Fault simulator of car engine

Pratik Goyal, Sumedha Fegade, Damini Dabhilkar, Dr. Sharmila Petkar

Department of Electronics Engineering, Ramrao Adik Institute of Technology, Nerul, Navi Mumbai, India.

DOI: 10.29322/IJSRP.9.01.2019.p8589 http://dx.doi.org/10.29322/IJSRP.9.01.2019.p8589

Abstract- As we know any system when comes to existence has some limitations and faults. We are proposing to develop a E-training system which will train the user about the faults of a car engine and guide him/her about the necessary steps required to overcome the corresponding fault. Parameters like poor lubrication, Dirty oil, Spark knock, poor compression, coolant loss, clogged radiator and worn spark plug are known as engine faults. The simulator is developed using LabVIEW which will consist of different panels viz. the Main panel, About faults panel, Normal conditions panel, Guide panels, Fault simulator panel and Trainer kit panel. A trainer kit for fault diagnosis in implemented using switches and indicators which will guide the user about the necessary steps required to be performed to overcome the corresponding fault.

Keywords: E-training, Fault Simulator, LabVIEW, Indicators.

I. INTRODUCTION

Our project "Fault simulation of car engine" is dedicated on finding out faults which arises in any system having any physical or mechanical components. In our project we have considered different parameters which possess great importance in any car engine. The parameters such as ignition fault, overheat fault, low compression, spark knock, noisy engine, overshoot fault and poor lubrication are some of the common engine faults of an

automobile. In Fault simulator panel the user changes the value of the devices like temperature meter, pressure gauge, decibel scale, rpm indicator and level indicators and observe the simulated faults in the 'fault indicator' window and 'other possibilities' window. In trainer kit panel the user selects the fault to be diagnosed and then pass various test cases through

push buttons on the engine block diagram. After hitting the check button the results of

diagnosis is observed through various indicators.

II. OBJECTIVE

Objective of this work is to develop an interactive teaching scheme for automobile engineers and beginners using virtual engine developed in LabVIEW. This facilitates the user to study engine parameters without having the physical engine. All the engine parameters can be included in the built vi (virtual instrument) using virtual instruments in LabVIEW.

III. PROBLEM STATEMENT

Detecting faults in a car engine is a complicated process and requires high level of expertise. Developing a system dealing with faults in a automobile engine

http://dx.doi.org/10.29322/IJSRP.9.01.2019.p8589

has to overcome various difficulties. Practical study of engine requires many devices and equipments, which increases the cost and maintenance, so this paper describes a simple solution to such problems using virtual instrumentation.

IV. LITRATURE SURVEY

Fault detection plays an important role in safety measures of any device. Abnormal events occurring in a process can be avoided by early detection of faults. There are several methods of faults detection. The literature survey of these methods and current state of research in the field is as explained below:

PROCESS MODEL-BASED FAULT DETECTION

The general scheme (Isermann 2006) employed for the model based fault detection is shown in Figure below. Based on measured input signals U and output signals Y, the detection methods generate residuals r, parameter estimates or state estimates which are called features. In comparison with the normal features, changes of features are detected, leading to analytical symptoms S. The process model approach for fault detection can be carried out using state observer/state estimation, parity equation, parameter estimator or neural network[13].



Figure 1: PROCESS MODEL-BASED FAULT DETECTION[1]

a. DATA BASED METHODS AND SIGNAL MODELS

Data based methods exploit only available experimental (historical) data. It includes various methods as spectrum analysis, Pattern recognition(neural networks)[7], Data analysis, Parametric models, Limit checking and Trend checking.

b. KNOWLEDGE BASED METHODS

In recent time there is a trend towards knowledge based and artificial intelligence methods like Expert systems, Fuzzy logic.

i. Expert system

Rule-based expert systems have a wide range of applications for diagnostic tasks where expertise and experience are available, but deep understanding of the physical properties of the system is either unavailable or too costly to obtain[14]. This approach offers efficiency for quasi-static systems operating within fixed set of rules. Main components of this approach are knowledge base and inference engine, Knowledge is represented in form of production rules[1]. Knowledge acquisition is always considered as one of the biggest difficulties in designing an expert system.

ii. Fuzzy Logic

The output of fault detection system needs not to be an alarm that takes two values, fault or no fault. Instead of simple binary decision fault/no-fault, fault severity of the system is provided to operators as the output of fuzzy controller[12].

V. SYSTEM DESIGN

Software used:

a. LabVIEW

LabVIEW stands for Laboratory Virtual Instrument Engineering Workbench. LabVIEW uses graphical programming approach that helped us to visualize different aspects of our application more clearly. Necessary devices required for our application were available through virtual instrumentation in LabVIEW this helped us in reducing system cost.

