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Automated blind spot vehicle parking with improved safety feature

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ABSTRACT

The ultimate aim of this paper is to eliminate the accidents occurring in the vehicle parking at the blind spot (not visible) of the vehicle at the parking area or in the basements/dark. In the existing Parking Assistance System (PAS) there is no automatic brake applying EHCU encoded is available in the market. Hence in this project, I have an idea to write coding in the EHCU for automatic braking with respect to the output from the PAS ECU to apply the brake automatically.

Keywords*— EHCU- Electronic Hydraulic Control unit, EMS- Engine Management System, ECU- Electronic Control Unit, EPB- Electronic Parking Brake, PAS- Parking Assistance System*

1. INTRODUCTION

The main objective of this idea is to ensure the safety of humans and other objects present in the blind spot of the vehicle during the parking of vehicles. Nowadays we have the Parking Assistance System (PAS) which will assist the driver to park the vehicle in a safe manner without hitting the obstacles present in the blind spot to the driver in the front and the rear of the vehicle.

Here I have an idea to introduce a new Coding to the EHCU which will command Anti-lock Braking System (ABS)/Electronic Parking Brake (EPB) to apply brake automatically without any manual interruption in the electronically controlled parking brake system when the vehicle reaches the pre-defined safety distance is ≤ 60 cms and the wheel speed is about to ≤ 10 Km/hr. during the parking of the vehicle.

2. ANTI-LOCK BRAKE SYSTEM (ABS)

When you brake on a slippery road, the vehicles try to move forward or in the respected director of the gear but the wheels are locked and unable to rotate. If this is the case, the vehicle will lose its steering or turn, resulting in an accident. ABS controls the wheels properly so that wheels are not locked to stabilize the vehicle.

3. ELECTRONIC BRAKE FORCE DISTRIBUTION (EBD)

Sudden braking while the vehicle is driven causes nose down in which the load of the vehicle is pulled to the front axle. In this case, the friction on the rear wheels is larger than the friction on the front wheels. Therefore the rear wheels are locked before the front wheels are locked, resulting in poor straight ahead run. To resolve this problem, the vehicle is equipped with Electronic Brake Force Distribution (EBD) system which is an advanced form of the proportioning valve.

The proportioning valve can control the pressure but cannot control according to the vehicle loading, number of occupants, cornering, and road conditions. But the EBD can control the braking force applied on each wheel independently by receiving the wheel speed from the wheel speed sensor. For a vehicle with EBD system, the HECU measures the wheel retardation continuously and the separate program of the ABS controls the rear brake pressure to ensure good straight ahead run. The EBD system works before the ABS is activated.

4. ELECTRIC PARKING BRAKE (EPB)

The EPB is used when parking or stopping the vehicle and operated by the switch. When the EPB is inactive, the vehicle does not move with the brake pedal released. Depressing the accelerator pedal deactivates EPB automatically.

It works differently from the wire type. It supplies electricity to rotate the motor and this motor movement pushes the calliper piston to lock the disc. The AVH (Automatic Vehicle Hold) determines if the vehicle is stationary and activates the brake system automatically without brake pedal depressed. You can enter AUTO Hold mode by the operating switch. In this mode, the piston of the calliper on each wheel is pushed by the brake hydraulic pressure, unlike EPB. The control units for EPB and AVH are integrated with HECU.

5. PARKING ASSISTANCE SYSTEM (PAS)

A system which is more useful and assists the driver to park the vehicle to his blind spot without hitting the obstacles based on the output front the PAS sensors displayed in the instrument panel or in the display if equipped.

6. FRONT PARKING ASSISTANCE SENSOR (FPAS)

The FPAS unit is connected to the PAS controller and receives the ON/OFF signal from the PAS controller through M-CAN.

When the FPAS ON signal is received, it requests the gear position from the GTU through M-CAN. If the gear is in the R or D position, the unit receives the vehicle speed from the instrument cluster through P-CAN.

If the vehicle speed is 10 km/h or less, and the distance from the obstacle and the sensor is ≤ 60 cm PAS controller commands the EPB to apply the Brake through CAN connection. If the speed is more than 10 km/h, the PAS system is turned OFF.

7. REAR PARKING ASSISTANCE SENSOR (RPAS)

The RPAS unit is connected to the PAS controller and receives the ON/OFF signal from the PAS controller through M-CAN.

When the RPAS ON signal is received, it requests the gear position from the GTU through M-CAN. If the gear is in the R or D position, the unit receives the vehicle speed from the instrument cluster through P-CAN.

If the vehicle speed is 10 km/h or less, and the distance from the obstacle and the sensor is ≤ 60 cm PAS controller commands the EPB to apply the Brake through CAN connection. If the speed is more than 10 km/h, the PAS system is turned OFF.

8. ACCELERATOR PEDAL POSITION SENSOR (APPS)

APPS are used to check the position of the acceleration pedal by the Engine Control Unit (EUC) with respect to the output of the potentiometer to the ECU.

