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Governance of External torque request using Embedded Systems in Automobiles

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Abstract— Automotive electronics has considerably facilitated automotive industry to improve efficiency, safety and has helped the industry to abide by emission norms. Embedded System forms the brain of the Automotive Electronics domain. This is a feature applicable in Automotive domain, in Light/Commercial Vehicles which increases the load on the engine and demands more torque. In order to reduce the concerns regarding safety, emissions and efficiency, the embedded systems are used to govern the feature. This helps the Original Equipment manufacturers to meet new and more stringent requirements of safety and reliability.

Keywords- Torque; testing; real time embedded systems;

1. INTRODUCTION

The application of electronics in mechanical components to improve their basic functionalities and to implement more efficient systems have always intrigued the industrialists and researchers. The Internal combustion engines which were saturated with respect to the efficiency and power factor were improvised with the help of electronics. The software for controlling the electronics were recognized and implemented to obtain the embedded systems. This is one such application of embedded systems in Internal combustion engines to improve important factors of an engine.

The Embedded systems used in Automotive Are Real time based systems which involves Real Time Operating systems, fast and more reliable responses.

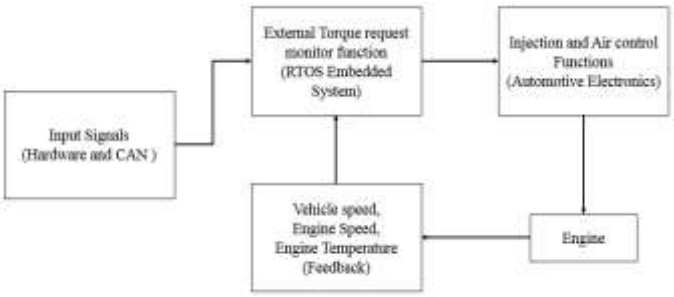
There is a need to improve the emission conditions and thus environmental factors, human safety factors and efficiency related concerns in the automobiles equipped with the functionality to serve additional external torque request. It is achieved with the help of Embedded Systems, which is Engine Control Unit in Automobiles, which is flashed with the developed software to monitor engine speed, vehicle speed and the emergencies.

2. CONTROL FLOW

The engine output has to be set with an offset as per the Torque request status, which is decided according to the requirement, clients and vehicles.

The values from the hardware pins are accepted, which are user inputs to the Increased Torque Demand and also the feedback values from the engine sensors are recorded. The values are then checked for signal plausibility, de-bouncing values and for the limits. The signal is further stored to the variables which decide the engine set points and maximum vehicle speed required for the engine operation, without causing reduction in actual user demand.

According to the set points decided by the module after processing the signals are further given to the injection monitor section which decide the injection quantity as per the demand.



3. TOOLS USED

ECU: This refers to Engine Control Unit. Which is a reliable embedded system and has more read write cycles.

Embedded C: This is a preferred language for embedded systems as it has better compatibility with the hardware when compared to other languages. The Embedded C language used here abide by the rules formulated by AUTOSAR and MISRA standards.

ECU Works: This tool assists in configuring the Hardware pins by providing graphical interface to enter the pin numbers, their labels and configuration items.

INCA: This tools is used for testing of the software which is flashed on to the Engine control unit. The testing is achieved with the help of calibrations. Calibrations are the datasets which can be varied to set the engine operation to the desired mode

TPT: This refers to Time Partition Testing. As in the name, this tool helps in testing the software using time partition

methodology. The module to be tested is given as the input, then the variables to be tested are selected and the variables to be varied are also selected. This does not involve closed loop operation as it just runs the code and does not simulate an automobile.

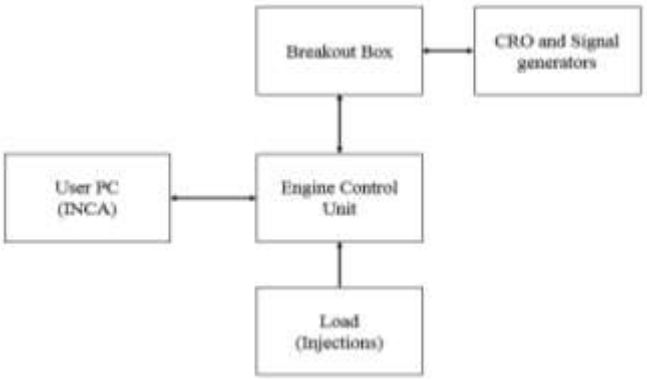
ASCET: This refers to Advanced Simulation & Control Engineering Tool. This is model based development software which converts the models into Embedded C abiding by the AUTOSAR regulations.

Arduino: This was used to simulate the pseudo code developed in order to understand the functionality in a simpler way. The coding is done using embedded C but the libraries were provided by the Arduino.

Open Loop Lab Car: This setup consists of open loop system wherein the values are independent of the feedback\ The open loop lab car consists of the lab car, break out box, and load for simulating an Automobile.

4. EXPERMIENTAL SETUP

The processor is connected to the Engine Control Unit through USB interface, which enables the processor (PC) to communicate with the ECU for flashing and for obtaining the results using INCA software. The Engine Control Unit used for the experiment is Bosch specific, which is connected to the Labcar through a breakout box for tapping the output/input pins, which helps in diagnostics. Injections load, CRO and signal generator are connected to the ECU and Lab car through Breakout Box.



RESULTS

The results were obtained using the INCA software, Measure data analyser and labcar setup which helped simulate the car operation.

The results for configured pins, each development modules were all captured and reviewed. The results are not displayed abiding by the company norms.

CONCLUSION

External Torque demand feature in Automobiles is governed with improved efficiency, safety and emission features. Efficiency in improved by precise controlling of injection quantities, timing and thus overall engine speed. Safety is improved by taking into the consideration of a modified maximum vehicle speed if the if the additional torque is requested. Safety is also improved by configuring an emergency hardware pin. Emission in controlled by feedback systems which help in determining the appropriate injection and air quantities. For software development, V model is followed wherein each module is developed and tested individually and then overall flow is checked. It is to be noted that to improve modularity and regularity, the application is divided into the modules.

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