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Vehicle Steering Shared between Driver and Automated Control System to Prevent Accidents

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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 behaviour of driver. The driver assistance system, which is 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.*

Keywords: *co-driver system, semi-automatic system lane departure, shared steering control.*

1. INTRODUCTION

There are many reasons why in the present days electronic driving aids are designed and developed at an increasing rate and speed. The most and foremost reason was to improve safety and avoid accidents at the time of driving. Driving is a dangerous activity which will have a serious impact on human and economic principles. Primarily a 'human factors' case is safety. But in most of the cases accidents occur due to driver inattention. According to surveys 90% of accidents occur because of driver failure at the time driving. The main cause of this failure is degradation in driver performance due to some factors such as fatigue, drowsiness or inattention. There are also some other reasons for the driver degradation in them the first reason is alcohol, when the driver was in drunk condition then it is a difficult activity to drive at this state there is chance of occurring accidents and one more reason for occurring accidents is if driver suddenly felt unhealthy that means like sudden heart attacks or some other severe health problems then it was difficult to control vehicle during driving which ultimately causes accidents.

The control or reduction of vehicle accidents requires counter measures that has to be designed and introduced to avoid those behaviours contributing to accidents. So in order overcome all these problems there are a need of one system which helps the driver to improve the safety at the time of driving. These factors have motivated to a major research effort in electronic driving aids and these research and development had a strong impact on driver comfort ability which is aimed at helping human and improving the safety, particularly by an active system that have a potential to avoid accidents. Many driver assistance systems have been proposed over the last decade to improve vehicle control and human safety. In those some of them are based on the principle of mutual control between the driver and on automation system. But there is a problem while in designing such a kind of human-machine interaction system because manual control vehicle tasks are prone to driver error, and fully machine controlled tasks are subjected to wide –ranging of limitations.

2. LITERATURE SURVEY AND RELATED WORK

A) Driver Assistance System

Driver assistance system has a considerable history. In European countries several car manufacturers and research institutes had started the initiative for developing the driver assistance systems, around 1986. A series of research was carried out under this and most of them aimed at practical solutions to urban traffic problems. The European countries started the DRIVE (Dedicated Road Infrastructure for Vehicle safety in Europe) program. So by using this program, a number of projects having practical problems and fundamentals issues have been tackled successfully.

B) Generic Intelligent Circuit

The next development is the GIDS (Generic Intelligent Driver Support) project; the largest project in DRIVE 1, at that time and still relevant. The complete theme of this ambitious project was "to determine the needs and design standards for a class of intelligent driver assistance systems which will conform to the information requirements and performance capabilities of the individual drivers". This kind of systems have two advantages one is that this will aid the drivers detection assessment of road and traffic hazards, and second is it will provide guidance on the drivers ability to handle with specific hazards the main working principle of driver assistance system is to facilitate the task performance of drivers by providing alerts, guidance and real time advice. This kind of systems is also described by the term "co-driver systems" or "driver support systems". Co-driver systems will Control in advisory manner, semi-automatic or automatic mode. All of this may have different results for the driving task, and with that on human safety. Although the main purpose of a driver support system is to have a positive reaction on human safety, but against effects have been shown on driver behaviour, indicative of negative effects on human safety.

Initially, the providing of information potentially leads to a condition where the driver's concentration is diverted from traffic. Next is, taking a part of the driving task by a co-driver system will may generate behavioural adaptation ultimately this will results, either the driver might be late of aware of a sudden hazard, or, is not fit for driving anymore that means not ready for any proper reaction. So before going to introduce any driver support system, the results or effects of the system operation in this sense must be identified.

C) Other Advanced 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 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.

3. PROPOSED ARCHITECTURE

When we switch on the power, the web camera starts capturing videos of road environment and fed to the pc. The pc will process the video with the help of MATLAB and image processing tools. Here the image processing tools divide the video into frames and they convert them into gray level images and apply the edge detection technique. With this it provide the information about line dispatch and curvature which fed to microcontroller as an input.

Now the microcontroller process the input from pc about road curvature and lane dispatch then control the steering according to the instructions given in the form of program. Here when the processor receives a command like left dispatch, it will alerts the driver first by giving a buzzer / alarm and then control the steer for right direction and at the same time if microcontroller receives a command like right dispatch it will controls the steer for left direction and if microcontroller receives a curve dispatch it will controls the steer according to the angel of deviation.

