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Real Time Multifeatured Accident Detection And Prevention System

[1]Ganesh Donhe , [2]Lokesh Girase , [3]Ashitosh Daptare , [4]PROF.A.A.Trikolikar

[1]ELECTRONICS AND TELECOMMUNICATION ENGG. DEPARTMENT ,
[1]JSPM's IMPERIAL COLLEGE OF ENGG. AND RESEARCH ,WAGHOLI , PUNE- 4122207

Abstract : Accident detection and prevention is an important topic. It involves using technology to identify and mitigate potential accidents on the road. This can include things like sensors, cameras, and warning systems in vehicles to alert drivers of potential dangers. It's all about keeping everyone safe on the road.One common method is the use of advanced driver assistance systems (ADAS) in vehicles. These systems can include features like lane departure warning, forward collision warning, and automatic emergency braking. They help drivers stay aware of their surroundings and can intervene if necessary to prevent accidents. Additionally, technologies like vehicle-to-vehicle communication and infrastructure-to-vehicle communication are being explored to enhance safety on the roads. These advancements are all aimed at reducing accidents and making our roads safer for everyone.Accident detection and prevention is a crucial topic that focuses on using technology and strategies to identify and mitigate potential accidents. It involves implementing advanced driver assistance systems, such as lane departure warning and automatic emergency braking, to help drivers stay alert and avoid collisions. Additionally, artificial intelligence and machine learning algorithms are being utilized to analyze various data sources and predict potential risks. Smart traffic management systems also play a role in preventing accidents by monitoring traffic conditions and adjusting signal timings. Together, these efforts aim to create safer roads for everyone.

KEYWORDS: RETROFITTING, EMERGENCY BREAKING SYSTEM ,SENSOR INTEGRATION, CAR SAFETY ,ACCIDNET PREVENTION.

INTRODUCTION

Ensuring road safety continues to be a top priority in the fast-paced world of today, where technological breakthroughs have altered many aspects of our lives.While modern vehicles are equipped with sophisticated accident detection and prevention systems, a significant portion of the global automobile fleet comprises older vehicles lacking such features. Older vehicles, characterized by outdated safety features and technology, pose significant risks on the roads. Modern cars now come equipped with basic features like blind-spot recognition, lane departure warning, and automated emergency braking.Additionally, aging components and worn-out parts increase the likelihood of mechanical failures, further compromising safety. Statistics reveal a concerning trend regarding road accidents involving older vehicles. Research conducted by various road safety organizations indicates that a disproportionate number of accidents involve older cars, resulting in fatalities and injuries. Moreover, the severity of injuries sustained in accidents involving older vehicles tends to be higher due to the lack of modern safety features. Implementing accident detection and prevention systems in old cars is crucial for several reasons: Enhanced Safety, Safeguarding Vulnerable Road Users ,Economic Benefits, Environmental Considerations, Regulatory Compliance..Older vehicles, characterized by outdated safety features and technology, pose significant risks on the roads. Modern cars now come equipped with basic features like blind-spot recognition, lane departure warning, and automated emergency braking.Additionally, aging components and worn-out parts increase the likelihood of mechanical failures, further compromising safety.Statistics reveal a concerning trend regarding road accidents involving older vehicles. Research conducted by various road safety organizations indicates that a disproportionate number of accidents involve older cars, resulting in fatalities and injuries. Moreover, the severity of injuries sustained in accidents involving older vehicles tends to be higher due to the lack of modern safety features. Integrating advanced safety technologies in older vehicles can significantly reduce the risk of accidents and mitigate their severity. Features such as collision detection, automatic braking, and adaptive cruise control can prevent collisions or minimize their impact, thereby saving lives and reducing injuries Safeguarding Vulnerable Road Users: Older vehicles are often involved in accidents with pedestrians, cyclists, and motorcyclists. By equipping these vehicles with systems like pedestrian detection and automatic emergency braking, the safety of vulnerable road users can be greatly improved, fostering a more inclusive and secure transportation environment.

I. LITERATURE REVIEW

1) Existing Accident Detection and Prevention Systems:

A number of technologies have been developed to identify and avoid accidents, such as blind-spot detection (BSD), lane departure warning (LDW), automatic emergency braking (AEB), and front collision warning (FCW).This systems utilize sensors,cameras, and radar to detect potential hazards and alert drivers or intervene autonomously to prevent accidents.
Effectiveness in Different Scenarios:
Studies have shown that these technologies are successful at reducing the occurrence of certain types of accidents.Studies have shown that these technologies are successful at reducing the occurrence of certain types of accidents. For instance, FCW and AEB have been shown to significantly decrease rear-end collisions, while LDW and BSD help prevent accidents caused by lane drifting and blind-spot issues, respectively. However, their effectiveness may vary depending on factors such as environmental conditions, road layout, and driver behavior.

