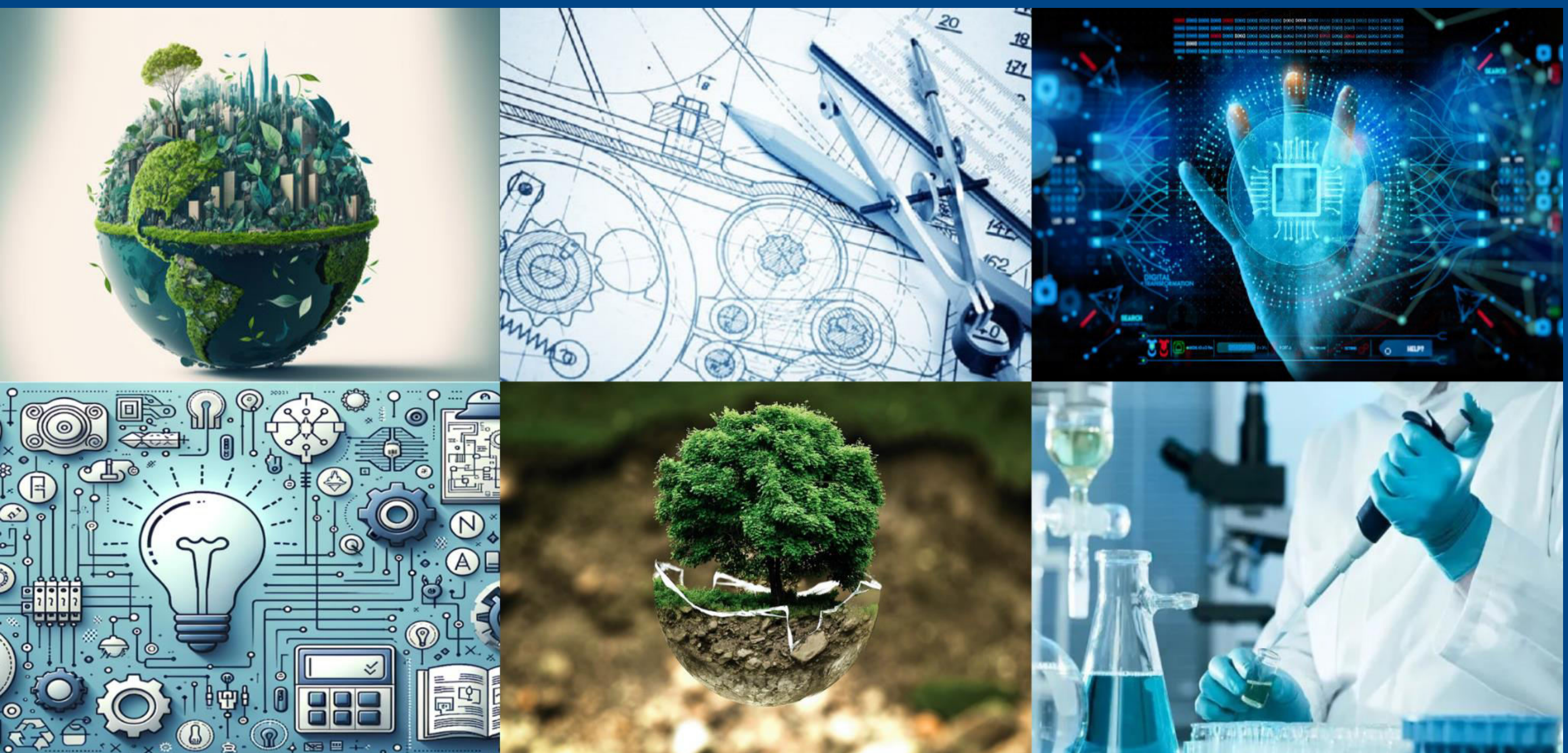

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Vehicle to Vehicle Communication in Electric Vehicle

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ABSTRACT: This project presents the development of an Advanced Driver Assistance Safety System (ADAS) prototype designed to enhance vehicle safety through automatic speed control and obstacle detection. The system is built using a Node MCU (ESP8266) microcontroller, integrated with ultrasonic and proximity sensors to detect obstacles in real time. Based on the distance from objects, the system intelligently controls the movement of a BO motor using an L298 motor driver IC, simulating the vehicle's motion by slowing down or stopping when an obstacle is detected. A 16x2 LCD display is used to provide live feedback to the user, showing sensor readings and system status. This low-cost, microcontroller-based setup demonstrates essential ADAS functionalities like collision avoidance and intelligent braking, making it a valuable educational tool and a scalable prototype for future automotive safety applications. The project highlights the importance of embedding sensor-based automation into vehicles to reduce human error and promote safer driving environments.