From the position of the APPS, ECU will send signals to the EHCU for brake force to be applied to the wheels and to Engine Management System (EMS) to cut off the fuel supply to the intake system of the engine when it is required.

9. GEAR TRANSMISSION UNIT (GTU)

The gear transmission unit is the main body of any vehicle which is very much useful to the transmission of power from the engine to the wheels. For a cut of an input of fuel to the engine intake system GTU input is mandatory.

10. WHEEL SPEED SENSOR (WSS)

When the vehicle wheel rotates, the tone wheel rotates along with the wheel, and this rotation of the wheels is changing the magnetic flux induced in the sensor and it generates the induced electromotive force. The frequency of this waveform changes relative to the number of the rotation counts, and this frequency is controlled to detect the speed of the wheel.

Hence this wheels speed is measured by the WSS and it sends signals through CAN network and the ECU refers this value with the Brake Pedal Switch (BPS) input for applying the brake force to apply the required and cut off the fuel.

11. ENGINE MANAGEMENT SYSTEM (EMS)

The ECU receives signals from various sensors. Then, it analyses and modifies them to allowable voltage level to control various actuators. The ECU can control the engine power and exhaust gas precisely because the microprocessor in the ECU calculates the injection duration, injection timing, and injection volume based on the engine piston speed and crankshaft angle using input data and a stored map. The output signal from the ECU microprocessor drives the solenoid valve of the injector to control the fuel injection volume and injection timing and control the ignition timing of the ignition coil so as to control various actuators in response to the changes in the engine condition. In addition, many auxiliary functions are added to the ECU in order to reduce emissions, improve fuel economy and ensure safety, riding comfort and convenience.

The ECU uses the CAN communication system to facilitate data exchange with other electrical systems such as A/T, braking device, and steering system. When servicing a vehicle, diagnostic equipment can be used to check the vehicle conditions and perform diagnosis.

12. WORKING

The ABS/EPB controller will receives the input from the PAS ECU, Accelerator Pedal Position Sensor (APPS), Gear Transmission Unit Controller (GTU), EMS ECU fuel flow, ESP/EPB, EHCU Pressure of brake fluid line, Brake Pedal Switch (BPS) and Wheel Speed Sensors (WSS) from the Control Area Network (CAN) connection.

13. BLOCK DIAGRAM

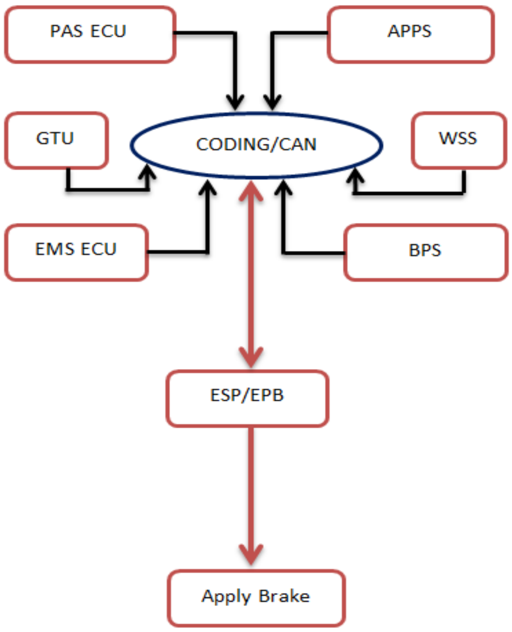

Fig. 1: Block diagram

After receiving the inputs from the above parametric units the controller will compare the pre-defined and standard values set to the EHCU and the PAS sensor input to the pre-defined value that is Distance in the coding for ≤ 60 cms between the obstacle and the vehicle. If the value of the distance is below or equal to the said value then the controller will send signals to the EHCU/EPB.

Electronic parking brake works based on the input from the EHCU controller. When the EPB switch is actuated by the user EPB will apply the brake to the wheels to prevent from moving. Here the EHCU will auto actuate the EPB switch to apply the brake based on the input from the PAS controller.

PAS system works based on the proximity sensors input and shows the output in the control panel about the distance from the obstacle and to the vehicle and it gives the varying sound based on the distance between the vehicle and obstacle if the sound system is equipped.

When the gear is engaged (D/R) the PAS controller checks for the obstacles near to it, when the vehicle speed is 10 km/h or less and compares the distance with the obstacle from 120cms. When the speed is about 10 km/hr and the distance become is ≤

60 cms the ECU will command the EHCU controller to actuate the EPB. And the Parking brake will be applied and the vehicle will be prevented from moving in order to avoid an accident.

14. CONCLUSION

From this idea, we can introduce a new EHCU which can avoid the accidents occurring the blind spot parking of vehicles by applying the brake automatically so that the damage to the vehicle and to the obstacles can be eliminated by introducing such type of a command to the EHCU. And repair cost and losses for human or any other obstacles can be avoided.

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