WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Drive by Wire and Adaptive Cruise Control

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ABSTRACT—

The automotive industry is seeing increased use of the advanced vehicle control systems drive-by-wire (DBW) and adaptive cruise control (ACC). DBW is a technology that substitutes electronic controls for conventional mechanical systems including the steering wheel, throttle, and brake pedal. With the aid of ACC technology, a car's speed can be automatically adjusted to keep a safe distance from the car in front. We explore how these technologies function and their influence on driving safety, comfort, and efficiency. We examine these technologies' drawbacks as well, including cybersecurity, dependability, and human-machine interaction. Last but not least, we discuss the acceptance status of DBW and ACC as well as the potential for further growth and integration with other cutting-edge technologies like autonomous driving and vehicle-to-vehicle communication. ACC, on the other hand, is a system that employs radar or other sensors to monitor the distance between a vehicle and the one in front of it. The driver no longer needs to continually modify their speed since the system will then automatically alter the speed of the car to maintain a safe following distance. When used in tandem, these two technologies provide a more convenient and sophisticated driving experience with better safety. Drivers may enjoy a more relaxed and enjoyable journey with DBW and ACC, which also lowers the risk of accidents and boosts fuel efficiency.

I. INTRODUCTION

The implementation of drive-by-wire technology in vehicles provides the driver with a whole new experience. Any type of drive by wire technology uses sensors to record signals (information) and transmit them to a network of computers or computers that convert electrical energy into mechanical motion. Drive by wire technology can be used to replace all mechanical wires with electrical wires. Over time, research and development in the automotive industry has experimented with making automobiles intelligent by integrating computers into them. If the drivers become acclimated to the notion, Drive by wire driven system has the capability to have a major influence on entire vehicle industry. The demand for safer, more effective, and more comfortable driving experiences, as well as the need to lessen the environmental impact of transportation, are two factors that are driving the adoption of DBW and ACC systems. These technologies have the potential to increase driving efficiency by maximising vehicle performance, improve driving comfort by lowering driver stress and fatigue, and increase driving safety by lowering the risk of human error. However, DBW and ACC systems also present substantial obstacles, such as cybersecurity risks, reliability concerns, and the necessity for good human-machine interaction. As these technologies continue to evolve, it is essential to understand their principles and benefits, as well as their limitations and potential risks.

Fig: Drive by wire

II. WORKING

Drive-by-wire (DBW) and adaptive cruise control (ACC) are two modern vehicle control systems that depend on electronic signals rather than traditional mechanical links to regulate vehicle operations. DBW systems use electronic sensors to detect and transmit driver inputs such as steering, braking, and acceleration to a central controller. The controller then sends electronic signals to the appropriate actuators, which move the vehicle's mechanical components, such as the throttle, brake, and steering systems, accordingly. This enables more accurate and responsive vehicle control, as well as increased fuel efficiency and lower emissions. ACC systems detect the distance and speed of cars in front of the vehicle using a mix of sensors such as radar and cameras. The ACC controller then adjusts the car's speed to maintain a safe following distance from the vehicle in front, generally by applying the brakes automatically or lowering engine power. Some ACC systems also have lane departure warning and automatic emergency braking. To work properly, both DBW and ACC systems rely on complicated electrical control systems and smart sensors. These systems must be very dependable, as any failure in these systems might result in a loss of vehicle control and a significant safety concern. Furthermore, these systems must be designed to function successfully in a variety of driving circumstances and scenarios, including as high speeds, heavy traffic, and inclement weather. The goal of DBW and ACC systems is to replace conventional mechanical systems with more accurate and responsive electronic controls, therefore enhancing driving safety, comfort, and effectiveness. Although these systems pose major technological difficulties, they are a crucial field for research and development in the automobile sector because of their prospective advantages.

