

Good human factors in automated driving system essay example

[Technology](#), [Cars](#)



I. Introduction

With the passage of time, in every area of human life, automation is penetrating more and more. From the method people commute from one place to another till the way people live in homes, lifestyles are being transformed more and more with the help of computer machines. Since past 50 years lots of researches have been done on automated cars but no one has been able to develop a safe and sound model. Cars however have been partially automated such as the ACC adaptive cruise control; Lane-adherence support and blind-spot support have been incorporated into cars at a very rapid pace. The problem of complete computerization is very complex. Majority of the issues are on the softer side i. e. related with human safety. However, these are not the only issues, the driving between a normal road and a highway road and many such traditionally technological issues act as a competitive hindrance .

II. The Automated System

Since cars are automated, it requires drivers to be more involved in regular administration rather than manually driving the car and frequently compensating the automobile .

Nowadays people need ACC to deal with new work that includes installing headway settings, supervising status of the automobile and overtaking management. Automation system is required by humans for two key purposes:

- (a) Authority transitions
- (b) Instruction and feedback.

Going ahead these operations are elaborated:-

- Authority Transition

The timing and process of shifting duties to automatic functioning from people and the other way round is called authority transition.

A transition needed by few situations is automation malfunction, street jam, extreme climatic circumstances, another car's unexpected drills and operator's inclination towards a particular option.

Automatic surprises should be avoided by an appropriate automatic system.

It should be capable of not only gaining human trust but also alerting the driver regarding its limits invalid times that the driver can easily take over all the controls of the vehicle

- Instruction and Feedback

Alarm, Display and automated preferences can be set as per custom-user likings and disliking. However, this might create difficulties for new users to adjust.

III. Human Interaction Issues in the Automated System

There is this misconception that the automation will completely eradicate human intervention; however, this is not the reality. In the case of cars, automation can make the driver go into more of a passive role. From an active driver, now the human is an active supervisor to guide the machine in taking decisions in the permutation of complex scenarios. A human cannot go totally out of the loop with the machine because this will mean over-reliance over the automation and in uncertain scenarios results could be drastic. In the coming paragraphs, the issues from the driver's perspective are briefly elaborated .

- Overreliance

As suggested by the name when a human starts over-relying on technology and automation without regular checks and follow ups, the end result is normally not that good. As per Peter and Peters (2002), distraction and bad assessment are a couple of important factors of accidents. Over-reliance on automation augments these issues from worse to worst. It normally takes an experience curve of some periods to develop affinity with the ACC system.

- Interactive Adaptation

It takes time for a driver to adapt him/herself with the ACC system. A study shows that frequent users of ACC system, such drivers perceive a lower level of risks as compared to those drivers who are seldom customers of ACC. Frequent users also indulge themselves into other activities and higher speed because his risk perception is relatively low as compared to the 2nd category. This phenomenon could be well defined by RHT also known as the risk homeostasis theory which explains that human behavior amends itself with the amount of perceived risk.

- Unpredictable Mental Condition

An automated system normally relieves a human of complex tasks, and thus soothes the person from excessive workload. This situation holds true in routine tasks but in on-routine and unexpected scenarios automation could result in excessive workload and complications because of the unprecedented condition and the automation to adjust accordingly.

Examples are visible in the aircraft and marine sectors that normally results in excessive workload if not dealt properly.

- Skill Deprivation

With over-reliance on machines and automation comes another curse that is degradation of human skills. Since one is now relying on automation, one doesn't process many logic and information in the brain and eventually brain receives less blood circulation and manual skills and sharpness of a person decreases because of minimum or no human practice

- Reduced Situation Awareness

With increased level of automation, normal humans tend to go in a state of oblivion and their reaction time to vital events is very sluggish and that event becomes costly. If this is brought into analogy with the human control the response time is more reactive because the driver is manually driving the car and is focusing on all occurring events. Another issue in automation is lack of understanding and awareness of the driver towards the mode of the control situation. The lag between comprehension and action also makes reactions fairly slow.

- Inadequate Model of Automation

Automated systems do not moderate the car like a manual driver does. Since an Automated system has sensory limits and operating requirements which must be fulfilled before it acts. Obviously these requirements are limited for instance, it can maintain a consistent speed on a steady headway but if the landscape is not consistent then how will it regulate the speed. The tracking radio in CAA has a narrow operational limit. Humans can cease to moderate the vehicle because of the inability to comprehend the ACC's operations.