KEYWORDS:- Node MCU, ADAS, LCD16x2

I. INTRODUCTION

In recent years, the number of road accidents and fatalities has significantly increased, often due to human error, distracted driving, or poor judgment in critical situations. Traditional vehicles rely entirely on the driver's reflexes and decisions, which can be inconsistent or delayed under stressful conditions. This has highlighted the urgent need for intelligent systems that can assist drivers by enhancing their awareness and reacting faster than human capabilities. Advanced Driver Assistance Systems (ADAS) are designed to improve road safety by supporting the driver with real-time information, obstacle detection, and automated control actions such as braking or speed adjustment. However, commercial ADAS solutions can be expensive and complex, making them inaccessible in lower-end or educational vehicles. This system not only improves safety but also educates users on the principles of intelligent vehicle systems. Such a model is essential for promoting the adoption of smart safety features in future transportation systems, especially in developing regions and educational setups. The concept behind this project is to build a compact and efficient Advanced Driver Assistance System (ADAS) that simulates intelligent vehicle behavior using embedded technology. The core idea is to monitor the surroundings of a moving vehicle in real time and dynamically control its speed or stop it to prevent collisions. A driver should constantly keep an eye on vehicles closest to her/his location in order to avoid collisions. Unfortunately, the driver often does not see closest vehicles due to obstacles (other vehicles, trees, buildings, etc.). In this paper, we introduce a novel type of query called a continuous range k-nearest neighbor (CRNN) query in vehicular adhoc networks, and propose a scheme for query processing. The main objective of this processing is to avoid the collision between the two vehicles when the driver should not able to control the vehicle. i.e. When driver should get disable to control the vehicle then this system should provide the proper response to the system for collision avoidance. The aim of our project is to avoid the collision between two or more vehicles on road for the safety purpose using this system. Following objectives can be achieved through this proposed work. The system is designed around the Node MCU (ESP8266) microcontroller, which acts as the brain of the project. It processes input from sensors and sends control signals to the motor driver. The ultrasonic sensor continuously measures the distance between the vehicle and obstacles ahead. If an object is detected within a predefined danger range, the system will either slow down or completely stop the BO motor, mimicking real-world braking. The proximity sensor serves as an additional safety layer, detecting close-range obstacles that might not be captured by the ultrasonic sensor—especially useful for low-speed movement, reversing, or parking simulations. This concept introduces the basic functionalities of ADAS, including real-time monitoring, automatic obstacle response, and speed management, using affordable components. It demonstrates how embedded systems and sensor integration can be used to enhance safety, serving as a foundation for more complex automotive systems. The increasing number of road accidents and traffic-related fatalities has become a major concern worldwide. Most of these incidents are caused by human error, delayed reaction times, and the inability to judge distances accurately—especially in critical situations. As a result, there is a strong global push toward incorporating smart technologies into vehicles to assist drivers and improve safety**.** Advanced Driver Assistance Systems (ADAS) have emerged as a promising solution to address these issues by enhancing the driver's situational awareness and enabling automatic responses such as braking and speed regulation. However, commercial ADAS are often expensive and complex, limiting their availability in lower-cost or educational applications. This prototype aims to simulate real-world vehicle safety mechanisms such as obstacle detection, speed control, and emergency stopping in a simple and educational format. By combining embedded systems and sensor technology, the project seeks to encourage innovation in affordable safety systems, raise awareness about intelligent transportation technologies, and inspire further research and development in the field of automotive safety—particularly in resource-constrained environments. In the Advanced Driver Assistance Safety System, the First in First out (FIFO) algorithm can be utilized to manage the real-time data collected from sensors in an orderly manner. FIFO ensures that the first data received is the first to be processed, which is crucial in a time-sensitive application like obstacle detection and speed control. For instance, as the ultrasonic and proximity sensors continuously send distance readings to the Node MCU, these values can be stored temporarily in a queue structure. By applying FIFO, the system processes each reading in the exact order it was received, avoiding data overwriting or delays. This helps maintain the accuracy of the obstacle detection mechanism and ensures that the L298 motor driver receives timely commands to control the BO motor. In scenarios where multiple sensor inputs are processed rapidly, FIFO helps prevent confusion or misinterpretation of older and newer data, thereby supporting smooth and responsive operation of the safety system. The Convolutional Recurrent Neural Network (CRNN) algorithm offers an advanced approach to improving the intelligence of the Advanced Driver Assistance Safety System. CRNN combines the spatial feature extraction power of Convolutional Neural Networks (CNNs) with the temporal sequence learning ability of Recurrent Neural Networks (RNNs). In the context of this project, CRNN can be applied to process and analyse sequences of sensor data—such as patterns in ultrasonic and proximity sensor readings over time—to predict potential obstacles or hazardous driving conditions. Although the current prototype is built on hardware like Node MCU and basic sensors, integrating CRNN in future iterations (possibly through cloud processing or higher-capability microcontrollers) could allow the system to learn from past obstacle patterns and make more accurate, intelligent decisions. For example, the system could predict if an object is moving closer or if it's stationary, and accordingly adjust the BO motor's speed via the L298 motor driver IC. This would transform the setup from a reactive system to a predictive one, enhancing safety and enabling more autonomous vehicle behavior. Convolutional Recurrent Neural Network (CRNN) offers significant potential to enhance the performance and decision-making capabilities of Advanced Driver Assistance Safety Systems (ADAS). A CRNN combines the strengths of Convolutional Neural Networks (CNNs), which excel at extracting spatial features, with Recurrent Neural Networks (RNNs), which are capable of learning temporal sequences and patterns. In the context of this project—using Node MCU**,** ultrasonic and proximity sensors, L298 motor driver IC, and BO motor—the CRNN algorithm can be employed to analyse sensor data not just as isolated readings but as part of a time-series pattern. For example, rather than simply reacting to a single obstacle detection, the CRNN can recognize trends over time such as an approaching object or fluctuating distances in crowded environments. This predictive capability allows the system to anticipate potential collisions and take proactive control measures such as adjusting motor speed or stopping movement altogether. Although the current hardware setup uses basic microcontroller logic, future versions of this system could implement CRNN through cloud computing or edge AI platforms, enabling a smarter, more autonomous driving experience.

