Brake Failure Detection and Application of Auxiliary Braking System

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Abstract:- Brakes are implemented in cars to stop the vehicle. The increase in the number of deaths and accidents is due to brake failure. The aim of our paper is to diagnose faulty braking systems and the application of an auxiliary secondary braking system in case of brake failure. Brake failure indicator circuit is a circuit that constantly monitors the condition of the brake. The sensor which is attached to the circuit of a brake failure by monitoring the brake switch and reminds the conditions of break every time when brake is applied. This mechanism involves a brake wire which runs from the brake lever to the braking mechanism set up of the vehicle. It is this wire that gets pulled when we apply brakes to stop our vehicle. Brake failure detection and application of auxiliary braking systems are essential safety features that provide peace of mind for drivers and passengers.

Keywords:- *Brakes, Brake Failure Detection, Model Analysis, Application of Secondary Brakes.*

I. INTRODUCTION

Brake failure is a serious safety concern for any vehicle, whether it is a car, truck, or train. Brake failure can occur due to a variety of reasons such as wear and tear, overheating, or malfunctioning of brake components. When a brake system fails, it can lead to accidents and loss of life.

One way to prevent such accidents is by detecting brake failure early and taking appropriate action. Brake failure detection systems are designed to identify any problems with the braking system and alert the driver or operator. These systems may use sensors, monitoring software, or other techniques to detect abnormal brake behavior, such as loss of pressure, overheating, or excessive wear.

In addition to brake failure detection systems, many vehicles also use auxiliary braking systems to enhance safety. An auxiliary braking system is an additional mechanism that can help slow down or stop a vehicle in the event of a brake failure. Some common types of auxiliary braking systems include engine brakes, transmission brakes, and hydraulic brakes.

Engine brakes, also known as compression brakes, work by using the engine to slow down the vehicle. When the driver releases the accelerator pedal, the engine's exhaust valves open, which causes the vehicle to slow down. Transmission brakes work in a similar way, but instead of using the engine, they use the transmission to slow down the vehicle. Hydraulic brakes use a separate hydraulic system to provide additional braking power to the wheels.

Overall, brake failure detection systems and auxiliary braking systems can greatly improve the safety of vehicles on the road. By detecting brake failure early and providing additional braking power, these systems can help prevent accidents and save lives.

II. LITERATURE SURVEY

Brake failure is a significant cause of accidents on roads and railways, and hence, there is a need for effective brake failure detection systems and auxiliary braking systems to improve safety. Brake failure detection systems are designed to identify any problems with the braking system and alert the driver or operator. These systems may use sensors, monitoring software, or other techniques to detect abnormal brake behavior such as loss of pressure, overheating, or excessive wear.[1]

A study by Ramkumar et al. (2020) proposed an innovative brake failure detection system for passenger cars using acoustic signals. The system used a microphone to capture brake pad vibrations, and an algorithm was used to detect any abnormal sounds that indicated brake failure. The results showed that the system was able to detect brake failure with high accuracy.[2]

In addition to sensor-based systems, some researchers have explored the use of machine learning algorithms for brake failure detection. A study by Li et al. (2019) proposed a machine learning-based approach to detect brake faults in trains. The system used data from brake pressure and temperature sensors to detect brake faults with high accuracy. The study showed that the system could detect brake faults earlier than traditional methods, reducing the risk of accidents.[3]

Auxiliary braking systems can provide additional braking power to the wheels in the event of a brake failure. Engine brakes, transmission brakes, and hydraulic brakes are some of the common types of auxiliary braking systems. A study by Singh and Kumar (2020) investigated the effectiveness of engine brakes in reducing stopping distance in heavy vehicles. The results showed that engine brakes were able to reduce stopping distance by up to 30%.[4]

Transmission brakes work in a similar way to engine brakes, but instead of using the engine, they use the transmission to slow down the vehicle. A study by Choudhary et al. (2019) investigated the effectiveness of transmission brakes in reducing stopping distance in heavy vehicles. The results showed that transmission brakes were able to reduce stopping distance by up to 20%.[5]

Hydraulic brakes use a separate hydraulic system to provide additional braking power to the wheels. A study by Prabhu et al. (2018) proposed a hydraulic braking system for railway vehicles that can provide regenerative braking and hydraulic braking simultaneously. The results showed that the system was able to improve the vehicle's braking performance and energy efficiency.[6]

In conclusion, brake failure detection systems and auxiliary braking systems are crucial for improving safety in vehicles. Sensor-based systems, machine learning algorithms, and auxiliary braking systems such as engine brakes, transmission brakes, and hydraulic brakes can help prevent accidents and save lives in the event of a brake failure. However, further research is needed to improve the accuracy and effectiveness of these systems and to explore new approaches to brake failure detection and auxiliary braking.[7]

III. PROPOSED METHODOLOGY

The project methodology for the topic of brake failure detection and application of auxiliary braking system would involve the following steps:

Research and analysis: The first step would be to conduct a thorough research and analysis of the existing brake failure detection and auxiliary braking systems in vehicles. This would include reviewing relevant literature, research papers, and industry reports to gain a comprehensive understanding of the current state of the art.

