Development of Control System for Electronic Power Assisted Steering (EPAS)

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Abstract— The project is designed to develop a control system for Electronic Power Assisted Steering (EPAS), a small compact unit requiring only a battery connection to work. The EPAS has an Engine Control Unit (ECU). The inputs to the ECU are torque and speed sensors. EPAS uses DC motor to assist the driver of a vehicle. Sensors detect the position and torque of the steering column and a computer module applies assistive torque via the motor, which connects to either the steering gear or steering column. This allows varying amounts of assistance to be applied depending on driving conditions. Electronic power steering systems eliminate the need for a pump, hoses and a drive belt connected to the engine using variable amounts of power. The configuration of an EPAS system can allow the entire power assist the system to be packaged on the rack and pinion steering gear or in the steering column. The system does not drag on the engine from either a power steering pump or alternator because it will not assist until required by driver input. Also, there is no hydraulic fluid. This system has an advantage in fuel efficiency because there is no belt driven hydraulic pump constantly running, whether assistance is required or not, and this is a major reason for their introduction. This greatly simplifies manufacturing and maintenance. By incorporating stability control electronic power steering systems can instantly vary torque assist levels. This project programs ECU and the output the ECU drives the DC motor. The DC motor controls the movement of the steering. This paper analyzes the influence of coloumn type assist on steering.

Key words: Electronic Power Assisted Steering (EPAS), Engine Control Unit (ECU), Microcontroller

I. INTRODUCTION

Electronic Power Assisted Steering (EPAS) is a full electric system, which reduces the amount of steering effort by directly applying the output from an electric motor to the steering system. Electronic Power Assisted Steering (EPAS/EPS) uses an electric motor to assist the driver of a vehicle.

This allows varying amounts of assistance to be applied depending on driving conditionsSensors detect the position and torque of the steering column, and a computer module applies assistive torque via the motor, which connects to either the steering gear or steering column.

Electronic power steering (EPS or EPAS) uses an electric motor to assist the driver of a vehicle. This gives more assistance as the vehicle slows down, and less at faster speeds.

The steering system of an automobile serves two main functions-

1) Firstly it allows the driver to make the vehicle follow a desired path.
2) It allows the driver to judge the driven conditions by allowing some feedback.

Electronic power steering offers greater vehicle safety by adapting variable steering ratios to human needs, filtering drive and even adjusting active steering torque in critical situations.

In addition, it can make cars even lighter and more fuel efficient when compared to those using hydraulic steering systems.

Power steering is a system for reducing the steering effort on cars by using an external power source to assist in turning the wheels.

Electronic Hydraulic Power Steering (EHPS) is an advanced system that uses conventional hydraulic power steering with an electric motor-driven hydraulic pump. Electric Power Steering (EPS) is the latest system in which the electric motor ("E-motor") is attached directly to the steering gearbox without a hydraulic system. Sensors detect the motion of the steering column and a processor module applies assistive power via an electric motor. This allows varying amounts of assistance depending on driving conditions. With electronic systems becoming more and more common in cars, EPS is the future power steering system that they will use. Unlike its conventional counterpart, EPS is active only during the actual steering process. It also eliminates maintenance on steering hydraulics and cuts fuel consumption by as much as 0.4 l/100 km.

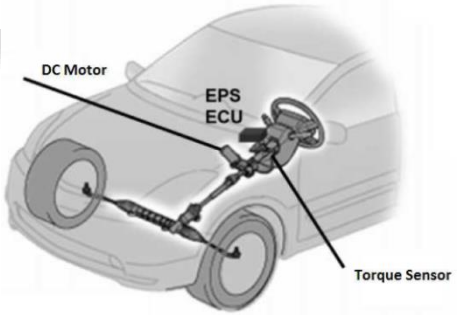

Fig. 1: Location of EPAS in Vehicles

II. BLOCK DIAGRAM

This figure shows various blocks of EPAS system.

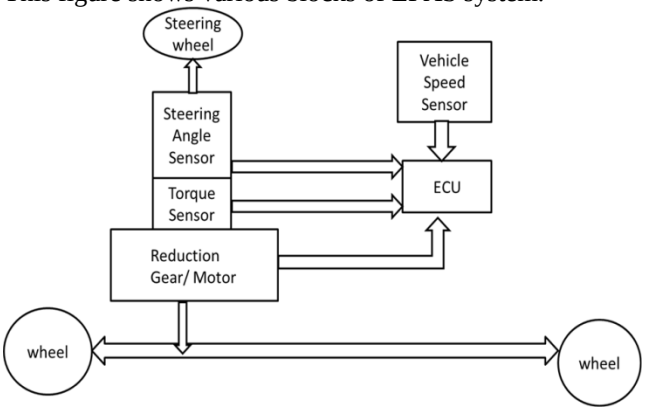

Fig. 2: Block Diagram of EPAS

A. Block Diagram Description

1) Torque Sensor:

Being a torque control system, the EPAS requires a sensor for the rotational efforts or torque that the driver exerts on the steering wheel in order to steer the wheel. This is the heart of the EPAS system.The sensor output signal is then passed on to a motor controller to develop the torque that is required to assist the driver.

2) Vehicle Speed Sensor:

The Vehicle Speed sensor or VSS measures transmission/ transaxle output or wheel speed. The ECM uses this information to modify engine functions such as ignition timing, AF ratio, transmission shift points, and to initiate diagnostic routines the Vehicle Speed sensor is typically located at the transmission or transaxle.

3) Angle Sensor:

The steering angle indicates where the driver wants to go. The steering-angle sensor unit is mounted on the steering column, mostly within the passenger compartment.

It is important to determine an angle value at power-on.

4) Engine Control Unit (ECU):

An ECU is basically made up of hardware and software (firmware). The hardware is basically made up of various electronic components on a PCB.

The most important of these components is a microcontroller chip along with an EPROM or a Flash memory chip. The software (firmware) is a set of lower-level codes that runs in the microcontroller.

B. Comparison of Different EPS Systems

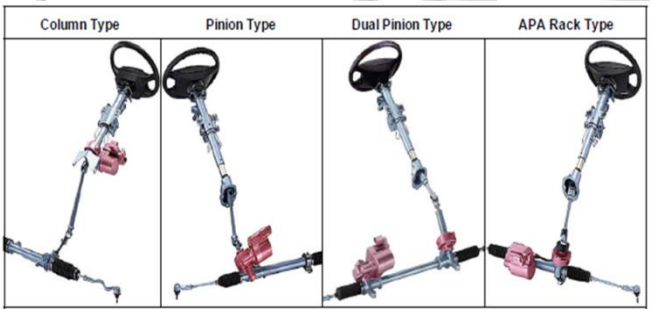

Fig. 3: Different Types of EPAS Systems

III. CONCLUSION AND SUMMARY

EPS provides a more flexible and less expensive steering system than a conventional hydraulic system. Combines MCU functionality and sensor input for processing. It is a highly efficient, compact and innovative technology in high end vehicles.

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