II. LITERATURE REVIEW

1. Deeksha V, Sujan Reddy G, Vilas S Reddy, Prathist Gowda A N "Automatic vehicle speed control with wireless in-road sign delivery system" In present scenario, accidents are occurring often, causing near death of the various people while driving thanks to mistakes by the driving force or the opponent driver. But sometimes it's getting to not be possible to seem at the signboards placed by the Highway Department to alert the drivers in such reasonably places and there is a chance for accident. The most objective is to style a controller meant to regulate vehicle's speed, which runs on an embedded system and should be customized to suit into a vehicle's dashboard, the Controller Unit warns the driving force, to scale back the speed, it waits for driver's response and reduces the speed of auto automatically after the action of driver. The major part which is included for an accident is mainly driver's speed. So, in order to control speed, we have proposed a model which automatically slows down the speed of vehicle with or without driver's help.

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Usually the accidents are caused at sharp turnings, hilly areas and school zones. Almost one third of the accidents are occurred in this place. We establish a prototype where the system is going to control the vehicle according to the data frame which is transmitted by the RF transmitter fixed to the nearby road signals. The data frame is received by the microcontroller in automobile which will try to control the speed of vehicle. This is a RFID-Based vehicle speed controller system where passive RF transceivers are arranged in the road close to the position of real traffic signals.

2. GVS.Bharadwaj kumar, M.Lahari, D.Sriharshitha, P.Gowthami "IoT Based Dynamic Vehicle Speed Control System" Over speeding vehicle make lot of nuisance sometimes also leading to loss of lives and other damages. Also imposing speed restrictions through sign boards have been rendered fruitless wherein the vehicle drivers do not comply with it and resulting catastrophic. Vehicle Speed Limit Controller Project is a great solution to this problem as it not only provides speed limitations, it also implements it through a controlling mechanism. This, this system greatly helps in curbing the speed of over speeding vehicles ensuring safety of vehicles on accident prone road ways. In this project, we have successfully designed and analyzed an automatic vehicle speed control system.