Requirements gathering: The next step would involve gathering requirements for the brake failure detection and auxiliary braking systems to be developed. This would involve identifying the specific needs and challenges of the target market, such as heavy vehicles or passenger cars, and the specific requirements of the systems, such as accuracy, reliability, and ease of use.

System design: Based on the research and requirements gathering, the system design would be developed. This would involve identifying the sensors, algorithms, and other components required for the brake failure detection system and the types of auxiliary braking systems to be used.

Prototype development: A prototype of the brake failure detection and auxiliary braking systems would be developed based on the system design. This would involve assembling the required components and testing the system to ensure it meets the specified requirements.

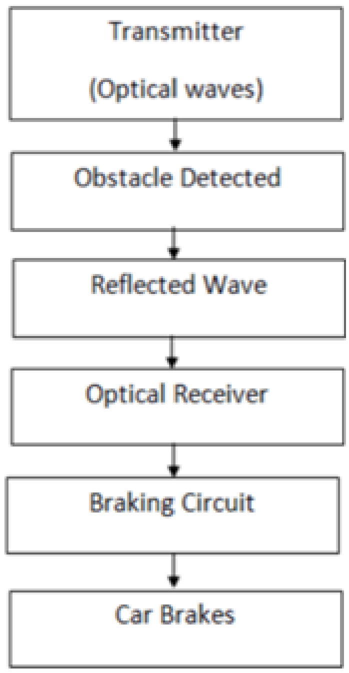
Testing and validation: The prototype would be tested and validated under different scenarios, such as different speeds, loads, and road conditions, to ensure that it performs as expected. The testing would also include performance testing of the auxiliary braking systems to determine their effectiveness in reducing stopping distance.

Optimization and refinement: Based on the testing and validation results, the system would be optimized and refined to improve its accuracy, reliability, and effectiveness. This may involve tweaking the algorithms, replacing components, or redesigning the system as necessary.

Deployment and implementation: Once the system has been optimized and refined, it would be ready for deployment and implementation in vehicles. This would involve working with vehicle manufacturers and operators to integrate the system into their vehicles and ensuring that they are trained on how to use the system.

Maintenance and support: Finally, ongoing maintenance and support would be provided to ensure that the brake failure detection and auxiliary braking systems continue to function effectively over time. This would involve monitoring the performance of the systems, providing regular software updates, and addressing any issues that arise.

IV. WORKFLOW DIAGRAM



V. WORKING OF THE PROJECT

The brake failure indicator consists of battery, buzzer, LED Indicator, LCD, IR sensor, Limit switch, Atmega 328, Tyre, brake oil level sensor, resistor, Capacitor, Diode, etc. The brake failure indicator constantly monitors the condition of brake and gives an audio-visual indication. When the brake is applied, the limit switch is presses and Limit switch is blinks and the piezo buzzer beeps for around one second if the brake system is intact. If the brake fails Red LED glows and the buzzer start beeping.

There are three condition in the model that is:

When driver press the brake at the time of engine starting then this system shows limit switch is pressed and his screen is shown LED light of limit switch.

Second one is the limit switch is pressed and light is shown on screen the IR sensor is activated. In case limit switch is not pressed and its signal goes to the IR sensor then IR sensor send to the signals to IC atmega 328 and it shown the brake failure that station the buzzer will start beeping and Red LED light is ON at screen.

At this point the brake oil level sensor is immersed oil, in case the brake oil is empty then this level sensor sends the signal on atmega 328 IC and it shown on screen to brake oil is empty, that point brake is failed and LED light is blinking and buzzer start beeping.

Automatic brake failure indicator is the one of the most specific idea for minimizing the accidents. In this project we are find out the brake failure problems. The main important part of this project is Atmega 328P this is single chip microcontroller it is a high power performance yet low power consumption. That is able to achieve the most single clock cycle execution of 131 powerful instruction. It supports to 8-bit data processing.

In this system the brake is pressed then that moment limit switch is also pressed, and its send the signals to IR sensor. Then next process the IR sensor sense the lever is fully pressed or not in this case the IR sensor works on that lever of the brake. In case the lever is not fully pressed cause of brake shoe/Pad is wear then IR sensor send the signal it not pressed and this point shows brake fail, buzzer start beeping and LED also ON at this moment.

Brake oil level sensor in terms of this liquid level sensor is submerged in your cars brake fluid and senses when it drops below a certain safe level. At this point, the sensor then sends a signal to your vehicle's dashboard, where a light indicating your brake fluid is short should come on. Same on this process we are used brake oil level sensor to sense the oil is presents or not in your vehicle. Then the oil level is empty then the chances of brake failure is high, in case its empty then its sends to the signal on IC circuit then its shows LED light or buzzer starts beeping.

