Project Description


- The system should be self powered.

- So, we are harvesting energy using vibrations of trains using piezoelectric material.

- Our project is to design cantilever to supply power to explosive vapour detection circuit. Our first task is to find parameters on which resonant frequency, voltage and power output of cantilever depends and to find relation between these parameters and output characteristics of cantilever.

- Using these parameters we will try to maximize power output of cantilever to match power requirement of vapour detection circuit which will consist of simulation of various designs and their fabrication.

Work in last 6 weeks:

- We first formulated resonant frequency of bimorph structure of cantilever and studied variation in resonant frequency with cantilever’s parameters. Then we also formulated resonant frequency for multilayer structure of cantilever. Then we calculated resonant frequency of the current design of cantilever using MATLAB which is around 17 kHz, so our aim is to reduce it in the range of Hz.

- After theoretical calculations we moved to simulation part using COMSOL. We simulated the current design to confirm theoretical calculations.

- In order to reduce resonant frequency we simulated various designs of cantilever like cantilever with proof mass at the end, accelerometer type structure, spiral structure and some other structures. We studied their
resonant frequency variation and stress pattern, as stress is the deciding factor for producing electricity from piezoelectric materials.

- We were able to come up with few designs which can have resonant frequency in the range of Hz.

**Software learned:**

- For theoretical calculation for resonant frequency of cantilever and to study its variation with parameters of cantilever we used MATLAB.

- For simulation we used COMSOL software to study resonant frequency of various designs and study their stress pattern.

After finalising two-three designs we are going to simulate those design for electric properties to study their output voltage and power and then we are going for fabrication part. As this is long term project I am going to continue the project in semester as well.