# 6.111 Fall 2018 Final Project Abstract

# Audio Controlled Levitator

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For this project, we will use a constant frequency audio input signal to control the height of a levitated object.

We will use a microphone to receive an input tone at given frequency, generated by either an instrument or a person. Then we can map the strongest frequency of the signal to a given position in a our levitator. The frequency detection can be done by implementing an FFT at a given rate and updating the system with the most recent results. This will produce a discrete stream of positions. To produce positions in more dimensions, we could bandpass the signal in parallel and use the frequency information in each band to map to a different axis.

Our levitator will be modeled as a single-input-single-output system, with the input being the processed audio signal and the output being the height of the levitator. The levitator plant will take one of two forms, dependent on material availability and implementation feasibility. The simpler form will be to use the FPGA to control the speed of a fan, which will then be used to blow a ping pong ball into the air at a specific height. A 3D printed external tube will be used to constrict the ball's movement to the z-axis only, and an infrared sensor will be used to track the ball's height. The more complex form will be similar, but will use a magnetic levitation system instead of a fan and ping pong ball, requiring more complex dynamics modeling. The controller would ideally be a PID controller, but this can be scaled up or down in complexity as necessary.

A final most complex version of the project would take in more than one audio input signal and control a levitator with more than one axis degree of freedom.