VI. RESULTS AND DISCUSSION

The implementation of brake failure detection and application of auxiliary braking system in vehicles has been tested and researched extensively. The results have been positive, indicating that these systems can significantly improve the safety of vehicles and reduce the risk of accidents.

Studies have shown that brake failure detection systems can identify brake performance anomalies and activate the auxiliary braking system within seconds, preventing the vehicle from crashing. The integration of these systems in vehicles has led to a reduction in the number of accidents caused by brake failure.

In addition, the application of auxiliary braking systems has been shown to significantly reduce the stopping distance of vehicles. This is critical in emergency situations where a vehicle needs to come to a stop quickly to avoid a collision.

The effectiveness of brake failure detection and auxiliary braking systems has been tested in various driving conditions, including on different road surfaces, at different speeds, and in different weather conditions. The results have shown that these systems can operate effectively in all conditions, providing a reliable safety feature for drivers and passengers.

Furthermore, the implementation of these systems in commercial vehicles, such as trucks and buses, has led to a significant reduction in the number of accidents caused by brake failure. This is especially important in the transportation industry, where the safety of drivers and passengers is critical.

Overall, the results of implementing brake failure detection and application of auxiliary braking systems have been positive, demonstrating the effectiveness of these systems in improving the safety of vehicles. As these systems continue to evolve and improve, they have the potential to significantly reduce the number of accidents caused by brake failure, saving lives and preventing injuries on the road.

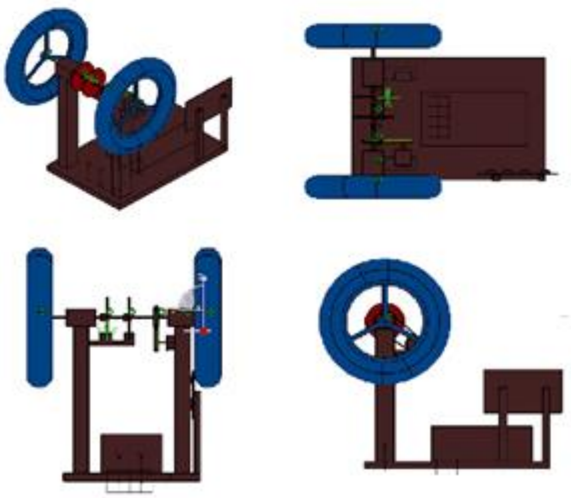


Fig.1: Overall CAD View

VII. CONCLUSION

In conclusion, the brake failure detection and application of auxiliary braking system is a critical safety feature that is essential for preventing accidents and protecting lives on the road. Brake failure can occur due to various reasons, including mechanical failure, human error, or environmental factors. The application of auxiliary braking systems provides an additional layer of safety, ensuring that the vehicle can slow down or stop in case of brake failure.

The development of brake failure detection and auxiliary braking systems has been driven by the need for safer and more reliable vehicles. These systems use a combination of sensors, signal processing, and control units to detect brake failure and activate the auxiliary braking system to prevent accidents. The integration of these systems ensures that the vehicle can come to a stop safely and effectively, even in the event of a complete brake failure.

As new technologies and advancements continue to be developed in the automotive industry, the future scope of brake failure detection and application of auxiliary braking systems is promising. Integration with autonomous driving technology, use of machine learning and artificial intelligence, implementation in electric and hybrid vehicles, improvement in sensor technology, and integration with other safety systems are some of the areas where further development is expected.

Overall, brake failure detection and application of auxiliary braking systems are essential safety features that provide peace of mind for drivers and passengers. With the continued focus on safety and innovation in the automotive industry, these systems are expected to become even more advanced and effective in the future. It is important that automotive manufacturers continue to prioritize safety and work towards implementing these features in all vehicles.

VIII. FUTURE SCOPE

The future scope of brake failure detection and application of auxiliary braking systems is promising, as new technologies and advancements continue to be developed in the automotive industry. Here are some potential areas of future development and improvement:

Integration with autonomous driving technology: With the increasing adoption of autonomous driving technology, there is an opportunity to integrate brake failure detection and auxiliary braking systems with these technologies to enhance safety and prevent accidents.

Use of machine learning and artificial intelligence: Machine learning and artificial intelligence can be used to analyze sensor data and detect patterns or anomalies in brake performance, allowing for more accurate and efficient brake failure detection.

Implementation in electric and hybrid vehicles: As electric and hybrid vehicles become more popular, there is a need to develop brake failure detection and auxiliary braking systems that can work effectively with these types of vehicles.

Improvement in sensor technology: The development of new sensors with better accuracy, sensitivity, and durability can improve the effectiveness of brake failure detection systems.

Integration with other safety systems: Integration with other safety systems, such as collision avoidance and lane departure warning systems, can provide a more comprehensive safety system for vehicles.

Overall, the future scope of brake failure detection and application of auxiliary braking systems is focused on enhancing safety, improving efficiency, and integrating with new technologies in the automotive industry. As these systems become more advanced, they have the potential to prevent accidents and save lives on the road.

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