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Volume 06, Issue 05, Page No: 1997 – 2001.

Paper Authors

***KURUBA MADHU SUDHAN, P.MAHESH.**
* Dept of ECE, Shri Sai Institute of Engineering and Technology.

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DRIVER ASSISTANCE SYSTEM-SHARED STEERING BETWEEN HUMAN AND AUTOMATION

***KURUBA MADHU SUDHAN,**P.MAHESH**

*PG Scholar, Dept of ECE, Shri Sai Institute of Engineering and Technology, AP.

**Assistant Professor, Dept of ECE , Shri Sai Institute of Engineering and Technology, AP.

ABSTRACT:

This paper presents a driver assistance system which is used for lane departure of vehicles and also analysis of its working and stability with respect to changes in the behavior of driver. The driver assistance system, which is an automation, was designed based on the concept of sharing the control of steering wheel with the driver/human. Its designing wad developed from the preview of co-driver system which is a semi-automatic system. The vehicle steering assist controller is designed using a driver model in order to take into account the driver's intentions in particular curve negotiation. This approach minimizes controller intervention while the driver is awake and steers properly. Usually, information flows through the interface from human to machine but not so often in the reverse direction. But in this model the system has an architecture in which bi-directional information transfer occurs across the control interface, allowing the human to use the interface to simultaneously exert control and extract information. Good results are obtained using several criteria for human–machine cooperation. Poor stability situations were successfully avoided due to the robustness of the whole system, in spite of a large range of driver model uncertainty.

Key words:- co-driver system, semi-automatic system lane departure, shared steering control.

1.1 INTRODUCTION

Driving is a dangerous activity that can have serious human and economic consequences. Driver assistance systems (DAS) are systems developed to automate/adapt/enhance vehicle systems for safety and better driving. We can design safety features by using technologies that alert the drivers about potential problems to avoid the accidents and collisions. Safety features can be provided by implementing safeguards and taking over control of the vehicle. Adaptive features may automate lighting, provide adaptive cruise control, automate braking, incorporate GPS/ traffic warnings, connect to smart phones, alert driver to other cars or dangers, keep the driver in the correct lane, or show what is in blind spots. There are many forms of driver assistance systems are available; some features are built into cars or are available as external package. Also, there are aftermarket solutions available for some late model cars Driver assistance systems are one of the fastest-growing segments in automotive electronics DAS technology can be based upon vision/camera systems, sensor technology, car data networks, Vehicle-to-Vehicle (V2V), or Vehicle-to-Infrastructure systems. Many advanced assistance systems have been developed over the last decade to improve vehicle lateral control. Some of them (man-machine systems) developed based on the principle of mutual control between driver and automation system. In man-machine systems, the mechanical response of the Control interface (e.g., knob, mouse, joystick, steering wheel) to the action of a human is not typically considered as a feedback signal to the human

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operator. Rather, a visual or auditory sensory input closes the loop in the traditional manual control analyses . In many cases, the response from the control interface does not carry information pertinent to the execution of manual control. We propose the explicit design (and analysis) of the response signal from a control interface to take advantage of the haptic (tactile and kinesthetic) sensory capabilities of the human. The haptic information will supplement the traditional sensory inputs (visual, auditory) and will be designed to improve the human/machine system performance.

To synthesize the haptic feedback, we propose the use of a hepatic interface (sometimes called "force-reflecting interface") as the control interface of the machine. In the following sections, we develop the idea of a haptic control interface in the context of ground vehicle steering.

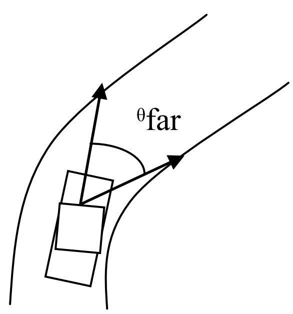

Fig.1. near and far visual points

1.2 DESIGN

Primary functionality of DAS is to facilitate the task performance of drivers by providingreal-time advice, instruction and warnings. This type of systems is usually also described by the term "co-driver systems" or "driver support systems". Driver support systems may operate in advisory, semi-automatic or automatic mode (e.g. Rosengren, 1995), all of which may have different consequences for the driving task, and with that on traffic safety. Although the purpose of a driver support system is to have a positive effect on traffic safety, adverse effects have been shown on driver behavior, indicative of negative effects on traffic safety (Zwahlen, Adams and DeBald, 1988, Van Winsum, 1997). Firstly, the provision of information potentially leads to a situation where the driver's attention is diverted from traffic. Secondly, taking over (part of) the driving task by a co-driver system may well produce behavioral adaptation. As a result, either the driver might not (or too late) be aware of a sudden hazard, or, is not fit (anymore) c.q. not ready for an adequate reaction. Before introducing any driver support system, the consequences of system operation in this sense should be identified.

A specific source of problems with the development of driver support systems that are intended to reduce accidents is that it is very difficult, if not impossible, to forecast the savings of death and disability that might result from the introduction of such systems. Although there is an urgent need to know what the effects are of introducing a specific system before it enters the market, no data exist on which estimates of the benefits and the risks of system-specific traffic behavior can be based. The only type of effects that can be studied is effects on behavioral aspects of the driving task per se. These aspects should be selected on the basis of known adverse effects on traffic safety, such as insufficient safety margins in lateral and longitudinal positioning (cf., Rumar, 1988). Hence, each individual IVIS application should be subjected to a test on behavioral effects before marketing, in order to pinpoint both beneficial and unwanted side effects at the behavioural level. For this, however, exact criteria still have to be developed (Brookhuis et al., submitted). Eventually,traffic safety effects are confined to an extrapolation from these test results then.

