FAULT DETECTION AND DIAGNOSIS FOR INTERNAL COMBUSTION ENGINES

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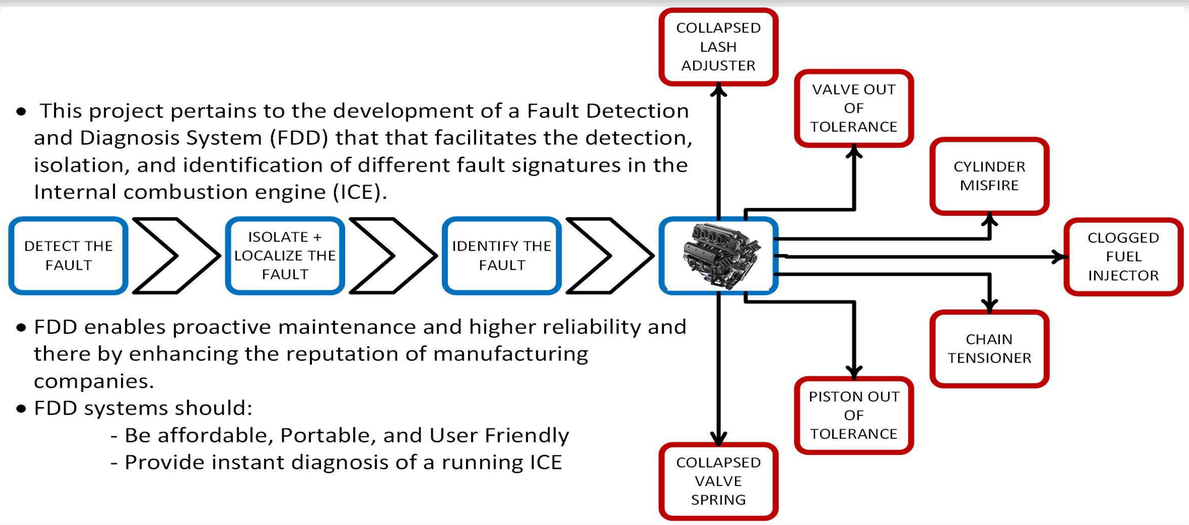
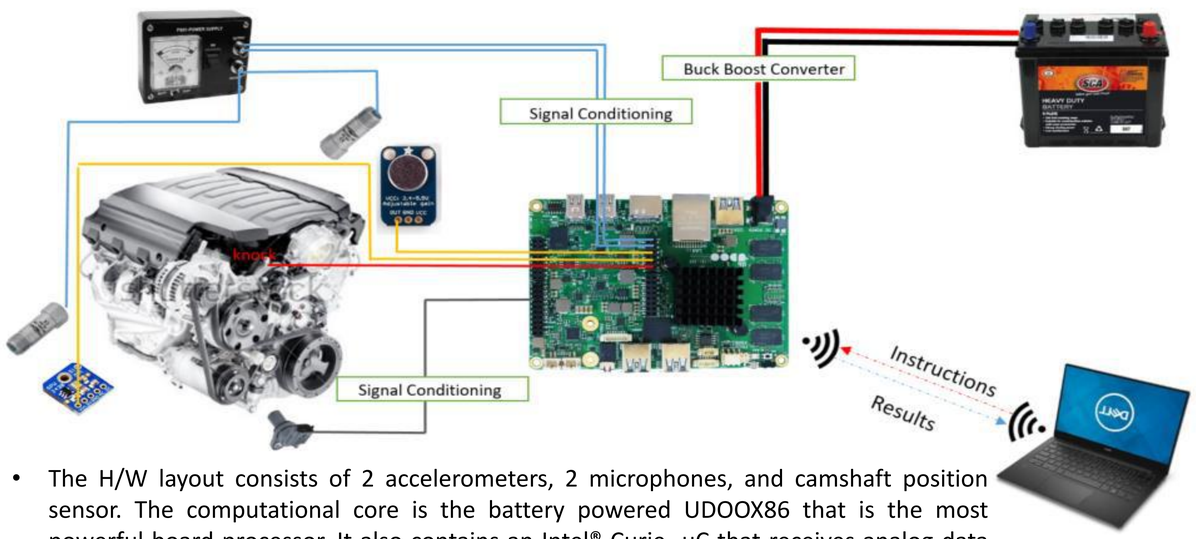
INTRODUCTION

- This project pertains to the development of a Fault Detection and Diagnosis System (FDD) that that facilitates the detection, isolation, and identification of different fault signatures in the Internal combustion engine (ICE).



- FDD enables proactive maintenance and higher reliability and there by enhancing the reputation of manufacturing companies.
- FDD systems should:
  - Be affordable, Portable, and User Friendly
  - Provide instant diagnosis of a running ICE

THE SENSORY SYSTEM (Hardware)



- The H/W layout consists of 2 accelerometers, 2 microphones, and camshaft position sensor. The computational core is the battery powered UDOOX86 that is the most powerful board processor. It also contains an Intel® Curie uC that receives analog data and a powerful 2.56 GHz Quad-Core uP that carries out the required signal processing

CAD DOMAIN IEMSPCA (Software)

The system uses the Industrial Extended Multi-Scale Principle Components Analysis (IEMSPCA) Algorithm that analyses signals in both time and frequency domains to detect any deviations from baseline measurements. If there is a deviation, The software generates faults signatures used to diagnose the fault type.

Collection of the raw data from all analog sensory inputs

Filtering background noise to improve the accuracy of the final results

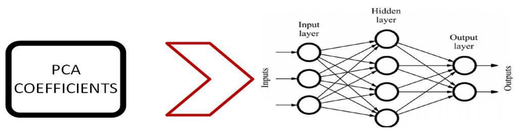
Transformation of time domain to CAD domain in order to account for the periodicity of the faults

The concurrent analysis in both CAD and frequency domain.

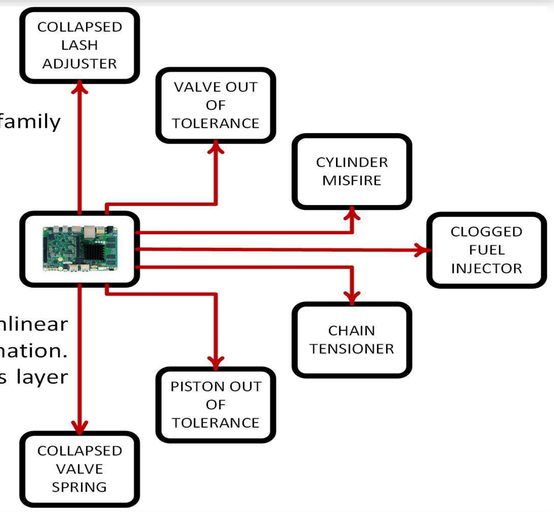
Detection of changes in both CAD and Frequency domains that results in PCA coefficients

DEEP LEARNING AI (Software)

- **Deep learning** in Neural Networks is part of a broader family of machine learning methods.



- In its core, it uses a cascade of multiple layers of nonlinear processing units for feature extraction and transformation. Each successive layer uses the output from the previous layer as input.



RESULTS

- Small, light, and modular Sensory System
- Cloud based API to maximize the learning throughput from many cars
- Expandability over both Hybrid and Electric car models

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