III. LITERATURE SURVEY

1. **Kumar, R., Yadav, N. K., & Singh, S. P**. [3] This paper discusses Drive-by-wire (DBW) technology enables electrical steering, braking, and acceleration of the vehicle. The writers address the advantages and challenges of DBW systems, including their influence on vehicle safety, performance, and efficiency. Additionally, they discuss other DBW system types, including steer-by-wire, brake-by-wire, and throttle-by-wire, as well as how they integrate with other cutting-edge automotive technology. The article gives insights into the state of the art in DBW technology and its potential for enhancing the driving experience and allowing new vehicle features.
2. **Weng, Z., & Yang, H. (2020) [2]** This study offers a detailed overview of drive-by-wire (DBW) systems for vehicle control. The authors explore the design, control techniques, and safety issues of numerous types of DBW systems, such as steer-by-wire, brake-by-wire, and throttle-by-wire. They also discuss recent developments in DBW technology, including cybersecurity and fault-tolerant control. The advantages of DBW systems—such as enhanced vehicle performance, fuel economy, and user experience—as well as the difficulties of their implementation—such as the requirement for standardisation, legislation, and testing—are highlighted in the article. The article gives insights into the present state of the art in DBW technology and its potential for changing the automobile industry.
3. **Deka, L., & Wang, X. (2020) [2]** This study looks at how adaptive cruise control (ACC) affects traffic flow. The authors present a review of the literature on studies that look into how ACC affects traffic stability, capacity, and safety. They also talk about the potential advantages of ACC for lowering pollutants, fuel use, and traffic congestion. The report discusses the difficulties in user acceptability, system dependability, and interaction with other vehicle technologies that are related to the broad use of ACC.

IV. Methodology

The methodology for developing drive-by-wire (DBW) and adaptive cruise control (ACC) systems typically involves the following steps:

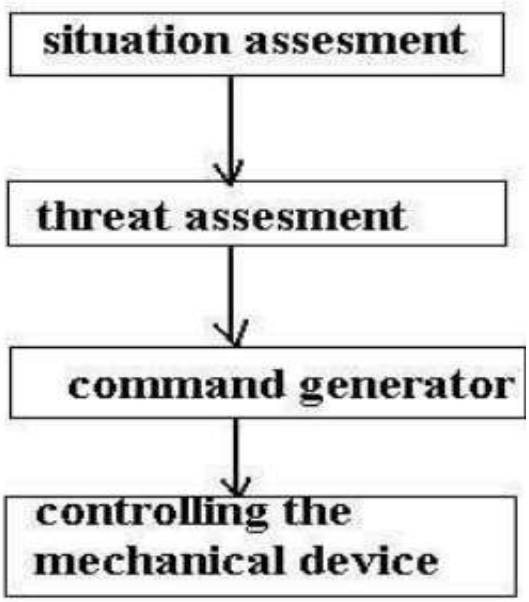

Fig: Flow diagram of controlling process

1. **System analysis:** This involves identifying the requirements and specifications of the DBW or ACC system, including the vehicle type, performance metrics, user interface, and safety standards.
2. **Hardware design:** This involves designing the hardware components of the DBW or ACC system, such as sensors, actuators, controllers, and communication interfaces. The design should be optimized for reliability, accuracy, and efficiency.
3. **Software development**: This involves developing the software algorithms that control the DBW or ACC system, such as the feedback control loop, signal processing, and decision-making logic. The software should be tested and validated to ensure its functionality and safety.
4. **Integration and testing:** This involves integrating the hardware and software components of the DBW or ACC system and testing the system in various scenarios, such as different driving conditions and environmental factors. The testing should include functional testing, performance testing, and safety testing.
5. **Verification and validation:** This involves verifying and validating the DBW or ACC system against the requirements and specifications identified in the system analysis phase. The verification and validation should ensure that the system meets the desired performance metrics and safety standards.
6. **Deployment and maintenance:** This involves deploying the DBW or ACC system in vehicles and ensuring its proper maintenance and updates over time.

The methodology for developing DBW and ACC systems requires a multidisciplinary approach that involves expertise in mechanical engineering, electrical engineering, computer science, and control systems. It also requires close collaboration with vehicle manufacturers, regulatory agencies, and other stakeholders to ensure the safety and effectiveness of the systems.

V. APPLICATIONS

Drive-by-wire (DBW) and adaptive cruise control (ACC) systems have a wide range of applications in the automotive industry and transportation sector. Some of the major applications of DBW and ACC include:

1. **Advanced driver assistance systems (ADAS):** DBW and ACC systems are key components of ADAS, which aim to improve driver safety and convenience. ADAS systems include features such as lane departure warning, automatic emergency braking, and blind spot detection, all of which rely on DBW and ACC technology.

