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STEER-BY-WIRE

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Abstract: *Steer-by-wire system (SbW) replaces the mechanical steering connection between the hand wheel and road wheels with algorithms, electronics and actuators. SbW emulates the "feel of the road," offers a wide performance range (including sporty, luxury, comfort, etc.) and enhances maneuverability through our variable steering ratio. SbW supports traditional driving and varying levels of Automated Driving. Steer-by-Wire is the center link in advanced steering technology suite – unlocking new safety and performance benefits. It also opens new possibilities for vehicle light-weighting and packaging flexibility. The automotive industry has already implemented many advanced computer systems in an attempt to increase safety and comfort of drivers. In parallel with these advancements we see a big shift from mechanical systems to electrical systems and steer-by-wire is another implementation that is very promising in terms of safety and functionality. Recent advances toward steer-by-wire technology have promised significant improvements in vehicle handling performance and safety. While the complete separation of the steering wheel from the road wheels provides exciting opportunities for vehicle dynamics control, it also presents practical problems for steering control. This thesis begins by addressing some of the issues associated with control of a steer-by-wire system. Of critical importance understands how the tire self-aligning moment acts as a disturbance on the steering system. A general steering control strategy has been developed to emphasize the advantages of feed forward when dealing with these known disturbances.*

I.INTRODUCTION

The automotive industry has already implemented many advanced computer systems in an attempt to increase safety and comfort of drivers. In parallel with these advancements we see a big shift from mechanical systems to electrical systems and steer-by-wire is another implementation that is very promising in terms of safety and functionality. Already, there are Many accidents at High-ways are taking place due to the various obstacles which are both large and small. Whenever any obstacle is detected in running vehicle depends on distance automatically control the speed of vehicle. Ultrasonic sensor system it will send signal to the embedded board. After receiving this signal embedded board sends a signal to the motor to reduce the car speed automatically which can control car speed immediately. Thus we are going to design a steer-by-wire system incorporated with an ultrasonic sensor.

II.LITERATURRE SURVEY

E.A.Bretz(2012)found that Steer-by-Wire systems are candidate to substitute the conventional (mechanical or hydraulic) steering systems in the new generation of vehicles. The task of a steer-by-wire system is twofold: turning the road wheels tracking the hand wheel rotation and providing the driver with a feeling of the steering effort. In this paper, the issue of designing a Steer-by- wire system is faced. An approach is proposed, based on three steps. Firstly, the model of a conventional steering system is formulated. Then the steer by wire system is developed with the same structure as the conventional ones. Finally, performance indexes for the steering maneuver are defined and utilized to set up the parameters of the steer by wire system. The paper has presented an approach to the design of a Steer-by-wire system. At first the conventional steering systems have been analyzed and a model of them has been formulated. Such an analysis has made it possible to arrange a steer- by-wire system replicating thestructure of the conventional ones.

S.Amberkar(2014)In his paper, the MATLAB /SIMULINK environment of the simulation model on the automotive steer-by-wire is devised, and active steering control and the controlling scenario of integral separation PID on the Steer by Wire System are proposed. By simulation analysis, the design model is validity, and dynamic performance under the control of the integral separation PID is better than one under the control of the common PID. The integral separation PID overcome some of the defects that the conventional control cannot be avoided and improves the control effects.

D.Odenthal(2017)Proposed that Steer-by-wire system is suited to active steering control, improving vehicle stability, dynamics and maneuverability, as well as to autonomous steering control to assist the driver. Conventional controller for Steer-by-wire system is designed by general feedback control method. However, driver can not exactly feel reaction torque generated from tire. In this paper, the goals are considered as following two points. One is a reproduction of environmental impedance in steering wheel. The other is improved maneuverability for steer by wire system. Moreover, control stability must be satisfied. Using the disturbance observer, bilateral controller is designed. Through analysis, it is confirmed that the three desired conditions in steer by wire system are well satisfied with this controller. The effectiveness of this research is demonstrated by experiment with electronic vehicle. In this paper, we have proposed the bilateral control method based on the disturbance observer. Using the proposed control method, the driver feels the virtual impedance through the suppressed slave dynamics. Since driver does not feel it through the suppressed master dynamics or the target impedance of master, the proposed control scheme would allow greater dexterity. The effectiveness of the proposed control method was demonstrated by experiment system.

I.Camuffo(2019)in his paper proposed The control of a SbW system using the hardware inthe loop simulation system was researched in this study. The steering wheel motor control to improve driver‘s steering feeland front wheel motor control to improve vehicle stability was studied in this paper. Steer by wire system is composed of two motors controlled by electronic control unit instead of mechanical linkage. Two motors follow general EPS system modeling. One motor in the steering wheel is to improve the driver‘s steering feel and the other motor in the steering linkage is to improve the vehicle maneuverability and stability. Several control algorithms related with vehicle and motor can he used together. These control algorithms include under steer and over steer gradient conception concerning vehicle‘s velocity. The SEW controller‘s availability was verified through a number of simulations on the HlLS system. We also have to consider about the safety of electronic system. So we can compensate it in the part of software and hardware.