IV. Potential Solutions to the Issues

Both the human and the automobile automation communication cycle deals in the achievement of proper programs attached with objectives discussed

before. Going forth wearer explaining some potential designs to make situation better .

- Shared Control

Many experts are of the opinion that the communication between the automobile and the driver should not be limited to activate and deactivate the device. Rather the interaction should be more shared for instance, even if the device is automated, the ACC system should seek constant but minimum advice from the human counterpart. This will ensure maximum comprehension for the human and also will ensure better supervision. A system with a shared network will also ensure that both the driver and the car's automatic system work together to achieve a common goal which means that minimum chances of error and better response with accuracy better than ever. This would also cause an issue of a sudden scenario, the system becomes an alien entity for a human driver.

For this purpose, an emergency urgent pedal-gas was created and tested as an experiment for car control and curl reconciliation.

The tightness of the pedal's to and fro movement adjusts itself as per the headway the car is pursuing. The person can still choose not to follow this automatic pedal pressure and can exert less or more pressure as needed. But this shouldn't be made a habit; rather it should only be used in limited emergency scenarios.

- Adaptive Automation

Since driving conditions are not the same everywhere i. e. traffic rules, infrastructure, density, and weather etc. and also the demographics of the

drivers, all these variability's justify the fact that an adaptive automation system is needed. This adaptive system can minimize the workload of the driver by adjusting itself as per need/situation. It has in it a Filter to figure out the type of situation so that adaptation takes place accordingly. In driving simulation research, various conditions were quantified based on sensitivity and scenario analysis and their response is saved in the adaptive database so that the system knows how to react in one type of situation and how to react in the type B situation and so on and so forth. With these findings, it was suggested that brake warnings could be created using statistical tools. Adaptive automation could be utilized to alert the driver if he/she becomes oblivious while driving.

- Using Information Portal

In order to avoid any mishaps, an information portal could be formed which will be informing the human on a constant basis regarding the status of the speed, the headway, the steering limits, the situational specialties. This portal could be used to facilitate interaction between the human and the machine . It could provide feedback regarding improvised back-view sight or better night-sight, can give suggestions for improved output and enhanced safety. Visual display techniques could incorporated to aware the driver regarding unforeseen sudden surprises along with audible cues.

- Advanced Training Methods

As the responsibility of the driver changes from an active driver to an active supervisor, new changes must be brought in in driving license training syllabus and methods. Futuristic drivers must demonstrate active IT knowledge and know how so that they will be able to adjust with the

increasing automation in the driving category. They should know crisis management, supervisory and active follow-up skills. Promoting the education of drivers is a pre-emptive approach towards undesired psychological adjustment.

Automation Manuals could be initiated as innovative methods of coaching programs. As per the books, are liable, consistent, prompt, energetic trainer has the ability to capture every crucial event of the car inclusive of abrupt driver role. Sensory gadgets could also help in revealing transitory problems or dormant driver role which may human trainers might not be able to figure it out. With the help of automated trainers, more and more measurability can be insured and real time human error feedback could be made possible.

V. Requirements and potential solutions

Cooperative-Adaptive-Cruise Control (CACC) should be used as the underlying basis for integration with the human automation control .

With the help of a kinematic information network, The CACC control system allows a squad of multiple automobiles cruising with automatic longitudinal power at a certain distance parameter which is also known as the time headway

In circumstances where visibility is below par such as foggy atmosphere, lack of street / highway / motorway lighting, dark conditions and wherever the visual sight is compromised, in such situations Cooperative cards can be used to overcome the complexity.

In such Scenarios cooperative automobile shave the capacity to out-do the humans with regards to road security, traffic and eco-driving.

One can easily differentiate in a CACC framework the different moves the vehicle takes. Mainly it has three major moves, joining, platooning, and splitting. Splitting and joining can be categorized as transitional moves while platooning is more inclined towards motionless position.

As this paper progresses the design mandatories are discussed, expected human-problems and the design remedies for correspondence between the drivers and the CACC

The results are centered on the driver factor problems presented in section 3, the CACC objectives and functioning was shortly oriented and the primary communication operations in the 2nd section.