2) Challenges and Limitations:
Despite their potential benefits, existing accident detection and prevention systems face several challenges and limitations. These include false alarms, particularly in complex traffic situations or adverse weather conditions, limited effectiveness at higher speeds, and the inability to address all types of accidents, such as those involving multiple vehicles or pedestrians.

3) Gap Analysis for Implementation in Old Cars:
Retrofitting older vehicles with accident detection and prevention systems presents unique challenges due to differences in vehicle architecture, compatibility issues with existing components, and cost considerations. There is a gap in the availability of affordable, aftermarket retrofit solutions that can effectively integrate with older car models without compromising safety or functionality.
In summary, while existing accident detection and prevention systems have shown promise in enhancing road safety, their implementation in old cars requires careful consideration of technical, logistical, and economic factors. Addressing the gaps in retrofit solutions and overcoming the challenges associated with integrating these systems into older vehicles are essential steps towards realizing the full potential of safety technologies in mitigating the risks posed by aging automobiles. Further research and development efforts are needed to bridge these gaps and facilitate the widespread adoption of accident detection and prevention systems in old cars, thereby contributing to a safer and more secure transportation environment.

1) Characteristics of Old Cars:
Old cars, typically defined as vehicles manufactured more than a decade ago, often lack modern safety features and technologies found in newer models. These vehicles may have outdated designs, limited structural integrity, and fewer safety enhancements compared to contemporary automobiles.

2) Old cars are prone to various safety issues, including:
Lack of advanced safety features: In order to close these gaps and promote the widespread installation of accident detection and prevention systems in older vehicles, further research and development work is required. This will help to create a more secure and safe traveling environment
Structural weaknesses: Aging components and corrosion can compromise the structural integrity of old cars, reducing their ability to withstand impacts in the event of a collision.
Poor crash protection: Airbags, traction control, anti-lock braking systems (ABS), and electronic stability control (ESC), which are standard on newer models, are among the vital safety features that many older cars lack.
Limited visibility: Outdated lighting systems, foggy windows, and worn-out mirrors can impair visibility, increasing the risk of accidents, especially in low-light conditions or adverse weather.

3) The need for safety upgrades in older vehicles is critical for several reasons:
Enhanced protection: Retrofitting older cars with modern safety features such as airbags, ABS, and ESC can significantly improve occupant protection and reduce the risk of injuries in accidents.
Adaptation to changing road conditions: As traffic volume increases and road infrastructure evolves, older vehicles may struggle to cope with the demands of modern driving environments. Safety upgrades can help older cars remain relevant and safe on the road.
Regulatory compliance: Due to less stringent crashworthiness regulations than those governing contemporary automobiles, older cars may offer occupants less protection in the case of an accident.Upgrading older cars to meet current safety standards ensures compliance with legal requirements and promotes road safety.
In conclusion, addressing the safety concerns associated with old cars is imperative to mitigate the risks posed by aging vehicles and improve overall road safety. By identifying common safety issues and implementing appropriate upgrades, stakeholders can enhance the safety and reliability of older vehicles, thereby ensuring a safer transportation environment for all road users.

II. TECHNOLOGY OVERVIEW

Accident detection and prevention technologies aim to enhance road safety by identifying potential hazards and mitigating the risk of collisions. These technologies leverage various sensors, systems, and algorithms to detect obstacles, monitor vehicle dynamics, and alert drivers or intervene autonomously to prevent accidents.
Sensors and Systems Used in Modern Vehicles:
1) **Radar Sensors:** Radio waves are used by radar sensors to identify objects nearby the car. They are frequently used in collision avoidance systems to identify impending crashes and in adaptive cruise control systems to maintain a safe distance from other

