ISSN 2350-109X
www.indianscholar.co.in

Indian Scholar

An International Multidisciplinary Research e-Journal

CRUISE CONTROL AND ACCIDENT PREVENTION

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Abstract

This research paper aims at analysing the current cruise control technologies present in road vehicles, and how they can be improved to avoid accidents and damage to vehicles and lives. It compares the usage of these automated technologies to those in airplanes and other airborne vehicles, to analyse how the systems of ground vehicles can be improved to come closer to the advanced systems of airborne communication systems, while keeping the costs under control to make it accessible to a wider range of the population. Cruise Control revolutionised the automobile industry, and it aims to make the roads a safer place to travel for each and every one of us, even today. This paper will analyse the different types of cruise control systems that are in current use, or are still being developed, and aims to put forth viable suggestions for solutions to any faults or shortcomings in the systems.

Keywords: *cruise control, accident prevention, airborne communication systems*

INTRODUCTION

In recent times, the usage and knowledge of the word “autopilot” in air transport systems has become increasingly common. While these automated systems were being developed alongside the very first airplanes in the 1910s, they have become increasingly advanced in terms of accident prevention, accuracy, and error correction. [1] Similar to this system, a much simpler version began to be implemented in road vehicles, specifically cars, during the mid-20th century. Called Speed Control, the system was known to maintain the car’s velocity at a set magnitude; to reduce the load on drivers during long journeys.

Cruise control in road vehicles is a concept that has been gaining momentum in the past few decades. Though it seems to be a modern invention, cruise control (developed by the American mechanical engineer Ralph Teetor) does have its roots deep in history. In fact, the first car with built-in cruise control hit the roads way back in 1948. Although the system was vastly tweaked and improved over the years, the fundamental concept remained the same. In fact, over 92% of the cars available right now have built-in Adaptive Cruise Control systems [4] (a system that will be elaborated upon in the paper). This concept interests me, because it is certainly a scientific breakthrough that we can now develop vehicles that cater to human safety as its top priority, and minimise fatal highway accidents worldwide. Currently, more than 1.3 million people are in fatal car accidents globally, and systems like these will help minimise that number to its greatest capacity, and help save precious lives around the globe.

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Theory

Traditional Cruise Control systems work by keeping the vehicle at a constant speed when the driver turns it on. Once the car has reached the desired speed, cruise control systems help maintain that speed to allow for a minor break or rest for the driver during the journey. However, this system would reset automatically the moment the driver set foot on the brakes, and hence didn't prove very useful on unpredictable roads. Due to the variables like other vehicles, pedestrians and turns, drivers would rarely be allowed a break before they had to slow down, stop or change direction. This led to the rise of several other advanced systems, including a few as follows:

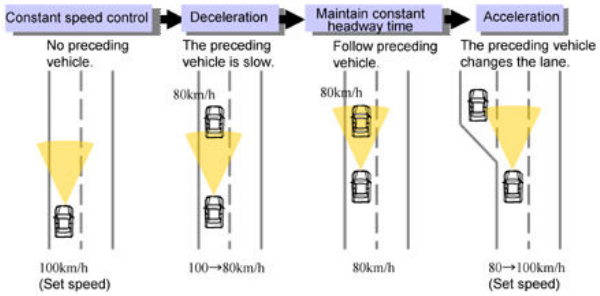

Fig. 1 RADAR in ACC Mechanism

Adaptive Cruise Control (ACC): Developed by William Chundrlik and Pamela Labuhn in 1990, ACC can do more than what others anticipated. Originally designed to improve the driving experience and therefore increase sales of cars, ACC goes one step ahead of thetraditional one. Along with maintaining a set magnitude of speed, ACC uses RADAR systems to detect the speed of a vehicle in front, and adjust the speed to prevent collisions and ensure a safe driving experience. RADAR systems emit radio waves which are reflected by the preceding car and are detected again by the RADAR system. By calculating the time taken between reflections, the RADAR system can accurately detect the speed of the preceding car, and will adjust the speed of the ACC to match the car, to maintain distance between the vehicles. However, this system does not in any way control steering so that must be supervised by the drivers themselves at all times for safety, just like in airborne autopilot systems. Currently in India, very few car models under 40 lakh INR are equipped with this feature.

Cooperative Adaptive Cruise Control (CACC): Sensors like RADAR and LiDAR (Light Detection and Ranging) are not failproof, and can lead to fatal accidents if they fail. CACC aims not only to maintain a constant speed, but mainly to maintain a constant time gap between the preceding vehicle and the driver vehicle. [2] CACC systems also display the basic safety measures, such as position, velocity and acceleration which is updated at regular time intervals. [2] This concept is quite new in the field of communication systems for traffic surveillance, but development in the near future could allow for this technology to become more common.

Traffic Aware Cruise Control: Commonly known as Tesla Autopilot, this is one of the most advanced self-driving systems released to date. It is currently exclusive to Tesla models, and is resultantly an extremely expensive system to own. Designed to improve safety on roads, it is one of the first automated driving systems that includes steering and changing lanes. (lane assist) [6] Such advanced technologies were only available in airplane systems up until now, so this is a breakthrough in road traffic vehicles. This type of cruise control can detect vehicles in the same lane as the vehicle, and make necessary alterations.

Although these automation features have intrigued and excited the public, as they feel they may not have to drive for long harrowing hours anymore, these systems might just be too good to be true. In the following section we will discuss the hazards and threats posed by this system, how exactly they come into being, and what can be done to fix them.