Entire system is developed using LabVIEW.

i. Main window: This panel helps user to select among different pages included in project.



Figure 2: main window

ii. About faults window: This panel provides information about the various faults occurring in an automobile engine.

adout it from rainin	* 0
n Auger Comme Tech Handes Heg n 18 H Thetaportamination (2.+ (2.+ 100+) 10+	Steel All
DYER HEAT FAULT: Not ended with the design of the strength of the strength to prove of story 191 or 191 design f	
A history constant specifics temperature is about any essential for projecter sources, good fur according and particularies	
Annequation of Autometrie Engine Overheating	
I ne engré com les de l'un reng de les rengements augertes anys en sur la partie de la segré en priper de les t	
Devent of Automative Engine Doctorality:	
Autoritative engine coefficiency can be caused by anything that decreases the coding system Labelly to Always compared and discourse how	
A tax estimation and loss of solitant drawing concernal or actional layers	
Polit haar vervelouttivity insule the angles bacaque of accumulated strengths in the water justists. A setter the discrimination that descent accum	
Peer siRea trough the redieter	
A signing the statet of an Anoperative electric country the	
 consport over research room An eroted or future events eroteder 	
Even a bafethile radiator soa	
GNITION FAULT	
and the second as a prior agreement to the second	
It for species systems a straight to have a period support works, if an ordering grant arrange with it. That it's Bady to have a very observe affect on the an Any instant advant dependent species on the characteristic care is not in the species.	the suggestion is a second prior line.
Scheelings and second	
Span ying problem	
Annual Annua	
States reported and the state and the engine	
IOW COMPRESSION	
Carlesgev compression refers to when an and gas are most together to the genoes of an engine. This provide a tepureor to the prevent of the p	notices. If there are any problems
ette tra compression probles, men pro vell'esperiense all'Indon of car problems.	
san a sanchian sasan Malan in Perse	
Unity Valves	
In the logic sector sector sector and the sector	
erer to de. The first thing your read to de 5 sets a sumpremier gauge and test to use if there is initially the compression in your engine. This process	ell usually later 42 Hillington oc. make
impression for you, if they first there is no impression, the risk step to make the system patient, and patient to easy any of their are	amaged or to over them there only
ter relate statement demaped increases the oil by a weighty will costly up because it invitiged lating out the weights	
DARK KNOCK	
bert truck structurent i an entity time of structure that prices when multiple family and send tanking mode a controller charter (encoder second because that in
agained to determine that persons are made test in access representative assessments when the segments haved and planer of Descent County	manual and a flam page.
Overset-straint lighters Torring	
Fol Mus Californian	
cale Fuel Michine	
Rown Plug Too Feb. Nacional Caso of the barrier description in a long back and rain rates therein a surrow the 200 rates in a subscript of	
NOISY ENGINE	
Nany de angeles result from a variety of dependences. Often the valide the variety the relian the engine. As parts lattice the singles good ables, the name and under the antide activities that associate as well that individe a case of during a dise.	to set work as well and to key.
Anna Selatara	
Lube Shi Brighe Presets	
Check The Hand Tablem	
Replace the Badater Cells	
ENGINE OVERSHOOT:	
Send out fails accur aleas the cented and get the Nex Indiano, Was the center of the solution gas begind the mathem speed of the sol	and fait countries had selars
Autor	
roge willing our encode with the second s	
righ power supply to the restants	
FOOR LUBRICATION	
hepets reaction and of coloured angles and a second a fee long-service leader and efficient functioning of your calculate like a heavier data associated	i Kamani.
ten weit zweit hiel hefte weiter mei nig weiten Caleford all beis prie sie bentte.	
I country a cliquery gas forbardy records worked parts in the engine and reduces bottom, here and once.	
It starts all of the surfaces within the wrights subsect when the strates is and sourcing it is probabled from summaries	
It issues to the test that is nationally should be the conduction provided within an active regime.	and and a second se
It recreates and that you'd etherway bold up in the angle and suce staring and price or anosh, polatilat surface	
It preserve the assumables of alongs. Onep do so all that is may execute he changing wit not only for to service studge and other contemporation	and will people in these speed and
I they find accept to keep month or sold sectors and this arrange to all sold actions a het another / presenting the world of and arrange re-	while while providence and bids on the
Access faults and also sound due to some strature framers for KOW CODMANT CAPACITY, INSURPORT FVID, AND LOW SMEARE DIS	

Figure 3: about fault window

iii. Normal conditions window: This panel provides information about the normal range of various engine parameters.