cars.They are commonly employed in adaptive cruise control systems to maintain a safe distance from other vehicles and in collision avoidance systems to detect imminent collisions.
2) **Ultrasonic Sensors:** Ultrasonic sensors emit high-frequency sound waves to detect nearby objects, particularly in close-range situations such as parking maneuvers. These sensors are integral to parking assistance systems and can help prevent minor collisions during low-speed maneuvers.
3) **LiDAR (Light Detection and Ranging**): LiDAR technology measures distances and produces intricate 3D maps of the area around the vehicle using laser pulses.. While primarily used in autonomous vehicles for precise object detection and mapping, LiDAR has the potential to enhance the capabilities of collision avoidance systems in conventional vehicles.
Retrofitting older vehicles with accident detection and prevention technologies involves several challenges but is feasible with appropriate modifications:
1) **Aftermarket Solutions:** Aftermarket manufacturers offer retrofit kits comprising sensors, cameras, and control units that can be installed in older vehicles to augment their safety capabilities. These kits may require modifications to the vehicle's electrical system and integration with existing components.
2) **Compatibility Considerations:** Older vehicles may have limited compatibility with modern sensor technologies due to differences in wiring, communication protocols, and vehicle architecture. Adapting these technologies for older vehicles often necessitates custom solutions tailored to the specific make and model.
3) **Cost-Effectiveness:** Retrofitting older vehicles with safety technologies can be cost-effective compared to purchasing a new car. However, the overall cost depends on factors such as the complexity of the retrofit, labor expenses, and the availability of aftermarket components.
4) **Regulatory Compliance:** Retrofit solutions must comply with relevant safety regulations and standards to ensure their effectiveness and legality. Manufacturers and installers of aftermarket safety systems must adhere to established guidelines to guarantee the reliability and performance of retrofitted vehicles.
In conclusion, while modern vehicles are equipped with advanced accident detection and prevention technologies, retrofitting older vehicles with similar capabilities is both feasible and beneficial for improving road safety. By leveraging aftermarket solutions and adapting existing technologies, stakeholders can enhance the safety and longevity of older vehicles, ultimately contributing to a safer transportation ecosystem.

III. SYSTEM DESIGN AND COMPONENTS FOR RETROFITTING OLD CARS WITH SAFETY SYSTEMS:

Design Considerations:

1) Compatibility: Ensure that the selected safety systems are compatible with the make, model, and year of the old car. Consider factors such as available space, electrical system compatibility, and mechanical integration.
2) Scalability: Choose a modular design approach that allows for the integration of additional safety features over time. This enables flexibility in upgrading the system as new technologies become available or safety requirements evolve.
3) Reliability: Prioritize reliability and durability in component selection to ensure consistent performance under varying driving conditions. Use high-quality components with proven track records in automotive applications.
4)Ease of Installation: Opt for retrofit kits or systems that are designed for easy installation and minimal modification to the existing vehicle structure. Simplified installation procedures reduce labor costs and minimize downtime during retrofitting

Components Required for the Accident Detection and Prevention System:

1) Sensors: Use a mix of LiDAR, radar, camera, and ultrasonic sensors to scan the area around the vehicle, identify obstructions, and determine distances precisely.
2) Control Unit: Utilize a central control unit or electronic control module to process sensor data, execute algorithms for collision detection and prevention, and coordinate the operation of safety features.
3) Actuators: Incorporate actuators such as electromechanical brakes, steering actuators, or throttle control systems to intervene autonomously in response to detected hazards or imminent collisions.
4) Communication Interface: Install communication interfaces to allow data transfer between the onboard electronics of the car and the safety system components, such as LIN (Local Interconnect Network) or CAN (Controller Area Network)
5) Power Supply: Ensure a reliable power supply for the safety system components, either through the vehicle's electrical system or dedicated power sources such as batteries or capacitors.
By carefully considering design factors, selecting appropriate components, and ensuring seamless integration with existing vehicle systems, retrofitting old cars with accident detection and prevention systems can significantly enhance their safety capabilities and contribute to a safer driving experience for occupants and other road users.

IV. IMPLEMENTATION PROCESS

Implementing modern systems in old cars can be a gratifying project, bringing new life and functionality to classic vehicles. This process, often called a retrofit, can vary widely in complexity and cost, depending on the specific systems you're looking to implement and the make and model of the vehicle. Below is a step-by-step guide, along with considerations for different vehicles and a rough framework for cost estimation and budgeting.

Step 1: Define the System and Objectives
Identify Specific Systems: Decide what modern conveniences or upgrades you wish to implement. Common upgrades include infotainment systems, electronic fuel injection (EFI) systems, air conditioning, power steering, or safety features like ABS or airbags.
Set Clear Objectives: Understand why you're implementing these systems. Is it for comfort, efficiency, safety, or value addition?