A.Lawrence(2020)proposes the main aim of the project to develop a system automatic speed control of vehicle and accident avoidance using eye blink sensor and ultrasonic sensor .whenever any obstacle is detected in running vehicle depends on distance automatically control the speed of vehicle. The driver in sleeping /drowse position the eye blink sensor detects the eye blink is not more than 30 sec eye closed vehicle stop the automatically, it is not manually. Give alarm to driver alert. The ultrasonic sensor system continuously sends signals and monitors any car or other obstacles are in front of car. The distance up to which ultrasonic sensor can work may be up to 4 meter. When any obstacle or vehicle detected by ultrasonic sensor system it will send signal to the embedded board. After receiving this signal embedded board sends a signal to the motor to reduce the car speed automatically which can control car speed immediately. Vehicle is controlled automatically without any manual operation when the vehicle is at 4 meter distance away from the front vehicle. Also give alarm to alert to the driver.

K.B.Fite(2022) in his paper presents an adaptive sliding mode (ASM) control methodology for a vehicle steer- by-wire system. Firstly, the steer by wire system is modeled as a second-order system fromthe steering motor input voltage to the front wheel steering angle. For simplicity, the self- aligning torque and friction arising from the tire-to-ground contact are regarded as external disturbance acting on the steer by wire system. Next, an Adaptive sliding mode controller is designed for the steer by wire system, which can not only cope with the parametric uncertainties in the plant model, but also estimate the coefficient of the self- aligning torque effectively. The stability of the adaptive sliding mode control system is proved in the senseof Lyapunov and the guidelines for selecting the control parameters are given. Finally, experiments are carried out for steering control to respectively follow a slalom path and a circular path under various road conditions. It is shown that the proposed adaptive sliding mode controller can achieve stronger robustness against various road conditions leading to significantly smaller tracking errors in comparison with a conventional sliding mode controller and a linear controller.

III.OBJECTIVE

Main objectives of this work can be illustrated as:

- The main aim of the project is to design and replace mechanical control with active Steer by Wire system.
- To Detect any Obstacle.
- To Reduce the car speed automatically after Obstacle detection.
- To Eliminate kickback or vibration transmitted from the car's front wheels to the steering wheel.
- To Reduce Accidents and improve driving experience

The functional system block diagram is provided in figure

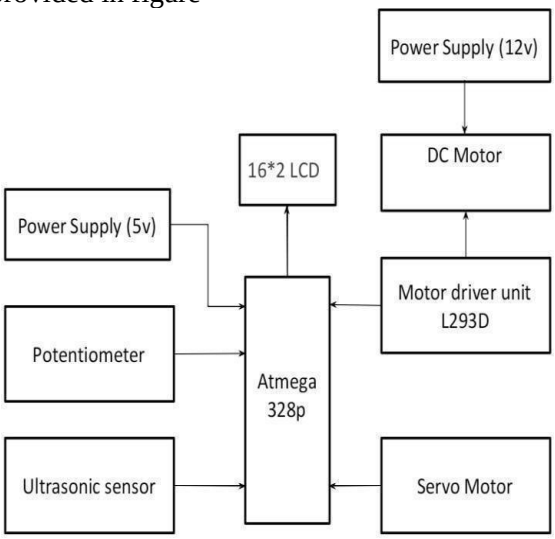

Figure 1: Block Diagram

III.ADVANTAGES

- Improved vehicle driving performance.
- Improves vehicle maneuverability.
- Improves the feasibility of innovative packaging and design.
- Increases operational accuracy.
- Interior styling is more versatile due to absence of steering column.
- There is more space available in the engine compartment.
- Reduces weight.

II.DISADVANTAGES

- There are some safety issues to be dealt with, because there is a slight chance of loss of control.
- Number of Motors used is more so energy consumed is slightly higher compared to normal steering types.

IV.SCOPE OF THE PROJECT

The proposed system is highly effective and efficient. The Steer by wire system can be improved a lot. For a future project, given better equipment, this system could be implemented in a small model car and can be used for control theory demonstrations. New control systems, such as state-space controls, can be implemented to enhance the performance of the system. Although not in the near future, given enough resources, this system can be implemented in real road cars and perhaps be combined with regular steering to take advantage of the safety benefits of a steer-by-wire system. However, the future of steer-by-wire technology could lead to a number of interesting developments. The removal of mechanical controls could allow automakers to design vehicles that are radically different from the cars and trucks that are on the road today. Concept cars like the By-Wire have even allowed the seating configuration to be moved around, since there are no mechanical controls that dictate the position of the driver. Steer-by-wire technology could also be integrated with driverless car technology, which would allow vehicles to be operated remotely or by a computer. Current driverless car projects use electromechanical actuators to control steering, braking, and acceleration, which could be simplified by connecting directly to steer-by-wire technology.

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