



**CALIFORNIA STATE SCIENCE FAIR  
2015 PROJECT SUMMARY**

<b>Name(s)</b> Ayush Gupta	<b>Project Number</b>  35546
<b>Project Title</b> <b>Arduino, FFT, &amp; Hot-Wire Anemometers: Creating a Device for a Developing Woodwind Player</b>	
<b>Objectives/Goals</b> It is important for a young instrument player to be in tune when playing. A wide variety of tuners simply tell the student what they are doing wrong, but don't suggest a way to fix the problem. For many, the reason notes are not in tune can be because they are not blowing with correct airspeed. I aimed to fix these problems when I started this project. The microphone and FFT tell the Arduino if the note played is off tune, and the hot-wire anemometer determines if airspeed is the problem. <b>Abstract</b> Objectives: To create a device that mimics a musical instrument tuner, but also provides feedback on how to correct playing. To write Arduino code that effectively recognizes notes compared to a normal tuner. To build a fully capable hot-wire anemometer. To have an understandable output display Materials: Arduino Due, Laptop, Electret microphone, Lightbulb (4W, tungsten filament), Breadboard, Misc electrical parts Procedures: Research FFT, HWA/airspeed. Build microphone circuit, connect to Arduino. Write code to measure frequency using FFT. Build HWA circuit, connect to Arduino. Measure a range of in-tune notes for velocity of each note (calibrate). Write Arduino program that takes into account airspeed, pitch, volume. Create visual feedback interface on TFT/LCD display screen Overall, this device was a general success, because all steps of the procedure were completed, and the general objectives outlined prior to the design were met. The code written for the device fulfilled design criteria, note recognition successful. The hot-wire anemometer operates well. The LCD screen provided clear display for device's coherent output. Although successful, this project was not without issues and challenges. The hot-wire anemometer, built directly onto the breadboard, proved to be very difficult to initially tune and then maintain. The potentiometers were very sensitive and susceptible to minute changes. However, this was somewhat as expected, as circuits of these type are known to be finicky. Programming the Arduino for two ADC channels also proved to be somewhat difficult. Aside from learning about FFTs and hot-wire anemometers, a side objective, I also became more #fluent# in C, the language of Arduino. Also, I obtained a better grasp of programming, circuit theory, and prototyping in general.	
<b>Summary Statement</b> The purpose of this device is to provide constructive feedback to a woodwind player on HOW to correct their playing.	
<b>Help Received</b> Father helped in design of circuit, tuning potentiometers, and general guidance.	