



# UNIVERSITY of ROCHESTER

## AUDIO & MUSIC ENGINEERING

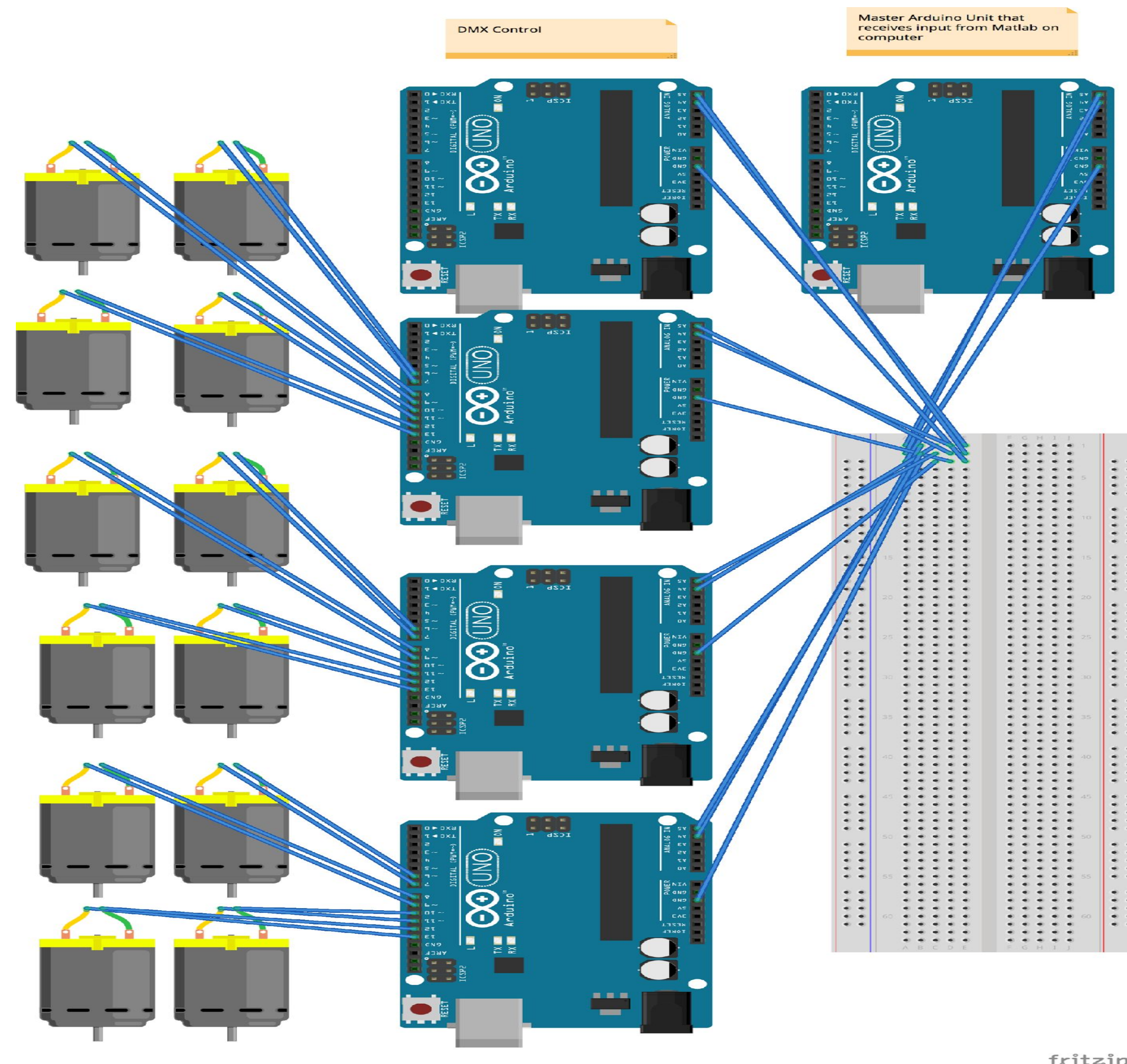
## H2wOah

Real-Time Chromagram interacting with Arduino units to generate a musically responsive water/light show

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### Abstract

H2wOah is a chromagram representation of music and audio that allows for viewers to have an intuitive yet interactive experience. This device also lets non-musicians to learn about basic tonalities as they appear in front of them. The approach used was determined to be successful as the project does react in real time to the data that is used as input. It was also noisy depending on the input signal source (audio file versus microphone input), The chromagram function is also not as robust as we would like and therefore there is overlap between notes.



### Future Outlook

- Integrated structures in public places that use this concept running on solar power
- Explore other concepts of Chromesthesia with artists who animate and create music based on what they draw

### Acknowledgements

We would like to thank Professor Duan, for all of his guidance and support on this project. Through this project, we were able to fortify our knowledge in sampling, digital to analog conversion, real-time audio signal processing, and chromagram algorithms. We are grateful for the opportunity to build this fountain, we think it's really cool.

### Concept

A combination of Matlab, Arduino units, a DMX shield, water pumps and an LED strip were used to create the physical representation of a chromagram. First, a song is uploaded to a computer on Matlab, where the chromagram is taken from in real time as it's being played. Then the output values send to a master Arduino unit. This master unit controls 1 Arduino dedicated to DMX controls while the other 3 Arduino units control 4 water pumps each so that there is full representation of the 12 notes in an octave.

### Methods

- Matlab
  - Real-Time Chromagram
- Arduino
  - Adafruit
  - Used to output values to 12 water pumps represented as DC Motors in the diagram
- DMX
  - DMX Shield
  - Language protocol used with a separate Arduino unit to communicate with LED Strip that has 12 lights

### References

- [1] "Adafruit Library Reference" .*Adafruit Motor Shield V2 for Arduino (2017)*  
<<https://learn.adafruit.com/adafruit-motor-shield-v2-for-arduino/library-reference>>
- [2] "Chromagram Representation for Music Signals". (2017)  
<<http://www.ece.rochester.edu/~zduan/teaching/ece472/lectures/Chromagram.pdf>>
- [3] "DMX Library for Arduino". *Conceptinetics*. (2017)  
<<http://sourceforge.net/projects/dmxlibraryforar/files/>>