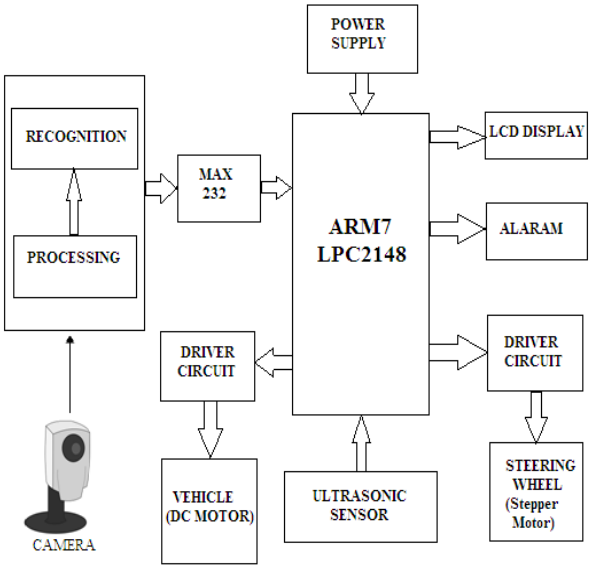

Figure 3. *Block Diagram of Driver Assistance System*

At the same time microcontroller scans the ultrasonic sensor, here the ultrasonic sensor is used to find the obstacles which are present opposite to the vehicle. Ultrasonic sensors when in active state, it will generate a high frequency waves and evaluate the echo's which are received back by the sensor, by measuring the time interval between sending signal and receiving the echo the sensor will determine the distance between vehicle an object. And thus if any such information coming from the sensor it will controls the DC motor which will represents the ignition of the vehicle. The system also continuously display the status by using LCD

4. SYSTEM HARDWARE

1. Power supply

Power supply unit contains adaptor, rectifier, capacitive filter and regulator. This block supplies the required power to all the components present in the system. The system requires +5volts and it is supplied by the power supply unit.

2. Web Camera

The main purpose of web camera is to take the videos of road and lane curvature.

3. Driver Circuit

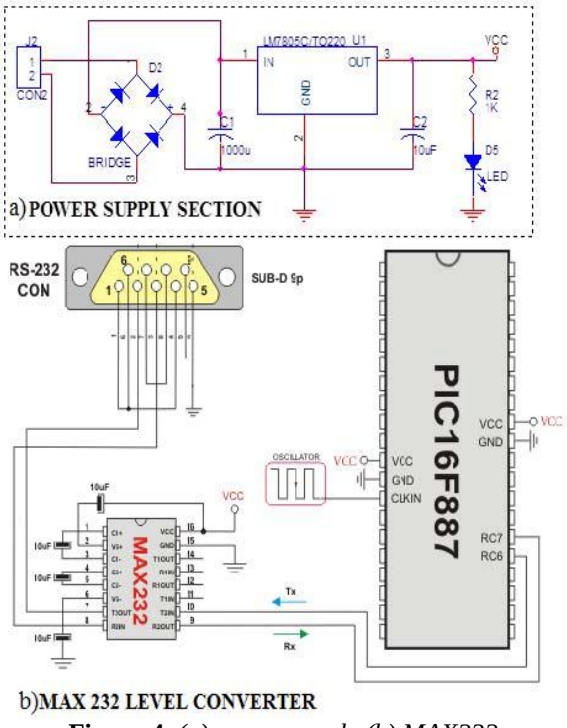

Figure 4. *(a) power supply (b) MAX232*

Here L293D is using as a driver circuit. The main function of the driver circuit is to amplify the signals coming from the controller and feed to the DC motor which is a substituent to drive motor.

4. Ultra Sonic Sensor

In this system ultra sonic sensor is used to find out the obstacles which are present in front of the vehicle and also providing this information to the microcontroller.

5. SYSTEM SOFTWARE

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 MATLAB 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.

