INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN & MANUFACTURING
KANCHEEPURAM, CHENNAI
(An Institute of National Importance Fully Funded by Govt of India)

Project Title: **Development of Low cost IoT based Vibration Spectrum Analyser**

Team: *Ganesh[1], Dhilipan[2], Chandralekha [3]*

MEC320T Project

Project Goal Development of low cost vibration monitoring and spectrum analysis systems for technical objects and provide predictive feedback using IoT.

Project Approach The project will model vibrational monitoring and Spectrum analysis of the Technical objects of the Machinery by a combination of sensor inputs, FFT algorithms , and study & analyse the vibrational parameters. The goal will be to detect the fault in Machine system through Vibrational inputs and provide a predictive control using IoT state-of-technology.

Resources Our plan is to first get a detailed insights of 'Vibrations and Acoustics of Machinery' to validate our idea. Then, Design of experimental setup to study the Vibrational parameters of different faults obtained from machinery (CNC Milling in our case). So, We plan to start with CNC Milling machine available from TLC as the Test machine as it has driving servos (either Bioloids spindle from the stock in 204 Cory or servos from the TLC Inventory supply). The first step in the project will be to identify a suitable wireless network and wireless sensors to use and Correct FFT implementation into Py code. The first goal will be to integrate MEMS based 3-axis accelerometer sensor communicating wirelessly with the RPi. A second input will be a Accelerometer sensor attached directly to the CNC. Combining these two sensor inputs, we plan to realize a IoT based device that will attempt to distinguish between types of vibrational events such as "Looseness," "Misalignment," and "Feed & Depth error." Time permitting, we will integrate additional feedback system to improve Predictive control system.

Our Ask:

Mentorship from experts in this area :

- Idea -> Valid Prototyping
- Sourcing of components needed
- Need more clarity on MECHANICAL VIBRATIONS & ACOUSTICS - WORK?

Academic aid :

- Workspace for us to setup the environment.
- Access to Power machine labs for the study of machines.

Proposed Schedule (Detailed one in GANTT Chart)

- Jan 8-17: Team formation & Project Selection
- Jan 20- 25: Narrowing down for problem statement & Background study.
- Jan 26-31: Project proposal & Making the docs.
- Feb 3-11: Brief study of Vibrational parameters and mathematical derivations etc.,
- Feb 18-25: Design of experimental setup.
  - Calibration of Measured sensor accuracy, modify simulation model.
  - Simplification of circuits with OpAmps, Amps, ICs,Inverter logics etc.,
- Mar 6 - 17: Modelling the Code aspects of the experiment, implementing Py Scripts, FFT transform eqns, etc.,
- Mar 18 - 25: System testing, measure false positives, assess timing effectiveness & taking experts opinions.
- Mar 28 - 31: Working on failures, implementing experts suggestions and Demonstration video made, powerpoint prepare.
- Apr 3: Final presentation and demo.
- Apr 6: Device delivery, Project report and video turned in.

Risk and Feasibility There are many unknowns. Since, we aren't familiarised with Advanced Engg. Maths, it may be a hinge for us. Accelerometer may be hard to calibrate for higher accuracy. Parts leading to the easiest solution may exceed the budget. Network interfaces may be difficult to control, particularly the timing. Software may not port easily to the chosen platform as we are working on linux based environment.

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