2. **Autonomous driving:** DBW and ACC technology are critical for enabling autonomous driving, where vehicles can operate without human intervention. Autonomous driving requires highly accurate and reliable control of the vehicle's steering, braking, and acceleration, which is enabled by DBW and ACC systems.
3. **Commercial vehicles**: DBW and ACC technology can also be applied to commercial vehicles, such as trucks and buses, to improve their efficiency and safety. For example, ACC systems can help reduce fuel consumption and emissions, while DBW systems can improve vehicle stability and maneuverability.
4. **Military vehicles:** DBW technology is increasingly being used in military vehicles to improve their performance and reliability. Military vehicles equipped with DBW systems can operate in harsh environments and challenging terrain, where traditional mechanical systems may not be suitable.
5. **Industrial automation:** DBW technology can also be applied in industrial automation, where it can be used to control heavy machinery and equipment. This can improve the efficiency and safety of industrial processes, as well as reduce the need for human intervention.

VI. FUTURE SCOPE

The future scope for drive-by-wire (DBW) and adaptive cruise control (ACC) systems is vast, as the automotive industry and transportation sector continue to evolve and innovate. Some of the potential future developments and applications of DBW and ACC technology include:

1. **Increased automation:** DBW and ACC systems are critical for enabling higher levels of automation in vehicles, such as Level 4 and 5 autonomous driving. This will require further advancements in sensor technology, artificial intelligence, and communication systems.
2. **Connected and cooperative driving:** DBW and ACC technology can be used to enable connected and cooperative driving, where vehicles communicate with each other and with the surrounding infrastructure to improve safety and efficiency. This can include features such as cooperative adaptive cruise control, where multiple vehicles cooperate to maintain a safe distance and speed.
3. **Cybersecurity:** As more vehicles become connected and autonomous, cybersecurity will become a critical issue for DBW and ACC systems. Future developments in cybersecurity will be essential to protect against potential cyber attacks and ensure the safety and reliability of these systems.
4. **Electric and hybrid vehicles**: DBW and ACC technology can also be applied to electric and hybrid vehicles, where they can improve efficiency and performance. This will require further developments in battery technology, energy management, and power electronics.
5. **Augmented reality:** DBW and ACC technology can be used to enable augmented reality features in vehicles, such as heads-up displays and augmented reality windshields. This can provide drivers with real-time information and enhance their driving experience.

The future scope for DBW and ACC technology is vast, and is expected to continue to drive innovation and advancement in the automotive industry and transportation sector.

VII. CONCLUSION

drive-by-wire (DBW) and adaptive cruise control (ACC) systems have revolutionized the automotive industry and transportation sector by improving vehicle safety, efficiency, and performance. DBW technology has replaced traditional mechanical linkages with electronic controls, enabling more precise and responsive vehicle control. ACC systems use sensors and algorithms to maintain a safe distance from other vehicles on the road, reducing the risk of accidents and improving traffic flow. DBW and ACC systems have a wide range of applications, including advanced driver assistance systems, autonomous driving, commercial vehicles, military vehicles, and industrial automation. The future scope for DBW and ACC technology is vast, with potential developments including increased automation, connected and cooperative driving, cybersecurity, electric and hybrid vehicles, and augmented reality. As these technologies continue to evolve, it is essential that safety and reliability remain a top priority. Further research and development will be needed to ensure that DBW and ACC systems can be safely integrated into vehicles and transportation infrastructure, and that they meet the needs of both consumers and society as a whole.

VII. REFERENCE

1. Kumar, R., Yadav, N. K., & Singh, S. P. (2019). Drive-by-wire technology: A review. Journal of Mechanical Engineering Research and Developments, 42(2), 36-42.
2. Subramanian, S., & Bhattacharya, S. (2019). Adaptive Cruise Control: A Review. In Proceedings of the 4th International Conference on Computational Systems and Information Technology for Sustainable Solution (pp. 15-20). Springer.

3. Weng, Z., & Yang, H. (2020). Drive-by-Wire Systems for Vehicle Control: A Review. IEEE Access, 8, 40189-40199.

4. Azevedo, R., Cao, Q., & Wu, Y. (2019). The Benefits of Drive-by-Wire and Autonomous Vehicle Technology for Persons with Disabilities. In Proceedings of the 2nd International Conference on Advances in Artificial Intelligence and Robotics (pp. 143-147). ACM.

5. Deka, L., & Wang, X. (2020). Adaptive Cruise Control and the Impact on Traffic Flow. Transportation Research Procedia, 48, 1374-1381.