3. Rejina Parvin, Sanjay Raja B, Sendhil Ram Pandian R, Shahid Ahamed J "IoT-Based Automatic Vehicle Speed Control System" The most frequent occurrence is traffic accidents, which happen relatively often. Over speeding is a major factor in most fatal collisions. An increase in speed may increase the likelihood of an accident and the danger of injuries occurring in one. Our team has thus developed a technology that intends to automatically manage the speed of cars in the restricted region in order to lessen this hiccup. Recent research on the IoT has found that since people are impatient to get where they're going, accidents near places like hospitals and schools have increased significantly. The primary goal of this work is to control vehicle speed using IoT sensors. This work used an RFID module to control the speed of the vehicle. The RFID receiver should be installed inside the vehicle, and the RF transmitter will be put at the start and end of the prohibited regions. The speedometer of the car was used to determine the speed. The controller then compares and keeps track of that speed. When a vehicle's speed exceeds the allowed limit, it automatically adjusts its speed to fit the zone. The road system has a significant impact on society and the economy in today's complicated world. Each human activity requires a high-quality roadway transportation system. However, no matter how properly the road is constructed, it will deteriorate over time as a result of stress. The typical road inspection technique involves human professionals visually inspecting and subjectively evaluating pavement segments. This labor-intensive procedure of human inspection and classification based on samples and experience costs a lot of money. It requires a computationally viable and efficient autonomous surveillance solution to provide optimal monitoring, control, and other activities. Unlike in the past, when there were only a few or countable automobiles, there used to be one or two lanes on either side of the road.

4. Ubaidullah Liyakatali Desai, Abhishek Shivgonda Ghatage, Vabhav Ulhas Jawahire "Advanced Driver Assistance System" This project will provide information about An Advanced driver assistance system car which is developed by using Node MCU micro-controller. In this system, various sensors are embedded to increase safety during the driving process on road. Some of the sensors are Ultrasonic sensor, IR Sensor & many more Technology with a BO motor. This system is also alert the driver and sense the vehicle is goes out of the road or departed from the road. The use of this system 7 the application of this system is like blind spot monitoring, lane assist and also forward collision warning. The main purpose of this system is to increase the road safety and proper traffic management. Also some vehicle accidents are caused due to driver laziness. To avoid this problem, this system assist the driver with a high degree of comfort and provide alertness in some dangerous situations.

5. Kunal Kandpal, Manisha Jamgade "Node MCU Based Vehicle Monitoring System on Construction Sites and Its Applications Using IoT Method" The construction business faces a few difficulties on the location that incorporates checking of construction vehicles, precise bookkeeping, well-being of development hardware, mishaps, wastage of fuel because of driver's missteps or absence of value laborers on location interminably expanding interest for innovation which can wipe out or forever address the issues, developing worries of the above issues on building locales are expanding step by step which is now a greater danger to any development organization in our country. For countering these issues we can present a vehicle-checking framework for construction vehicles. A procedure is very protected and trustworthy. The Node MCU chip interacts sequentially with an internet communication or internet of things (IoT) modem and Global Positioning System recipient. The internet communication or IoT modem is put to use to send the place of the vehicle from a remote spot constantly. The Global Positioning System recipient modem that utilization satellite innovation for its route framework will constantly give information like longitude, scope, distance voyaged,

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No.	Paper Title	Author Name	Key Points
1	Automatic vehicle speed control with wireless in-road sign delivery system	Deeksha V, Sujan Reddy G, Vilas S Reddy, Prathist Gowda A N	In present scenario, accidents are occurring often, causing near death of the various people while driving thanks to mistakes by the driving force or the opponent driver. But sometimes it's getting to not be possible to seem at the signboards placed by the Highway Department to alert the drivers in such reasonably places and there is a chance for accident.
2	IoT Based Dynamic Vehicle Speed Control System	GVS.Bharadwaj kumar, M.Lahari, D.Sriharshitha, P.Gowthami	This system greatly helps in curbing the speed of over speeding vehicles ensuring safety of vehicles on accident prone road ways. In this project, we have successfully designed and analyzed an automatic vehicle speed control system.
3	IoT-Based Automatic Vehicle Speed Control System	Rejina Parvin, Sanjay Raja B, Sendhil Ram Pandian R, Shahid Ahamed J	This work used an RFID module to control the speed of the vehicle. The RFID receiver should be installed inside the vehicle, and the RF transmitter will be put at the start and end of the prohibited regions. The speedometer of the car was used to determine the speed.
4	Advanced Driver Assistance System	Ubaidullah Liyakatali Desai, Abhishek Shivgonda Ghatage, Vabhav Ulhas Jawahire	This project will provide information about An Advanced driver assistance system car which is developed by using Node MCU micro-controller. In this system, various sensors are embedded to increase safety during the driving process on road. Some of the sensors are Ultrasonic sensor, IR Sensor & many more Technology with a BO motor.
5	Node MCU Based Vehicle Monitoring System on Construction Sites and Its Applications Using IoT Method	Kunal Kandpal, Manisha Jamgade	The construction business faces a few difficulties on the location that incorporates checking of construction vehicles, precise bookkeeping, well-being of development hardware, mishaps, wastage of fuel because of driver's missteps or absence of value laborers on location interminably expanding interest for innovation which can wipe out or forever address the issues, developing worries of the above issues on building locales are expanding step by step which is now a greater danger to any development organization in our country.