6. RESULTS

A) *The Driver Assistance System:*

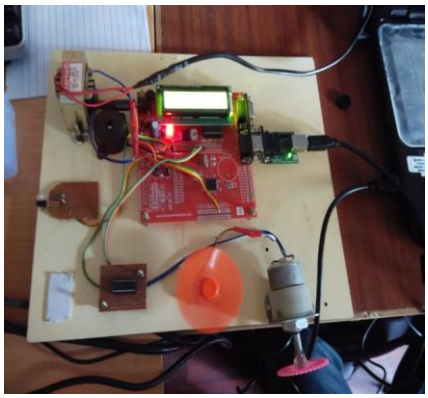

Figure 6.1(a): *Circuit of DAS*

The above figure shows the model developed as DAS which will be fit in to the vehicle to provide assistance to driver. This model is best suitable for electric cars; with some modifications this can be applicable to the cars which contain engines. In the above figure there is a wheel to indicate the steering action and there is one more wheel to indicate the vehicle speed under the control of DAS and the driver.

The screen shot is work under test of the driver assistance system. Finally it is tested around 20 times it worked very accurately in 18 times hence this system provides 90% accuracy in result.

Figure 6.1(b). *Example of vehicle lane*

B) The Operation:

In the operation there are various cases as follows; if Lane is normal and there is no obstacle in front of vehicle.

Figure 6.1(c). *output screen for vehicle normal departure*

Figure 6.1(d). *output screen for vehicle normal departure*

If the vehicle crossing the right side border of the lane then the vehicle become automatically slow and taking the left side of the lane.

Figure 6.1(e). *Output screen for vehicle right departure*

Figure 6.1(f). *Output screen for vehicle right departure*

If the vehicle crossing the left side border of the lane then the vehicle become automatically slow and taking the right side of the lane.

Figure 6.1(g). *output screen for vehicle left departure*

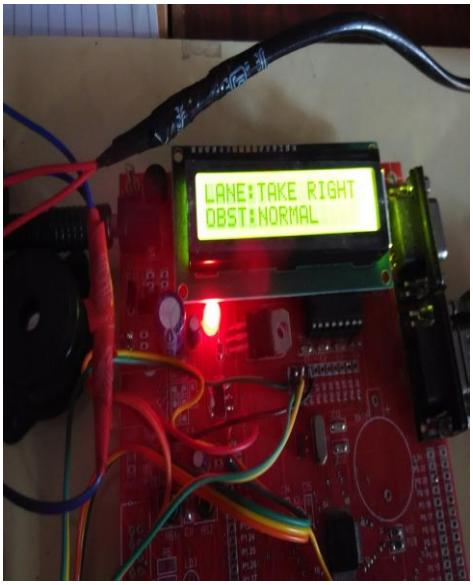

Figure 6.1(h). *output screen for vehicle left departure*

7. CONCLUSION AND FUTURE SCOPE

Before to introduction of electronic modules in automotives the vehicle is fully controlled by human and after that the vehicle is partially controlled by embedded control system and now the automated systems were developed to control the vehicle without any human interaction. But there is a problem in human-machine interaction system because manual control vehicle tasks are prone to driver error, and fully machine controlled tasks are subjected to wide–ranging of limitations. Finally, in this work a solution is given by providing a switching operation between the embedded control system and the driver by providing sharing of steering between the ECS or driver. The sharing of steer between human and machine in driver assistance system is the major work carried out in this research. The ability of this DAS is great; it is completely accepted and widely applicable in the future. To do this, the DAS (sub) systems will have to be made as a fail-safe as possible. Acceptability of DAS is highly dependent on the demonstration of these features. It is also found to be dependent in the form of which DAS applications are implemented. Finally for the end-user the benefits should be clear and preferably directly noticeable.

Driver assistance system can be further developed by introducing, Traffic signals data like take 'U' turn etc., and Overtaking Assistance and Blind Spot Detection systems can avoid all vehicle accidents in the future. Methodologically, it is correct to add all these safety potential figures, as they are arisen from independent subsets of accident data. If all cars are fitted with these systems, all car accidents in the current database shall have been avoided. It is to be believed that the system will have broad application prospects.

REFERENCES

[1]. W. G. Najm, J. D. Smith, and M. Yanagisawa, "Pre-crash scenario typology for crash avoidance research," Nat. Highway Transp. Safety Admin.,Washington, DC, USA, Tech. Rep. DOT-HS-810 767, 2007.

