International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 6 474 - 476

Automated Tool for Calibration Features Checking Engine Platform

Deepali P Pathak
ME (VLSI & Embedded Systems)
Pimpri Chinchwad College of Engineering Pune, India

Dr. N. B. Chopade
HOD, E&TC Dept
Pimpri Chinchwad College Of Enginering Pune, India.

Mr. Vishal Halale
Electronics Engineer Cummins India Ltd Pune, India

***Abstract*—** Fuel economy and government emissions regulations and other compulsory features like ABS and Cruise Control are important for automotive engine manufacturers. New engine sensors and actuators are introduced to meet these requirements, which increases engine complexity and cost. Calibration is the process of achieving optimal settings by evaluating the behavior of an engine. This multistep process involves designing tests, collecting data, analyzing the data and calibrating lookup tables to model the engine. This process helps to identify the optimal balance of engine performance, emissions, and fuel economy. There are number of calibration parameters which control the engine performance and behavior of its accessories. These parameters needs to be calibrated and adjusted to arrive at an engine settings which are optimized for performance, fuel economy, emissions and cost. In this project, we have developed an automated tool which helps in this calibration tuning process to reduce time and efforts. In this project, the calibration process is to be automated.

Keywords*—Calibration, engine performance, automated tool*

*****

I. INTRODUCTION

Since the invention of digital electronics in the automotive field, which have proven to be reliable over a period. The electronics in today's vehicles have made the advancement to complex semiconductor chips which are proven to be reliable and flexible. Figure 1 shows working of current engines with sensors and actuators in a closed loop system. In a closed-loop control system, information flows around a feedback loop i.e from sensors to Engine Control Unit to actuators. This closed- loop control repeats as often as necessary until the desired process condition is achieved. For example, cruise control to maintain the speed of a vehicle which uses a speedometer to measure and maintain the vehicle speed. If the vehicle is traveling too slowly, the controller instructs the accelerator to feed more fuel to the engine. If the vehicle is traveling too quickly, the controller lets up on the accelerator. The vehicle speed is the process, the speedometer is the sensor, and the accelerator is the actuator.

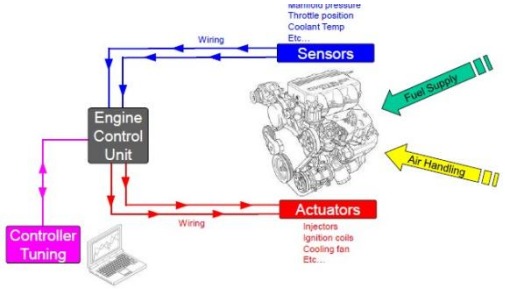

Figure 1: Working of Engine in closed loop

Hence calibration of an engine has become an essential part in the development of new power trains. Calibration is proposed for the optimized tuning of the engine and optimizing the control system hardware. During the calibration process, the ECU signals are obeserved, which means that any change occurring inside the ECU can be followed by detailed examination and analysis of system behavior.

With intention to reduce the work involved in calibration by using efficient methods and intelligent tools at the same time meeting all requirements, an automated tool development for calibration feature checking is proposed in this paper. Automated Testing means using automation tool to execute current process. The automated offline test is an innovative solution for the efficient data analysis. It allows a quick configuration of a simplified power train model and enables the calibration engineer to test the basic settings against requirements. Also multiple features can be checked at a time using automated tool which is not possible in manual testing. Therefore it supplements calibration work in the vehicle with analytic results and speeds up the calibration process significantly. This improves the efficiency of testing and reduces workload.

CALIBERATION PARAMETERS OF AN ENGINE

by 2 hour. The manual process takes 3 hours of time. With the help of this tool it can be done in 1 hour.

Engine calibration includes tuning ECU parameters to maximize performance in the operational range of engine speeds and loads. It is impossible to calibrate an engine by simply optimizing one variable at a time, as the effects of calibration variables are interdependent. However, there may be a number of variables, each with a range of possible values, it is not feasible to test all possible combinations on a working engine. With a large number of power train or vehicle parameters, the management of calibration parameter sets is a big challenge, as each engine has application wise different calibration. Hence to keep track of all these calibrations and their values is tough and lengthy process. Hence requirement based parameter management is a very important part of the calibration process. Miss of a one parameter may cause unexpected engine behavior. So it's important that the values to be set correctly. Hence a database is maintained to keep track of all the parameter values. The data base includes the parameters and its correlation to the physical characteristics of the power train. This correlation allows a fast analysis of parameter sets for parameters out of previously calibrated power trains. The database contains default parameter settings for various engines platforms. The proposed tool uses this database for comparison with the actual calibration of the engine and helps in analyzing the

behavior of the parameters having value other than default value.