Step 2: Research
Vehicle-Specific Information: Gather detailed information about your vehicle, including make, model, year, and existing systems.
Compatibility and Availability: Research which modern systems are compatible with your vehicle. This may involve looking into aftermarket kits specifically designed for your vehicle or universal systems that can be adapted
Regulatory Compliance: Check local regulations to ensure your upgrades meet legal standards, especially for emissions and safety.

Step 3: Planning and Design
Technical Assessment: Evaluate the technical feasibility of installing new systems. Consider space constraints, power requirements, and integration with existing systems.
Resource Identification: List the tools, parts, and expertise (professional mechanic or electrician) required for the project.
Project Timeline: Develop a realistic timeline, accounting for research, procurement of parts, and installation.

Step 4: Cost Estimation and Budgeting
Parts and Materials: List all parts and materials required and research their costs. Include a buffer for unexpected expenses.
Labor Costs: If professional assistance is needed, get quotes from several service providers.
Contingency Budget: Set aside 15-20% of the total estimated cost for unforeseen expenses

Step 5: Implementation
Preparation: Gather all tools and parts. Prepare the vehicle by ensuring it is clean and in a suitable working environment.
System Installation: Follow the installation guide for each system. It's essential to proceed cautiously, especially with electrical systems.
Testing and Troubleshooting: After installation, test each system thoroughly to ensure it functions correctly. Troubleshoot any issues that arise.

Step 6: Finalization
Professional Inspection: Consider having the vehicle inspected by a professional to ensure everything is installed correctly and safely.

V. BLOCK DIAGRAM

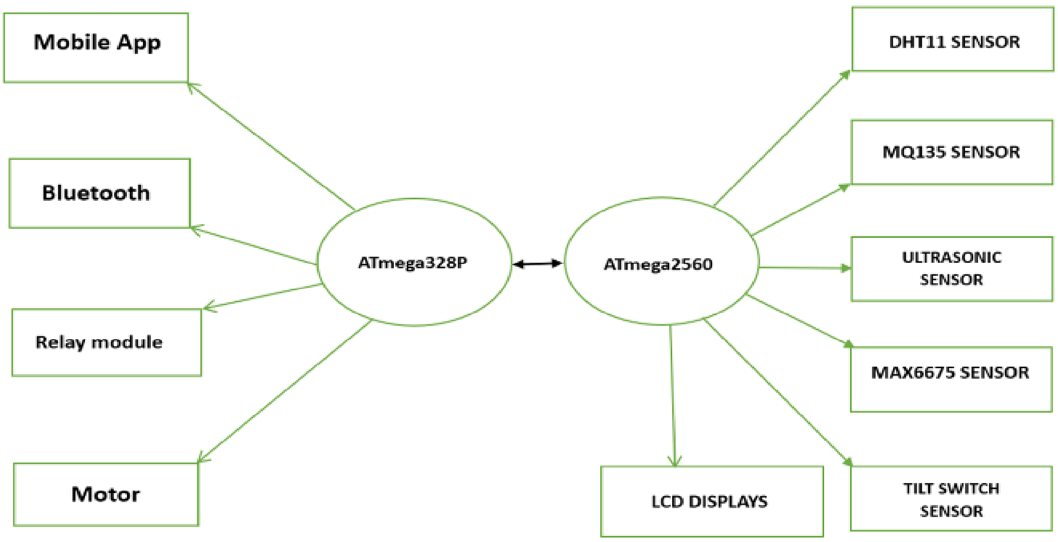

FIG.[1].BLOCK DIAGRAM OF THE SYSTEM.

This system based on 2 controlling modules like Arduino uno & Arduino mega using Arduino uno we are controlled the blutooth control car as a demo model & Using Arduino mega controlled the telemetric sensors like ultrasonic sensor, temperature & humidity sensor, thermocouple sensor, air quality sensor, tilt switch etc.

