1 PROPOSAL: Distributed Source Localization Using Numerical Methods

For my project, I intend to build a distributed network of PZT sensors whose cards can localize an impact in a composite board based on a method called Sparse Reconstruction. Figure 1 describes the physical setup of the PZT sensors.

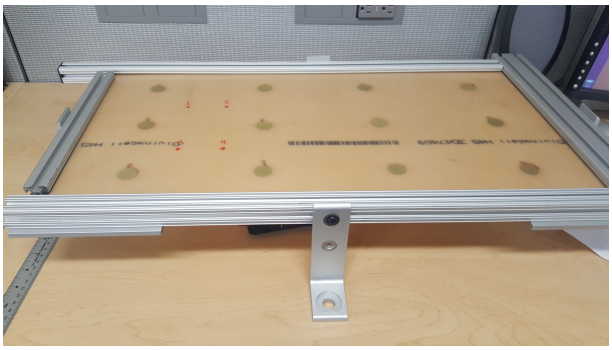

Figure 1: Physical setup of the sensors. It is a composite board with a grid of PZT sensors where each one is connected to a Particle Photon.

It is important to mention that the piezo-sensors can only measure the shear waves that occur during the impact/touch because the voltage comes from having the piezos get "squished." Another consideration to take into account is that solving time is a very important variable since we would like to obtain near-real-time results. Finally, a source position estimate $\hat{\mathbf{r}}^{(j)}(0) = [\hat{x}_{sk}, \hat{y}_{sk}, \hat{z}_{sk}]^T$ is what I intend to determine after the solution of the elastic wave equation. In Figure 1, the dots drawn with sharpies indicates the positions that I will be testing.

Here is my detailed plan of attack:

- Set up the elastic wave equations in rectangular coordinates and solve that for one sensor assuming constant force and matching the x-y distance to the one where a similar pattern was produced.
- Try to map that x-y information into polar coordinates so I have information on the radius and angle of that sensor's estimation.
- Produce a heat map of those solutions.
- If I have time, try to solve the same problem assuming information coming from the other sensors so I can move on with a distributed approach in the future or try solving the problem in an unstructured grid.