II. METHODOLOGY

The existing system is manual process for calibration feature checking, which requires more time. Cummins strategy to save time and increase accuracy, the new concept of automated calibration feature checking tool is developed. It has streamlined and simplified the calibration features checking process. The workflow of the tool involves a database which contains all the features and their specified default values. The GUI contains a list of all features. The user selects the features which need to be checked and excel file with all default values of the selected features parameters imported from database is then generated. These values are compared with the values from actual calibration which is downloaded into engine ECU using Cummins Engineering Calibration tool and with the help of the proposed tool faulty values are highlighted. The parameter values from ECU can be read using Cummins Engineering Calibration tool. Cummins Engineering Calibration tool is an engineering development tool used to monitor ECU for Cummins engine systems and to alter the calibration data contained therein. Cummins Engineering Calibration tool is designed to modify fueling calibration parameters and featuresettings in an engineering development and test environment.From Figure 2, it shows that the proposed tool saves time in diagnosis of parameter values which differ from default values.

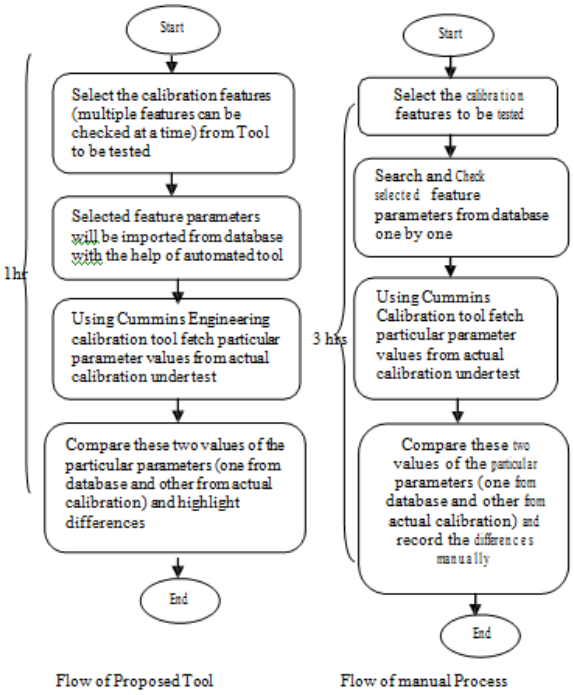

Figure2: Comparison between flow of automated tool and manual process and their time requirement

III. ADVANTAGES OF THE TOOL

The proposed tool has following advantages:
User friendly
Saves development time, increases accuracy hence reduces cost overall.
High customer satisfaction due to accurate methods which gives the product first time right.

IV. RESULTS

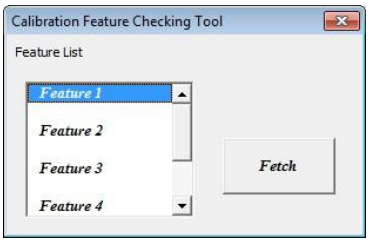

Figure 3: Proposed Tool

The tool consists list of different features named Feature1, Feature2 etc. Due to Cummins confidentiality use names like Features 1,2,3…and parameter1,2,3… have been included to give the idea how the tool looks like.
Select feature for testing and press fetch button. It will fetch the default parameter values from database and using Cummins Engineering Calibration tool those parameter values from actual calibration can be fetched. At the end the excel file will be generated highlighting the difference values of parameters from database and from actual calibration.

	A	B	C	D	E	F
1	Parametrs			Value from Database		value from Calterm
2	Feature 1					
3	Parameter 1			1		0
4	Parameter 2			0		0
5	Parameter 3			1		1
6	Parameter 4			1		1
7						
8	Feature 2					
9	Parameter 1			1		1
10	Parameter 2			1		0
11	Parameter 3			0		1
12	Parameter 4			0		1
13	Parameter 5			0		1
14	Parameter 6			0		1
15	Parameter 7			0		1

Figure 4: Resulting excel file with highlighted values

V. CONCLUSION

Calibration is an iterative process. With the help of this tool complex task of calibration can be made simple to some extent. Major benefit of this tool will be reduced costs due to improved and smart safety diagnosis, reduced human efforts and time requirement. Also customer requirements can be met within time.

ACKNOWLEDGMENT

I would like to thank to my guide of this project, Dr. N. B. Chopade, HOD at Electronics and Telecommunication Department for the valuable guidance and advice. I would like to thank Mr. Vishal Halale, Mr. Bipin Hingu, Cummins India Pvt. Ltd for their valuable suggestions, constructive inputs and their support and giving me opportunity to work in organization.

REFERENCES

[1] Namrata A. Gajare, Prof. Bharati M. Narute, Bhakti Kalghatgi, " Calibration Tool for ECU based on CCP", International Journal of Science and Research (IJSR)June2015.
[2] Hasan Uzun, " Calibration of Engine Performance at Mercedes-AMG" , White Paper from MathWorks News and Notes 2010.
[3] Andr Rolfsmeier, "Challenges to a Modern ECU Calibration System dSPACE", Automotive Electronics 2004.
[4] Taksale A. , Vaidya V. , Shahane P., Dronamraju G., "Low cost hardware-in-loop for automotive application", Industrial Instrumentation and Control (ICIC), IEEE 2015.
[5] Tom Denton "Automobile Electrical and ElectronicSystems", Elsevier Butterworth-Heinemann Publications.