Fault simulator of car engine

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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 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].

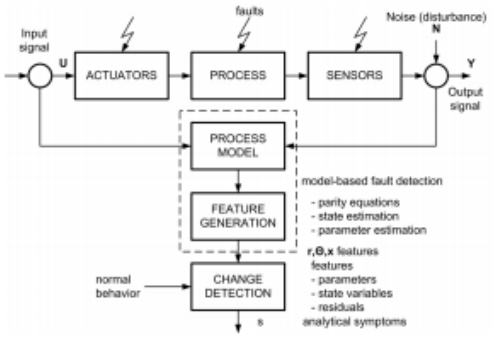

Figure 1: PROCESS MODEL-BASED FAULT DETECTION[1]

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.

Figure 3: about fault window

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

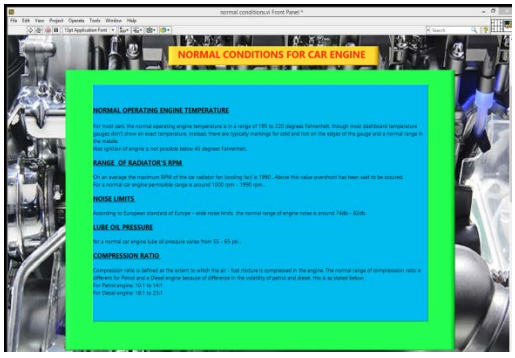

Figure 4: normal conditions window

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

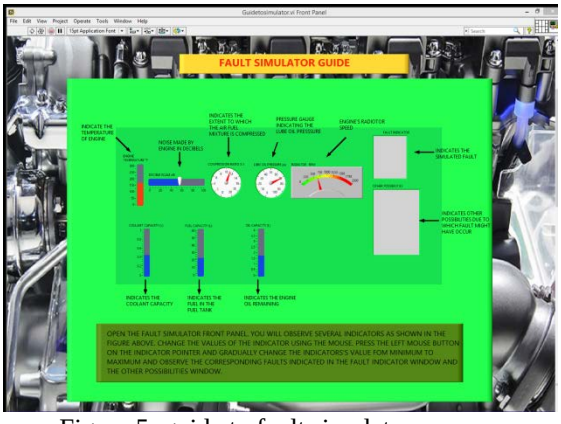

Figure 5: guide to fault simulator

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

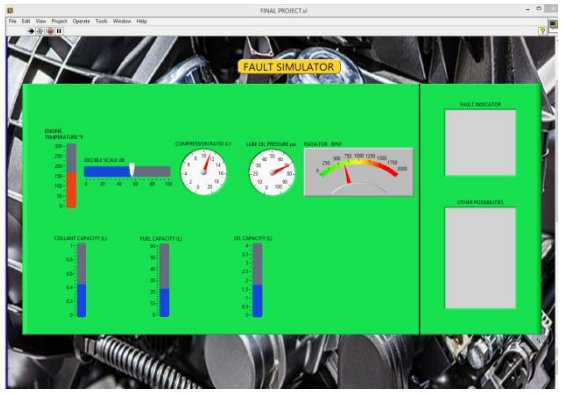

Figure 6: fault simulator wnidow

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.

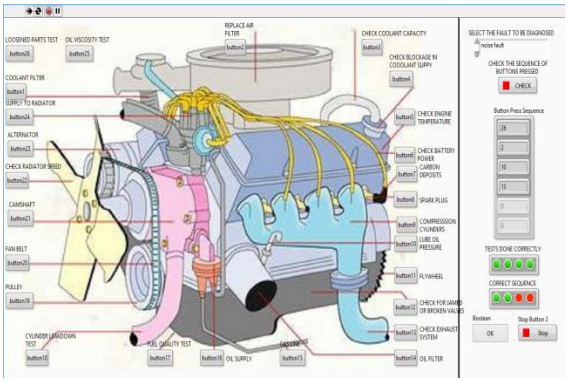

Figure 7: fault diagnosis trainer

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.

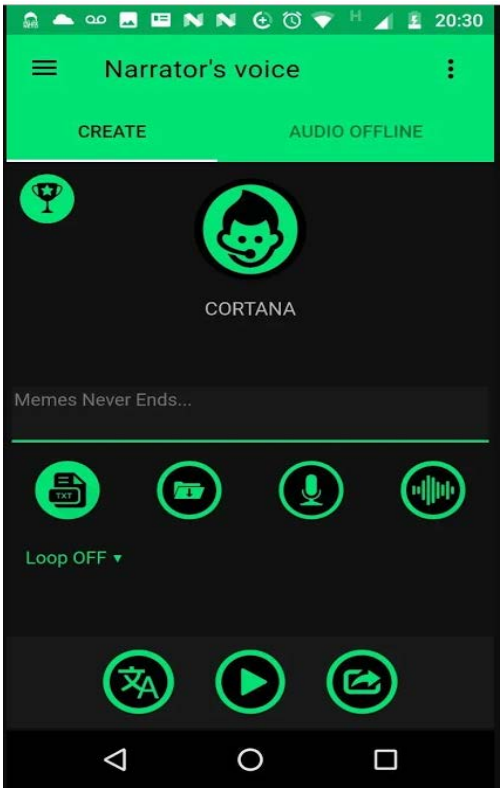

Figure 8: narrator's voice app[7]

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

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