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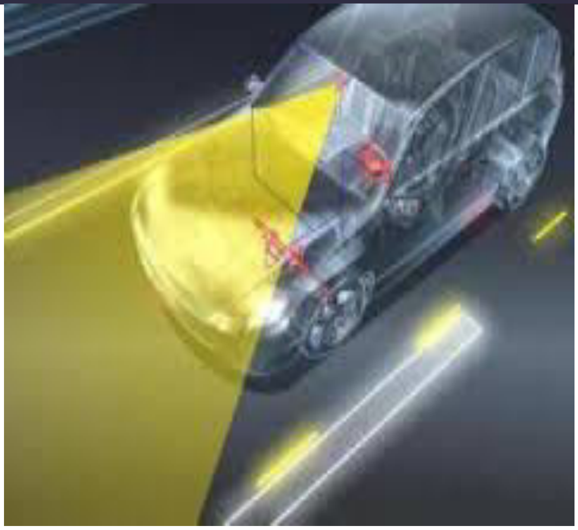

Fig.2.graphical representation

1.3 WORKING

In the proposed system a shared steering concept is implemented. The position of the road is found using the web camera installed in front of the vehicle which is connected to the PC installed with MATLAB. Using MATLAB the image is processed to check the road characteristics. For example assume that the road has a very sharp turn. This is obtained as a result of M ATLAB processing. Then the control system takes this as input and monitors the Steering wheel and if found to be uncertain that is the angle of wheel turning is not exact with the turning then the control system takes control over the steering wheel(stepper motor) and also intimates the user about this. The prototype is designed with ARM7 Microcontroller and a steering wheel(stepper motor). Microcontroller will accept input from pc about road curvature and lane dispatching, then it will control the steering according to the instructions given in the form of embedded program. Here when the processor receives a command for example "left dispatch" then it will alerts the driver first by giving a bugger sound and then controls the steering for right dispatch.

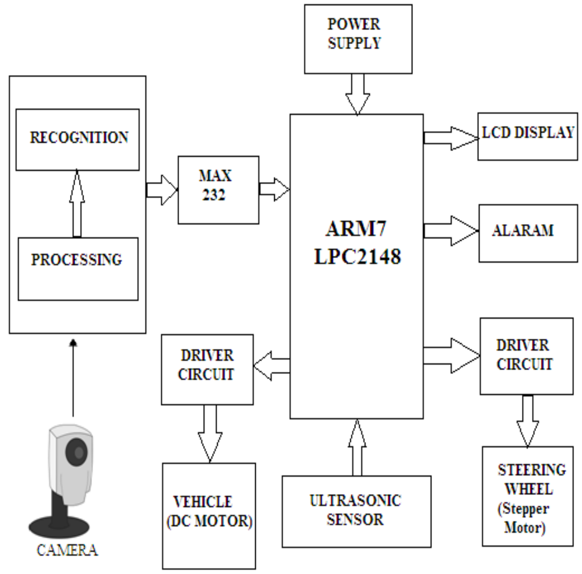

Fig .3. block diagram of DAS

1.4 RESULT ANANLAYSIS

The performance of a nominally stable uncertain system model will generally degrade for specific values of its uncertain parameters. Moreover, the maximum possible degradation increases as the uncertain parameters are allowed to deviate in a large interval from their nominal values. The uncertainties about the driver model parameters could be due to the quality of identification, the variability of driver behavior, or even the variety of driving styles. The latter is relevant if the assistance system is aimed at being robust enough to meet the needs of a class of drivers without adaptation.

1.5 CONCLUSION AND PERSPECTIVES

In summary, this paper has presented a DAS model that includes a cybernetic driver model.

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Based on this global model, a steering assistance system has been designed to perform shared control of the steering wheel. A simulator study showed that an improved performance lane, keeping with a low level of negative interference between the driver and the system, could be achieved. Robust stability analysis in the presence of driver model variability was also carried out. The results were compared with those achieved on the driving simulator. The performance and robustness of the proposed H2-Preview controller was shown for a large class of driver models. Before considering the implementation of the system in standard road vehicles, several issues should be addressed. First, we did not consider the impact of measurement errors that would take place in real conditions. Although there exist hardware and algorithms to compute all the inputs we used, they can be inaccurate or noisy in some circumstances. For example, it has been shown that the tangent point angle θfar or TLC can be accurately computed in real-time imaging with a monocular in-vehicle camera, but errors in measurement increase beyond 35 m ahead of the vehicle Concerning the vehicle dynamics, some measures are already available in standard vehicles (such as yaw rate and steering angle). However, to our knowledge, some states can be measured only with specific and expensive sensors, typically the slide slip angle, and their estimation is still an open problem. In all cases, it remains to be determined to what extent our shared control law is robust to such uncertainty in signal measurement.

In this paper, we have aimed at analyzing the stability of the assisted system with respect to the driver's variable behavior. The key point of this analysis was to answer the question as to whether the device should be adjusted to every driver, leading to more efforts on onboard driver model identification, or whether the device can cover a wide range of driving styles without needing individual adjustment. Still, further studies are needed to assess the potential benefits of adapting the control law to each driver.

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