III. METHODOLOGY OF PROPOSED SURVEY

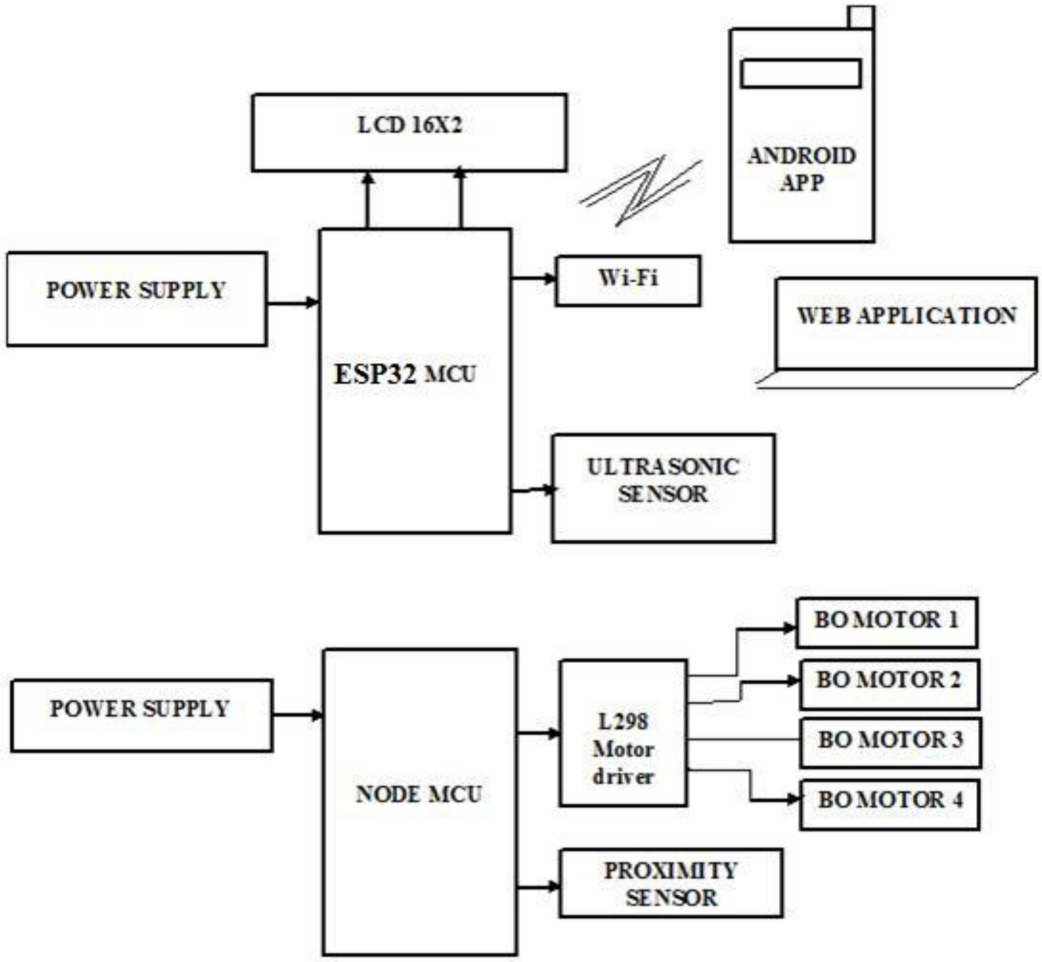

Fig 1: A Complete system design

The diagram of the Advanced Driver Assistance Safety System with speed control illustrates the connection and coordination between all major components. At the core of the system is the Node MCU (ESP8266), which acts as the main controller. It receives input signals from both the ultrasonic sensor and the proximity sensor. The ultrasonic sensor is positioned to detect obstacles at a distance by emitting sound waves and measuring their reflection time, while the proximity sensor assists in detecting nearby objects at very short range. Based on the data received, the Node MCU processes the information and sends output signals to the L298 motor driver IC. The L298 motor driver is responsible for driving the BO motor, which simulates the vehicle's movement. It controls the speed and direction of the motor depending on the commands received from the Node MCU. If an obstacle is detected within a critical range, the Node MCU instructs the motor driver to reduce the motor speed or stop it completely to prevent collision. A 16x2 LCD display is also connected to the Node MCU, which provides real-time visual feedback such as distance readings, system alerts. Power is supplied to all components through a regulated power source. The diagram represents a simple, smart vehicle model where sensors, control logic, motor control, and user interface are integrated to enhance safety and simulate basic ADAS functionalities. These raw signals are then pre-processed and passed to the Convolutional Neural Network (CNN) layer, where spatial features—such as sudden changes in distance or consistent object proximity—are extracted through convolutional filters. The output feature maps from the CNN are then fed into the Recurrent Neural Network (RNN) layer, specifically a Long Short-Term Memory (LSTM) or Gated Recurrent Unit (GRU), which analyses the temporal patterns of the sensor data over time. This enables the system to recognize movement trends, such as whether an obstacle is approaching or stationary. The processed data is passed to a decision-making module,

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which generates control signals. These signals are then sent to the Node MCU, which acts as the microcontroller unit interfacing with the L298 motor driver IC. The motor driver controls the BO motor, either adjusting its speed or stopping it entirely based on the system's prediction. A 16x2 LCD display provides real-time feedback on system decisions, sensor readings, or alerts. This intelligent data flow enables the CRNN model to make predictive and context-aware driving decisions, enhancing overall system responsiveness and safety.

IV. CONCLUSION AND FUTURE WORK