VI. FLOW CHART

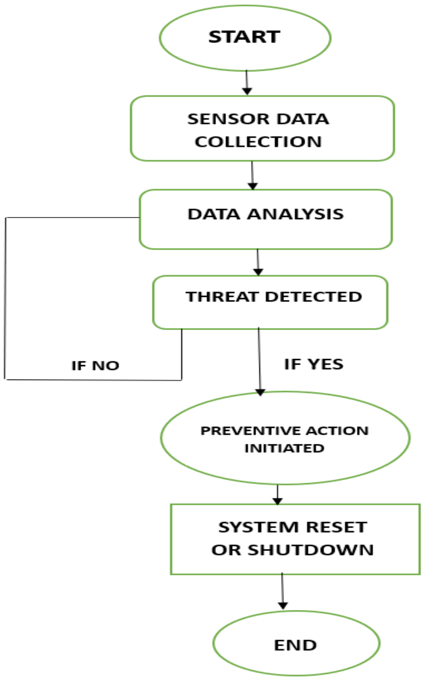

FIG.[2].FLOWCHART OF WORKING MECHANISM

Implementing an Accident Detection and Prevention System in old cars involves integrating sensors, a microcontroller or microprocessor, GPS, and possibly communication modules to detect potential accidents and, if possible, take action to prevent them or minimize their impact. Below, I'll outline a basic flow of how such a system can work, followed by a description that could be visualized as a flowchart:

1) Start

Initialization: System checks all sensors and communication modules for readiness.

2) Sensor Data Collection: Continuously collect data from sensors (accelerometer, proximity sensors, etc.).

3) Data Analysis: The microcontroller analyzes sensor data to detect potential collision threats.

Acceleration/deceleration patterns

Proximity to obstacles.

4)Threat Detected?:

Yes: Proceed to step 6.

No: Loop back to step 3.

5)Preventive Action Initiated:

Activate warnings (audible alerts, dashboard indicators).

If equipped and safe, initiate automatic braking or steering adjustments.

6) Accident Detected:

Based on sensor data (sudden deceleration, impact detected), determine if an accident has occurred.

7)Emergency Response:

If an accident is detected, send GPS location and alert to emergency services via a communication module (e.g., GSM).

8) System Reset/Shutdown: Depending on the severity, the system either resets itself for continuous monitoring or shuts down if the vehicle is no longer operable.

9)End.

VII. WORKING

The system consists of various sensors for accident prevention:

ULTRASONIC SENSOR: The sensor detects the returning echoes of these ultrasonic waves. The sensor emits ultrasonic waves, which are sound waves at a frequency higher than humans can hear, typically in the range of 40 kHz to several GHz By measuring the time it takes for the echoes to return, the system can calculate the distance to the object. This calculation is based on the speed of sound in air, using the formula: Distance = (Speed of Sound in Air x Time) / 2. The division by 2 accounts for the distance to the object and back to the sensor.

In an accident detection and prevention system, the **MAX6675** could be used in Overheating Detection By monitoring the temperature of critical components in machinery, vehicles, or systems, the MAX6675 can help detect overheating issues before they lead to a failure or accident. For instance, in a car, it might monitor the engine or brake system temperature, allowing for preventative measures if temperatures rise beyond safe limits.

TILT SENSORS in accident detection and prevention systems play a crucial role by measuring the angle of tilt or inclination of a vehicle relative to the horizontal plane. This information is crucial for identifying potential rollover scenarios or extreme tilting that may lead to accidents. If the tilt angle exceeds safe limits, it could indicate that the vehicle is in danger of tipping over or losing control. This situation is often found in high-speed turns, off-road conditions, or during collision avoidanc maneuvers.

THE DHT11 SENSOR is primarily used for measuring temperature and humidity, but it can be innovatively integrated into an accident detection and prevention system, particularly in vehicles. By monitoring the humidity levels inside and outside the vehicle, the DHT11 can help in detecting conditions that are likely to cause fogging on the vehicle's windows and mirrors. An automated system could activate defoggers or air conditioning to prevent the fogging, enhancing visibility and reducing the risk of accidents.
By taking all parameters into consideration when emergency condition occurs alarm get buzzerd and by measuring the distance of front vehicle car get stop by applying the breaks.When the next car is from the distance of typical value car get automatically stop which result into accident prevention.When the car crosses the limit value of parameters such as distance , temperature and humidity , air quality etc . then alarm get buzzered for the avoidance of accident.

