The Third AFSS(1998). 199-198

Development of Intelligent Cruise Control System for Automobile

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Abstract

This paper describes an intelligent cruise control system for automobile. With the remarkable numerical increase of automobiles on the road, the optimized traffic flow control using the cruise control is one of the very important traffic problems to overcome the limitation of an existing road capacity.

Based on this idea that minimize the fuel cost and the air pollution, and accept a driver's needs for driving, we have developed an intelligent cruise control system for vehicle. This proposed intelligent fuzzy cruise controller was successfully implemented using the fuzzy algorithm, the i80c196 μ-controller board and the throttle valve actuator. The field test results on an linear road was introduced.

1. Introduction

High fuel cost and environmental concerns also provide an important incentive for minimization of traffic delays. Advanced systems controlling both speed and distance to preceding vehicles, Autonomous Intelligent Cruise Control (AICC) systems and Advanced Vehicle Control Systems(AVCS) as the critical components of Intelligent Transportation Systems (ITS) are currently under investigation in the world.

They mainly incorporate both longitudinal and lateral schemes for semi or fully automated vehicle operation, aimed at increasing the highway traffic flow with the improved fuel efficiency and the enhanced safety. Therfore, in order to achieve the high ride comfort, an intelligent cruise control system similar to an skillful human driver is requestd.

Applying the fuzzy logic algorithm as an intelligent concept to the proposed cruise control seems to be an appropriate way to achieve this huristic behaviours, because the various driver's experiences can be transformed easily into a series of fuzzy rules.

Based on this idea that minimize fuel cost, air pollution and accept driver's need for driving, we have developed a intelligent control system for cuise driving vehicle.

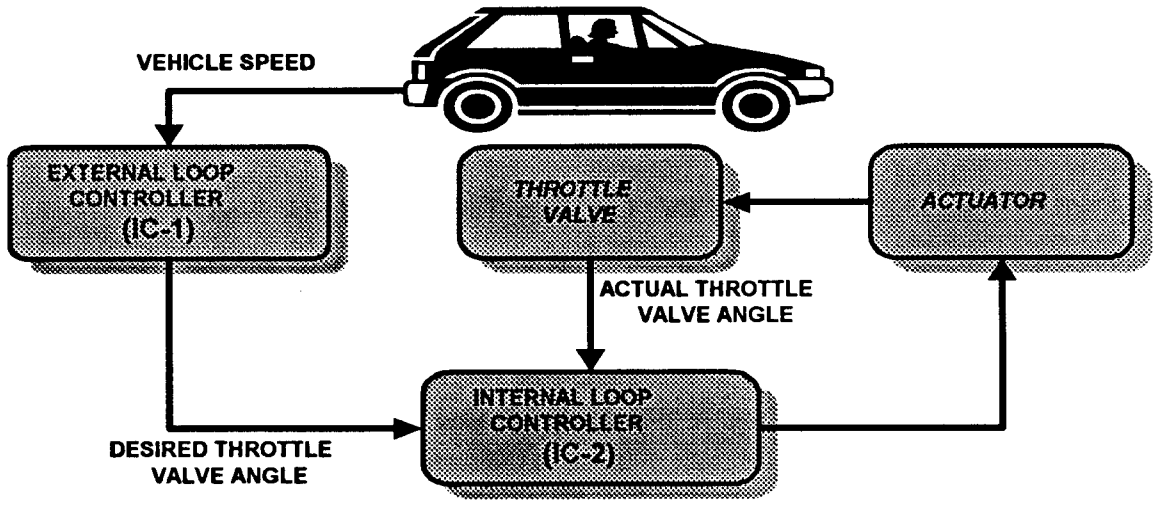


FIg 1. Intelligent Cruise Control

In this paper, an intelligent control system for the cruise driving vehicle maintains a constant speed prespecified by driver, which were implemented as one throttle valve actuator and two fuzzy controllers in an inner loop and an outer one. The feedback data from a throttle valve angle sensor and a vehicle speed sensor were used to generate the desired control signal. This proposed intelligent fuzzy cruise controller was successfully implemented using the fuzzy algorithm, the 80196 microprocessor board and the throttle valve actuator. The field experimental results on an linear road were introduced.

2. Design of Intelligent Controller

Figure 1 represents the intelligent cruise control system proposed in this paper. The controller is consisted of an inner loop one(IC-2) and an outer loop one(IC-1). IC-1 determines the desired throttle opening using the vehicle speed sensor attached to wheel.

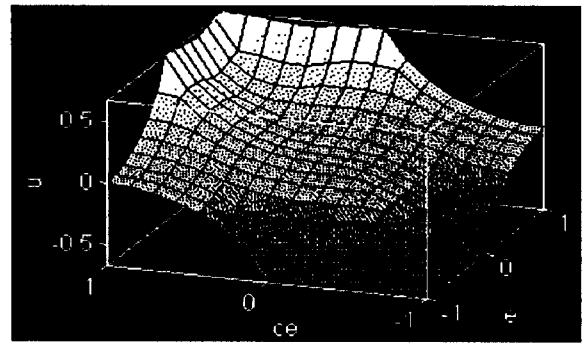
Given the desired throttle valve angle by IC-1, the real trottle valve angle is determined by IC-2.