8		normal conditions/vi Front Panel *	- 0
f9e	Edit Yany Project Openate Tool	i Weden Hab	HIR
		NORMAL CONDITIONS FOR CAR ENGINE	
I		ORMAL OPERATING ENGINE TEMPERATURE	
	PERM	meet and the normal operating engine temperature is in a reage of 195 to 200 degrees Environment, though meet disableant temperature degre don't show an exact temperature, however, they specify methy provide and that this the edges of the gauge and a normal range on teamson of energy as monorable block of downers Environment.	1
a		ANGE OF RADIATOR'S RPM	Contraction of
		an average the maximum \$9M of the car natistar for localing familis 1990. Above this value overhead has been said to be assured, r a normal car engine permulsive range is around 1000 rpm - 1990 rpm.	
	A 10 M	OISE LIMITS.	
1		conting to Europeen standard of Europe - wide noise Innis. the normal range of engine noise is around 14do - 82db.	A West
2		JBE OIL PRESSURE	-
25		a normal car angine lube of procease varies from 55 - 65 pcl .	
X.		IMPRESSION RATIO	
		requestor one as adhed as the electric scale in the result of an inclusion is compared in the eight. The memory organization was a the final scale of the electric scale of difference in the visibility of environment and devise. No. 6 is indeed below (Memory eight - 10:15:14) (Source eight - 10:15:14)	

Figure 4: normal conditions window

iv. Guide to fault simulator: This panel help user to understand how to operate the fault simulator.



Figure 5: guide to fault simulator

v. Fault simulator window: In this panel user is allowed to change different engine parameters and observe the corresponding fault generated.



Figure 6: fault simulator wnidow

vi. Fault diagnosis window: In this panel user selects the fault to be diagnosed and passes different test cases using the buttons provided. The sequence of the buttons pressed is recorded and after pressing the check button the results are displayed using various indicators.



Figure 7: fault diagnosis trainer

b. Android application: Narrator's voice

Narrator's Voice, this application helped us to share our messages to user in different speech styles and languages. We have to type a text message, select the voice and language and this app returns the audio file [3].

We have used this application to provide sound effects in our project.



Figure 8: narrator's voice app[7]

VI. CONCLUSION

This paper is built with aspect of learning about car engine through an interactive application developed using LabVIEW. This would result in leveraging the logic to analyze any faults that occur in reality. This also provides better solution to beginners for engine related study. Using a virtual engine as an alternative to physical engine reduces the effective cost to a great extent.

VII. FUTURE SCOPE

Scope of this project can be extended to develop an android application for engine study.

Different case studies can be developed for particular types of engines like 'V' engine, Jet engine, locomotive engine etc.

Complete removal of dependency on physical engine for engine related study.

The system can be focused more on getting the real time data from sensors, instruments that provides actual data.

VIII. REFERENCES

- [1] Dubravko Miljkovi, Hrvatska elektroprivreda, Zagreb and Croatia, Fault Detection Methods: A Literature Survey
- [2] Mihaela Miron, Laurentiu frangu, Sergiu Caraman. "Fault detection method for a

wastewater treatment process based on a neural model", 2017 5th International Symposium on Electrical and Electronics Engineering (ISEEE), 2017

- [3] ://play.google.com/store/apps/details?id=br.com. escolhatecnologia.vozdonarrador&hl=en_IN
- [4] https://www.cars.com/articles/should-i-worryabout-how-hot-my-engine-is-running-1420680334271//
- [5] http://iopscience.iop.org/article/10.1088/1757-899X/257/1/012083/pdf
- [6] https://cartreatments.com/causes-of-car-enginelow-compression/
- [7] http://www.onestopauto.com/What-causesspark-knock.html
- [8] https://www.ebay.com/gds/How-to-QuietaNoisyEngine/10000000178758687/g.html
- [9] https://www.micksgarage.com/blog/ignitionsystem-faults
- [10] https://dannysengineportal.com/enginecompression/
- [11] https://www.machinerylubrication.com/Read/288 19/engine-lubrication
- [12] www.fmt.vein.hu
- [13] aca2004.aanet.ru
- [14] ljs.academicdirect.org
- [15] http://shodhganga.inflibnet.ac.in/bitstream/10603 /29845/7/07_chapter2.pdf

Authors

First Author- Pratik Goyal, Under Graduate, Ramrao Adik Institute of Technology, pratikgoyal1807@gmail.com

Second Author- Sumedha Fegade, Under Graduate, Ramrao Adik Institute of Technology, sumedhafegade@gmail.com

Third Author- Damini Dabhilkar, Under Graduate, Ramrao Adik Institute of Technology, daminidabhilkar43@gmail.com

Fourth Author-Dr. Sharmila Petkar, PhD. , Ramrao Adik Institute of Technology, profsjpetkar@gmail.com

Correspondence Author- Pratik Goyal, pratikgoyal1807@gmail.com, dudepratik96@gmail.com, 7506411872