VIII. RESULT

In result we designed the model that shows the result of how system actual works for the accident detection and prevention

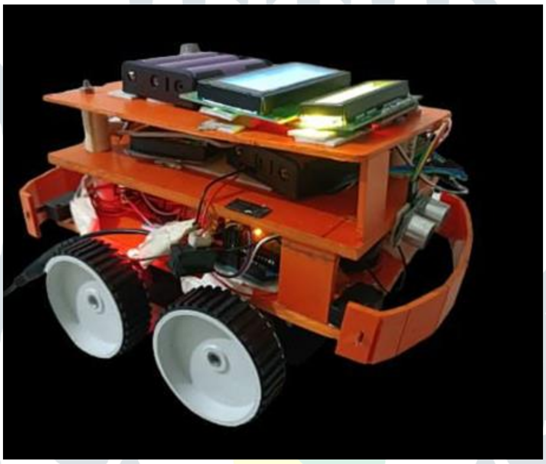

FIG.[3]. REAL MODEL

Two LCD display shows the parameters which provides the information about car performance.

FIG.[4]. DISPLAY RESSULT

IX. IMPORTANCE OF IMPLEMENTING ACCIDENT DETECTION AND PREVENTION SYSTEMS IN OLD CARS:

Implementing accident detection and prevention systems in old cars is crucial for several reasons:
1) Enhanced Safety: Retrofitting older vehicles with modern safety technologies can significantly reduce the risk of accidents and mitigate their severity, thereby saving lives and reducing injuries

2)Extended Vehicle Lifespan: By improving the safety features of older cars, their usable lifespan can be extended, allowing owners to continue using them safely and reducing the need for premature vehicle replacement.
3) Inclusivity and Equity: Ensuring that safety advancements are accessible to owners of older vehicles promotes inclusivity and equity in road safety, regardless of the age or model of the car.
4) Environmental Impact: Extending the lifespan of older cars through safety upgrades contributes to reducing the environmental impact associated with manufacturing new vehicles.
Future Directions and Recommendations
Moving forward, several recommendations and future directions can further enhance the effectiveness and accessibility of accident detection and prevention systems in old cars:
1) Standardization: Advocate for industry-wide standardization of retrofitting procedures and compatibility requirements to streamline the integration process and ensure interoperability across different vehicle models.
2) Research and Development: Invest in research and development efforts to advance sensor technologies, machine learning algorithms, and AI techniques tailored for retrofitting older vehicles, focusing on improving detection accuracy, reducing false alarms, and optimizing power consumption.
3) Regulatory Support: Collaborate with policymakers and regulatory bodies to establish incentives and mandates for retrofitting old cars with safety systems, promoting widespread adoption and ensuring compliance with safety standards.
4) Public Awareness and Education: Raise public awareness about the importance of vehicle

X. FUTURE DEVELOPMENTS :

1)**Standardization Efforts**: Advocate for industry-wide standardization of retrofitting procedures and compatibility requirements to streamline the integration process for accident prevention systems in old cars.

2)**Advanced Sensor Technologies**: Explore advancements in sensor technologies, such as low-power radar and lidar systems, to improve detection accuracy while minimizing power consumption and integration complexity.

3)**Machine Learning and AI:** Incorporate machine learning algorithms and artificial intelligence (AI) techniques to enhance the system's predictive capabilities and reduce false alarms by learning from real-world driving data.

4)**Regulatory Support:** Advocate for regulatory support and incentives to encourage the adoption of safety systems in older vehicles, fostering collaboration between automotive manufacturers, policymakers, and technology providers.
By addressing these challenges with innovative solutions and continuously evolving the technology, accident prevention and detection systems in old cars can become more accessible, reliable, and effective in improving road safety for all drivers.

XI. CONCLUSION

In conclusion, the implementation of an accident prevention and detection system in old cars represents a significant advancement in automotive safety. Through meticulous testing, analysis, and the development of innovative solutions, this project has demonstrated the potential to enhance vehicle safety and mitigate the risks associated with driving older vehicles.
Key findings have highlighted the effectiveness of the system in improving accident detection rates, reducing response times, and ultimately saving lives. By addressing challenges such as integration complexity, compatibility issues, and cost constraints, the project has paved the way for the widespread adoption of safety technologies in older vehicles.
The importance of implementing accident prevention and detection systems in old cars cannot be overstated. It extends the usable lifespan of vehicles, promotes inclusivity and equity in road safety, and contributes to environmental sustainability by reducing the need for premature vehicle replacement.Looking ahead, future developments and recommendations, including standardization efforts, research and development investments, regulatory support, and public awareness campaigns, will further enhance the effectiveness and accessibility of these systems. By working collaboratively across industries and sectors, we can continue to make significant strides in improving automotive safety for all drivers, regardless of the age or model of their vehicles.

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