The control actuator and throttle valve, which generate real vehicle velocity is drived by the resultant control signal .

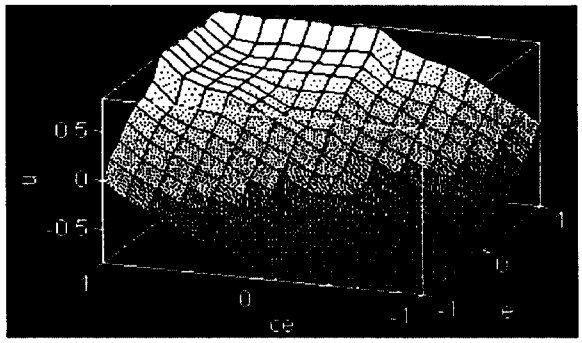
3. Membership Functions of Fuzzy Controller and Rules

The membership functions used in this paper are given as Fig . The rules for IC-1 and IC-2 are as Table.

And the input/output mappings in each rule are showed in Fig. .



(a) In case of Rule 9



(b) In case of Rule 25

Fig 2. Input/Output of fuzzy controller

4. Experimental Results

In experiments, the valve actuator and the i80c196 μ-controller for the proposed cruise control system was immplemented as Fig. 3.

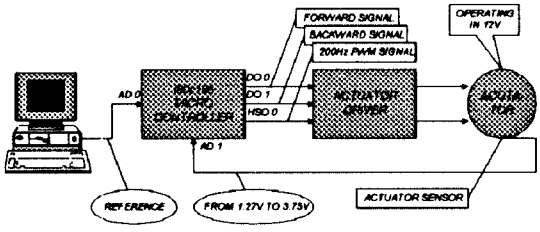


Fig 3. H/W construction of ICC

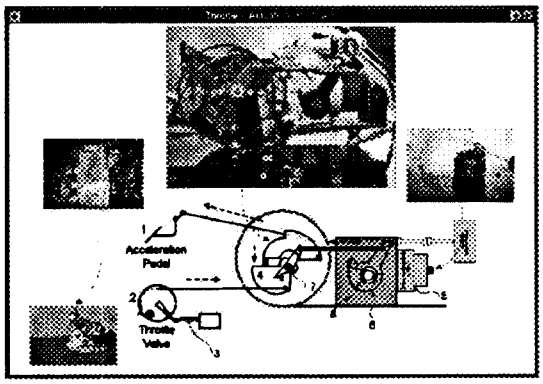


Fig 4. Throttle Valve and Actuator connection

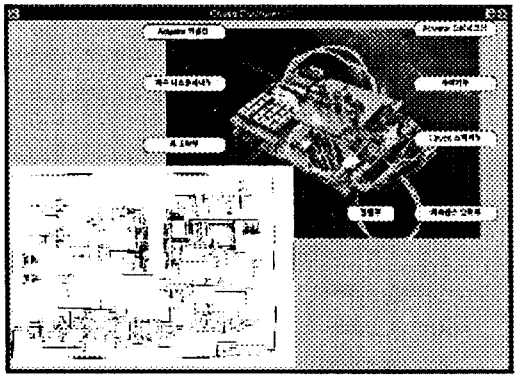


Fig 5. Controller, Actuator, and ECU

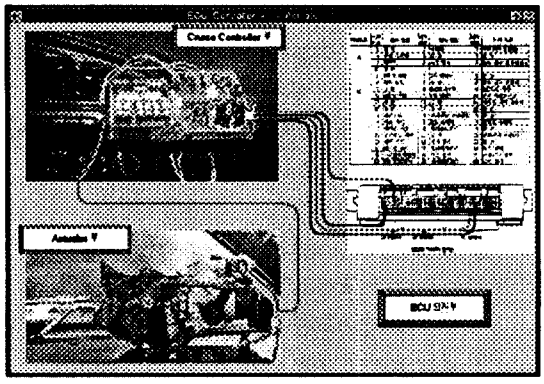


Fig 6. Actuator and ECU

Fig. shows the experimental result on the real road.

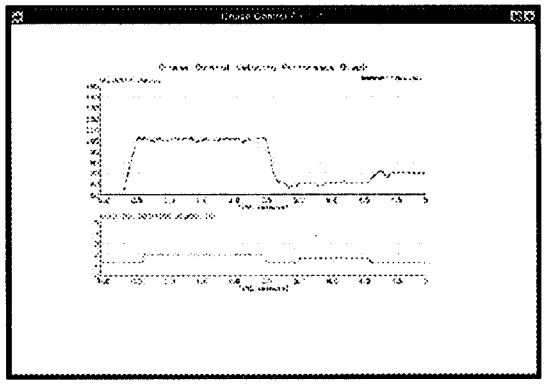


Fig 7. ICC Ouput

5. Conclusion

In this paper, we designed and implemented an Intelligent Fuzzy Cruise Control system using fuzzy controller. From the results of experiment, we confirmed that the proposed control system could give the satisfactory

performances, including the highly ride comfort and the small fuel consumption than the conventional cruise control system.

Reference

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