ISSN 2350-109X
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Experimental

As illustrated in this graph, the number of accidents per freeway miles were quite a bit higher when the Tesla Autopilot was on, between 2018-2019. It is a common misconception that once cruise control is turned on, the drivers can leave the system unsupervised. However, thiswould be extremely dangerous because if the system malfunctions, coupled with high speeds on highways, can result in innumerable fatalities. First of all, ACC systems, which are the most common, do not steer the cars and do not have the ability to manoeuvre through complex situations on roads involving intersections, pedestrians or other special cases. In this survey, I aim to reach out to the public and root outthe exact opinions and knowledge the general people have about this system and how it should be operated, and then propose changes and possible solutions.

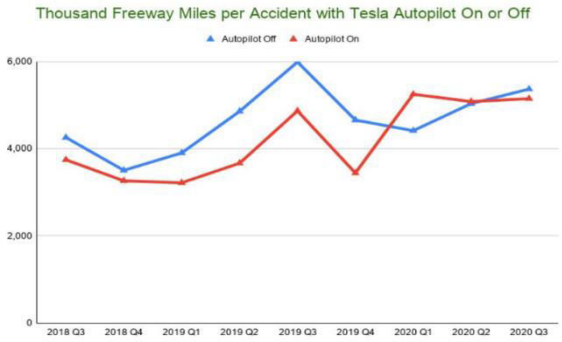

Fig. 2 Accidents when Tesla Autopilot is on

RESULT

Public opinion on the usage and abilities of cruise control was gathered using a public survey linked as follows: https://forms.gle/n3cqj724yYyfBko27

The results are as follows: MISA RESEARCH RESPONSES (the emails have been blanked out for confidentiality) The results show that although the majority of the people may have never used this system first-hand, they are aware of the dangers and precautions to be taken, since many people have agreed it is dangerous to leave an automated car unsupervised. Follow this link for a pictorial representation of the results: SURVEY RESULTS (MISA 2022: CRUISE CONTROL) (annika davuluri)

DISCUSSION

It can be inferred that the general public is aware of the hazards in the system, as shown by the fourth and fifth questions in the questionnaire, where in both cases more than 80% of the respondents agree that cruise control systems can be dangerous if left unsupervised. However, to ensure fail-proof safe use of this system, a few guidelines or rules can be implemented by drivers and manufacturers regarding this mechanism. Since safety is of utmost importance, there are several technologies in place that can ensure a safe in-vehicle technology system.[7] Multicoloured emergency lights can alert the drivers whether the car is in adaptive cruise control more; and furthermore, it must alert them on the status. For example, a green light could indicate the smooth functioning of the system and the driver may not need to intervene, but must still maintain full attention. An orange light could indicate the need for intervention either in terms of change of direction, speed or deceleration. When the distance between the vehicle and a preceding vehicle or hazardous object falls below the threshold deemed to be safe, an alerting red light could flash, at which point the driver would have to resume full control of the car in t-5 to 10 seconds, during which emergency brakes will be attempted to exert their function. In this way, high speed accidents on highways can be reduced, similar to how autopilot systems in airborne vehicles function. Also, short but mandatory training courses could be a requirement for

drivers intending to operate a car with adaptive cruise control, and a licence could be required for doing so. Drivers can avoid using this system during high-risk legs of a journey, for example at intersections, highway exits or areas with heavy traffic. To this end, Tesla models which incorporate Tesla Autopilot use highly advanced RADAR systems and multiple cameras to ensure complete safety of passengers. [6]. Its Collision Avoidance Assist systems also work towards a safer journey by alerting the drivers if there are any inbound collisions from any directions. However, this model is extremely expensive and more work will have to be done to manufacture this safety equipment on a cheaper scale to make safe and accident-free travel accessible to one and all.

CONCLUSION

There is still a long way to go before road-travel accidents can fully be eradicated from being. Using the tools of technology, specifically Cruise Control in this context, it is possible that with more advancement high-speed travel can become an accessible commodity for the general public, and the staggering numbers of roadway accidents can be minimised. However, the technological future is bright and there is hope for this goal to become a reality in the coming decades.

Acknowledgements

I would like to extend my thanks to the faculty in my college, Ms Shanta Chowdhary and Ms Varsha Kusnur for their guidance in this research paper.

REFERENCES

1. Y. Jia, L. Guo and X. Wong “Real Time Control Systems" in *Transportation Cyber-Physical Systems* Ed. Clemson University, USA, Elsevier, 2018 ch.4 pp 81-113
2. G. Marsden, M. Mcdonald, M. Brackstone “Towards and understanding of adaptive cruise control” University of Southampton, Highfield, Southampton, Accessed: April 15th 2022. Available: https://bit.ly/3yE27Sf
3. Liu, Y.; Wang, W. “A Safety Reinforced Cooperative Adaptive Cruise Control Strategy Accounting for Dynamic Vehicle-to-Vehicle Communication Failure.” Sensors 2021 Accessed: May. 12, 2022 Available: https://www.mdpi.com/1424-8220/21/18/6158/pdf
4. J. Bartlett “How Much Automation Does Your Car Really Have?” consumerreports.org Available: https://bit.ly/3lulZ2t (accessed May. 12, 2022)
5. G. Martin. “Study: Drivers More Likely to Speed When Using Adaptive Cruise Control” Apr. 19, 2021 Accessed: May. 12, 2022. Available: https://bit.ly/3FOFYSs
6. Tesla. “About Autopilot” https://bit.ly/3lanLp1 (accessed Apr. 16, 2022)
7. S. Magdici, M. Althoff “Adaptive Cruise Control with Safety Guarantees for Autonomous Vehicles” Technical University of Munich, Germany, 2017Accessed: May 15th 2022.