Figure1. Illustration of the CACC-equipped vehicles .

The problem of cars equipped with CACC vs. cars which are not equipped is not taken into account because it is assumed that all cars are equipped with CACC technology.

System Initialization. This program will help the driver in determining if the CACC is active or inactive. Initialization will guide the driver regarding the status of the headway, speed setting, stopping distance and chances of hazards. This program can guide the driver in choosing whether to drive in platoons or individually. This program will also allow the driver in extracting and modifying headway data and velocity configuring sand this initialization incorporation would not bring in any extra analytical burden over the human.

Platooning. The sequential protocol approach of CACC automobiles should get driver's approval. Drivers in normal scenarios will not experience any turbulence such as sharp changes in acceleration, sudden change in inter-vehicle distance, topology surprises of platoon and inferior string consistency. This system should explicitly communicate the hurdles in platoon style driving in order to have the correct platoon posture. For instance, the system will clarify that the drivers are not allowed to real-time overtake on the headway. Also Humans shall be given a function to exit the platoon at any given time range in smooth transitional manner and shouldn't be exposed to minimal work-stress levels.

Joining and splitting can be commenced by platoon control protocol or by the driver. As coming out of platoon, drivers shall take control of the vehicle. Further, Humans cannot be perplexed by the automatic maneuvering of the vehicle be it was started by driver or the controller. In order to avoid a mix-up, the joining and splitting could be concluded by minimum steps. This will also minimize mental stress. This system should alert the drivers of the beginning, ending and processing of either of the splitting and joining transient phases

CACC Solutions

Initialization. This whole procedure of choosing headway and setting up speed settings could be very distractive for the driver and could result in mental stress and confusion. Also there are high chances that a driver might not be able to understand the functions and could possibly end-up in a mishap. As additional icons are being used, it could be very perplexing for

the driver to learn and use them. Therefore a solution to overcome the issues was designed which is that an adaptive setting could be activated that would save in the drivers driving habits and apply it accordingly. This system can select the mean-minimum headway range and maximum velocity that was set by the driver for a greater set period (1minute) as per the recent driving records. Such a system will help the driver in tackling unforeseen changes. CACC should be activated by the human who shall be made aware by visual or audio clues for correctness.

Joining: Once the system is activated, a car has the automated ability to join an ongoing platoon. The car will begin moving towards the platoon at an average speed and will reduce to much slower speed once approaching a vehicle along with constant brakes to a complete pause if the situation calls for. It can join a Platoon from behind without driver instructions. However, In case of high speeds it is highly advised to inform the drivers so that they may change the fast lane if needed.

In this scenario adaptive automation could be used to monitor the driver' status and providing him/ her with realistic feedback regarding the joining move whether it is viable or not and if viable then what modification will optimize the process. Also it should be able to highlight the hurdles such as highest extent of the platoon because of the road-layout, the transition pace and distance and the role of other platooning affiliates should be brought into notice of all relevant stake-members.

Platooning. The overall status of the scheme should be explicitly informed to the driver via a Platoon Mode portal or information center. This exercise should be repeated audibly and consistently to keep the driver informed

after every interval. With the help of adaptive technology, the frequency and the intensity of the reminders could be setup.

In the midst of platooning, drivers should not feel uninformed sharp changes. Topology issues in a platoon and a splitting off and amalgamation of other cars should be officially intimidated beforehand to avoid any surprise and mistrusts towards automatic functioning of the car. Regarding the range of maneuvers, humans must know them. For instance, a driver cannot instantly steer beyond defined limits or should not shut headway beyond certain limits. To avoid such scenarios, loud emergency feedback option should be there on steering.

Splitting. This option should be there with the driver if they want to finish off safely platooning. A possible remedy is that the driver should enhance the headway at a maximum of the given limit. When the limit arrives, the CACC system itself will disable and the human will be informed regarding deactivation via the dashboard or main portal.

VI. Conclusion

This research revealed and took into account various human vs. automation driving issues, solutions for the driver, vehicle, the CACC system and the required action were taken into account to develop an interacting mechanism in between the humans and the machines. This suggested system has several modes and will keep in loop the drivers control and would enhance functioning between humans their own cars and other cars which are able to communicate with the help of CACC.

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