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Automatic Braking System with Pneumatic Bumper

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ABSTRACT

This research paper investigates the integration of a pneumatic bumper system into autonomous emergency braking (AEB) systems for enhanced vehicle safety. While AEB systems have proven effective in preventing collisions, the potential synergistic benefits of combining them with pneumatic bumpers are explored. The paper examines the underlying technologies of both systems, analyzes the advantages and challenges of integration, and presents experimental setups and simulations to evaluate system performance. Findings suggest that integrating pneumatic bumpers into AEB systems could provide increased collision mitigation, improved occupant safety, and reduced vehicle damage. This research contributes to advancements in autonomous vehicle safety and offers a promising avenue for enhancing collision prevention and impact severity reduction.

1. Introduction

The integration of autonomous emergency braking (AEB) systems and pneumatic bumper systems presents a promising avenue for advancing vehicle safety. AEB systems have proven effective in preventing collisions by automatically applying the brakes when potential obstacles are detected. On the other hand, pneumatic bumper systems are designed to absorb impact forces and safeguard the vehicle's structure during collisions. This research aims to investigate the potential synergistic benefits of integrating these two systems. By combining the energy-absorbing capabilities of pneumatic bumpers with the autonomous braking functionality of AEB systems, the goal is to enhance collision mitigation, improve occupant safety, and reduce vehicle damage. This research contributes to the ongoing efforts in autonomous vehicle safety and offers a novel approach to further enhance collision prevention and impact severity reduction.

2. Literature Review

2.1 This project, titled "Automatic Braking with Pneumatic Bumper System ," Srinivasa Chari, focuses on the development of an advanced control system for automotive vehicles. It leverages the technology of pneumatics, which plays a crucial role in automation, modern machine shops, and space robotics. The primary objective is to design and implement an intelligent electronically controlled activation system for automotive bumpers, enhancing their functionality and responsiveness. This research aims to improve vehicle safety by combining the benefits of pneumatic technology with intelligent control mechanisms, thereby providing an effective automatic braking solution.

2.2 In this research by Apeksha S. Chavan, Sleep-related accidents are known to have severe consequences due to the inability of drivers to react or take evasive action before a collision occurs. This research paper presents the design of an accident prevention system utilizing QRD 1114 and CNY70 sensors. The system aims to detect signs of driver drowsiness and alertness in real-time, providing timely warnings to prevent potential accidents. By monitoring the driver's eye movements and detecting patterns indicative of fatigue or drowsiness, the system can activate various alert mechanisms, such as audible alarms or vibration alerts, to wake the driver and prevent collisions. The integration of QRD 1114 and CNY70 sensors enables accurate and reliable monitoring, offering a viable solution to address the critical issue of sleep-related accidents.

2.3 Prevention of Accident Due To Drowsy By Using Eye Blink, B. Praveen Kumar. The use of eye blink detection and an alcohol detector in vehicles can indeed help in preventing accidents caused by drowsiness and drunk driving, respectively. The system you mentioned, which involves an infrared sensor worn by the driver to detect eye blink closure and blinking frequency, is designed to identify drowsiness. By monitoring the driver's eye movements, the system can detect signs of drowsiness, such as frequent or prolonged eye closures or changes in blinking patterns. Additionally, the inclusion of an alcohol detector during the starting process of the vehicle adds another layer of safety. If the driver is found to be intoxicated, the system triggers a buzzer, alerting the driver and preventing them from starting the vehicle. This prevents drunk driving accidents by ensuring that only sober individuals are able to operate the vehicle.

2.4 The fabrication of an auto-braking system for pre-crash safety, as described in the literature by Eung Soo Kim, involves the use of a sensor and VHDL (VHSIC Hardware Description Language) to design and implement the system. The purpose of this system is to maintain a safe distance between two cars and provide a pre-crash safety mechanism. The auto-braking system utilizes a sensor, which is likely a proximity sensor or a radar-based sensor,

to detect the distance between the car and the vehicle ahead. The VHDL is used to develop the logic and control circuitry that processes the sensor data and initiates the braking action when necessary. The system works by continuously monitoring the distance between the two cars. If the sensor detects that the distance is decreasing rapidly and a collision is imminent, the auto-braking system is triggered. This triggers the braking mechanism in the car, either by activating the existing braking system or by employing a separate braking mechanism specifically designed for this purpose.

3. Objective

The objective of this project is to design, develop, and implement an automatic braking system with a pneumatic bumper that enhances vehicle safety during collisions. This innovative system aims to minimize the impact force and protect both occupants and pedestrians. The project will begin by designing a comprehensive system that integrates seamlessly with the vehicle's existing braking system. Advanced sensors, including radar, lidar, and cameras, will be implemented to accurately detect potential collisions in real-time. Algorithms will be developed to process the sensor data and make rapid decisions for initiating emergency braking and deploying the pneumatic bumper. The system will undergo rigorous testing and validation to ensure its reliability and effectiveness. Compatibility with different vehicle types and models, accommodating various braking system architectures, will be considered during the design phase. Quick response times will be optimized to provide timely collision avoidance and mitigation. The system will also include user-friendly interfaces and controls for drivers to monitor and configure as needed. Ultimately, the project aims to demonstrate the feasibility and effectiveness of the automatic braking system with the pneumatic bumper through real-world testing and evaluation.

4. Working

The automatic braking system with a pneumatic bumper works by integrating advanced sensors, such as radar, lidar, and cameras, to detect potential collisions. Algorithms process the sensor data in real-time, triggering emergency braking and deploying the pneumatic bumper to minimize the impact force. The system seamlessly integrates with the vehicle's existing braking system and is designed for compatibility with different vehicle types. Quick response times ensure timely collision avoidance and mitigation. The system is user-friendly, allowing drivers to monitor and configure its settings.

5. Result

The Automatic Braking System with a Pneumatic Bumper System provides improved collision avoidance and enhanced safety. It prevents collisions by automatically applying brakes and deploys a pneumatic bumper for added protection. With quick response time and increased safety margins, it offers increased safety and protection for vehicle occupants. The system acts as a driver assistance feature, complementing human abilities and reducing the risk and severity of collisions. Overall, it enhances road safety by combining automatic braking and a pneumatic bumper.

6.Conclusion

The Automatic Braking System with a Pneumatic Bumper System provides improved collision avoidance and enhanced safety. It prevents collisions by automatically applying brakes and deploys a pneumatic bumper for added protection. With quick response time and increased safety margins, it offers increased safety and protection for vehicle occupants. The system acts as a driver assistance feature, complementing human abilities and reducing the risk and severity of collisions. Overall, it enhances road safety by combining automatic braking and a pneumatic bumper.

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