In conclusion, the development of the Advanced Driver Assistance Safety System using Node MCU successfully demonstrates the integration of embedded systems with sensor-based automation for enhanced vehicle safety. The system effectively detects obstacles in real time and responds by automatically controlling the speed or stopping the motor, simulating essential ADAS functions like collision avoidance and intelligent braking. The use of low-cost and easily accessible components makes this prototype not only practical but also ideal for educational and research purposes. It highlights how microcontroller-based systems can be applied to real-world problems, paving the way for safer and smarter transportation solutions. This project serves as a stepping stone for further innovations in intelligent mobility and can be expanded in the future with more advanced technologies such as IoT, machine learning, and image processing to develop a more robust and comprehensive driver assistance system. The future scope of this Advanced Driver Assistance Safety System is vast, with numerous possibilities for enhancement and real-world application. The current prototype can be further developed by integrating IoT capabilities, allowing data to be transmitted to cloud platforms for remote monitoring and analysis. Incorporating a GPS module would enable location tracking and geo-fencing features, making the system more context-aware. Additionally, mobile app connectivity and voice alert systems can be added to improve user interaction and accessibility. Advanced sensors such as infrared, LIDAR, or cameras can be introduced to enhance obstacle detection accuracy and support features like lane detection, pedestrian recognition, and traffic sign identification. By implementing machine learning algorithms, the system could learn and adapt to different driving environments, improving decision-making over time. These enhancements would make the system not only more intelligent but also closer to commercial-level ADAS used in modern vehicles, paving the way for safer, smarter, and more efficient transportation systems. The integration of the Convolutional Recurrent Neural Network (CRNN) algorithm into the Advanced Driver Assistance Safety System significantly enhances the intelligence and adaptability of the setup. By combining the spatial analysis power of CNNs with the temporal learning ability of RNNs, the system can effectively detect, interpret, and predict obstacle movement patterns using real-time data from ultrasonic and proximity sensors. This enables proactive decision-making, such as adjusting the speed or stopping the BO motor through the L298 motor driver IC, thereby improving the safety and responsiveness of the vehicle. The use of Node MCU and LCD 16x2 for control and display demonstrates a low-cost yet scalable platform suitable for both academic and practical applications. Looking ahead, the future scope of CRNN in this system includes integration with edge AI hardware or cloud platforms to handle more complex data and real-time training. The system can be extended to include visual sensors like cameras, enabling recognition of traffic signs, pedestrians, and road lanes. Additionally, combining CRNN with IoT connectivity would allow remote monitoring and predictive maintenance. As machine learning models improve and become more efficient, the CRNN-based ADAS can evolve into a fully autonomous safety system for modern smart vehicles, reducing human error and enhancing road safety across a wide range of transportation environments.

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