[2]. J. Navarro, F. Mars, and M. S. Young, "Lateral control assistance in car driving: Classification, review and future prospects," *IET Intell. Transp. Syst.*, vol. 5, no. 3, pp. 207–220, Sep. 2011.

[3]. D. Abbink, M. Mulder, and E. Boer, "Haptic shared control: Smoothly shifting control authority?" *Cognit., Technol.,Work*, vol. 14, no. 1, pp. 19– 28, Mar. 2012.

[4]. D. A. Abbink and M. Mulder, "Neuromuscular analysis as a guideline in designing shared control," in *Advances in Haptics*, M. H. Zadeh, Ed. New York, NY, USA: InTech, Apr. 2010, pp. 499–516.

[5]. P. Griffiths and R. B. Gillespie, "Sharing control between humans and automation using haptic interface: Primary and secondary task performance benefits," *Hum. Factors*, vol. 47, no. 3, pp. 574–590, Fall 2005.

[6]. M. Mulder, D. A. Abbink, and R. Boer, "The effect of haptic guidance on curve negotiation behaviour of young, experienced drivers," in *Proc. IEEE Syst. Man, Cybern. Conf.*, Singapore, Oct. 2008, pp. 804–809.

[7]. K. H. Goodrich, P. Schutte, and R. Williams, "Piloted evaluation of the H-mode, a variable autonomy control system, in motion-based simulation," in *Proc. AIAA Atmos. Flight Mech. Conf.*, Honolulu, HI, USA, Aug. 2008, pp. 574–590.

[8]. W. B. Griffin, W. R. Provancher, and M. R. Cutkosky, "Feedback strategies for telemanipulation with shared control of object handling forces," *Presence*, vol. 14, no. 6, pp. 720–731, Dec. 2005.

[9]. D. Kragic, P. Marayong, M. Li, A. M. Okamura, and G. D. Hager, "Human–machine collaborative systems for microsurgical applications," *Int. J. Robot. Res.*, vol. 24, no. 9, pp. 731–741, 2005.

[10]. C. Basdogan, A. Kiraz, I. Bukusoglu, A. Varol, and S. Doanay, "Haptic guidance for improved task performance in steering microparticles with optical tweezers," *Opt. Exp.*, vol. 15, no. 18, pp. 11616–11621, Sep. 2007.

[11]. W. Mugge, D. A. Abbink, A. C. Schouten, J. P. A. Dewald, and F. C. T. Van der Helm, "A rigorous model of reflex function indicates that position and force feedback are flexibly tuned to position and force tasks," *Exp. Brain Res.*, vol. 200, no. 3/4, pp. 325–340, Jan. 2010.

[12]. M. Mulder, M. M. R. van Paassen, and E. R. Boer, "Exploring the roles of information in the manual control of vehicular locomotion: From kinematics and dynamics to cybernetics," *Presence*, vol. 13, no. 5, pp. 535–548, Oct. 2004.

[13]. F. Mars, L. Saleh, P. Chevrel, F. Claveau, and J. F. Lafay, "Modeling the visual and motor control of steering with an eye to shared-control automation," in *Proc. 55th Human Factors Ergon. Soc.*, Las Vegas, NV, USA, 2011, pp. 1422–1426.

[14]. L. Saleh, P. Chevrel, F. Mars, J. F. Lafay, and F. Claveau, "Human-like cybernetic driver model for lane keeping," in *Proc. 18th IFAC World Congr.*, Milan

[15]. D. Salvucci and R. Gray, "A two-point visual control model of steering," *Perception*, vol. 33, no. 10, pp. 1233–1248, 2004.

[16]. D. J. Cole, "Neuromuscular dynamics and steering feel," in *Proc. Steering Tech*, Munich, Germany, Mar. 2008. [Online].

[17]. A. Modjtahedzadeh and R. A. Hess, "A model of driver steering control behavior for use in assessing vehicle handling qualities," *Trans. ASME, J. Dyn. Syst. Meas. Control*, vol. 115, no. 3, pp. 456–464, Sep. 1993.

[18]. C. Sentouh, P. Chevrel, F. Mars, and F. Claveau, "A sensorimotor driver model for steering control," in *Proc. IEEE Int. Conf. Syst., Man, Cybern.*, 2009,