

# **Aliased Water Illusion Screen**

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**ECE 445 Project Proposal — Spring 2017**

**TA: Luke Wendt**

# 1 Introduction

## 1.1 Overview

During the pitching session, we heard our TA Luke Wendt talked about the Aliased Water Illusion project. The project is based on the stroboscopic effect. Essentially by adjusting difference between sampling rate, we can create an illusion of objects floating in the air or flying up. We want to create a screening wall for interior house design.

## 1.2 Background

First time we saw this illusion is from the movie Now You See Me 2. The magician in the movie used a sprinkler system and set of lights to create the illusion of water floating in midair. The effect is so impressive that it made an burning impression on almost everyone. After listening to the pitch from Luke Wendt, we went on with a bit research on our own. Turns out there has already been an product on the market that utilize this effect.

[https://www.amazon.com/Levitating-Waters-Gravity-Defying-Water/dp/B00OBSMOLA/ref=sr\\_1\\_1?s=toys-and-games&ie=UTF8&qid=1486548696&sr=1-1&keywords=levitating+water](https://www.amazon.com/Levitating-Waters-Gravity-Defying-Water/dp/B00OBSMOLA/ref=sr_1_1?s=toys-and-games&ie=UTF8&qid=1486548696&sr=1-1&keywords=levitating+water)

However we do realize there are limitation to the current design.

1. Current product on Amazon is overpriced to 300 dollars.
2. Current design is limited to perform the optical illusion on one stream of droplets, even in the movie they fail to implement an interaction between streams of droplets. All droplets stays in the same location on the horizontal plane.
3. The current size of the product made it less likely to have any utility other than being a “neat thing to have” on customer’s table.

And we decided to tackle and improve this product from these perspective.

1. we aim to decrease the cost for production.
2. we aim to have interacting illusion between streams of water.

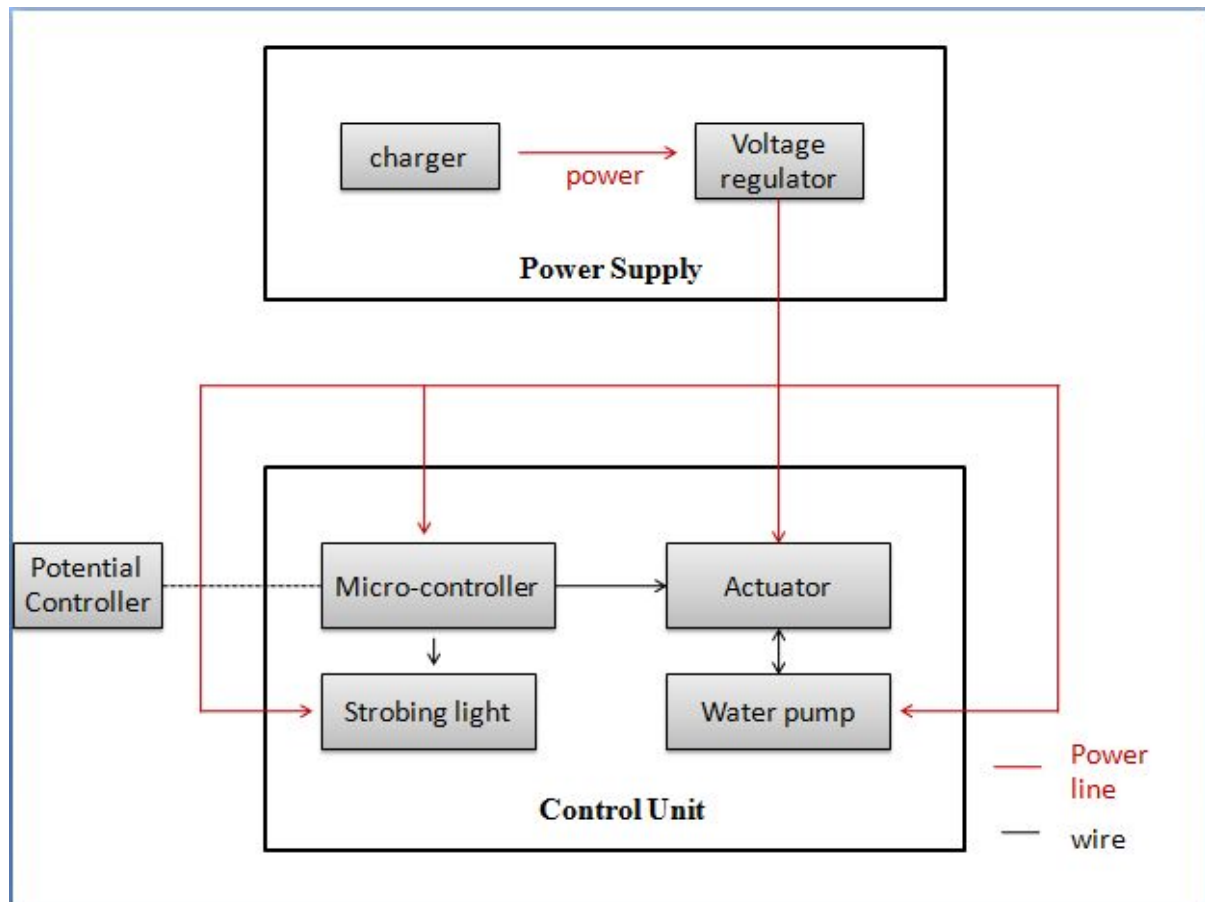
3. And we aim to build a model that would function as a screen and decoration for interior design.

### 1.3 High-Level Requirements

The undersampling of water is achieved by having a matching frequency for the vibration of water/falling objects and the observant (usually a frame rate of a camera or the rate of flickering light if you want it to be captured by human eye). Therefore I believe our system would consists of five parts.

- A group of actuator that create the right amount of frequency with a water hose attached to it
- Array of strobing light for strobing effect
- A water pump system so we can recycle the water
- A nice separation between the electronic component
- Control system that controls all of this

## 2 Design



## 2.1 Power Supply

A power supply is required to keep our instruments work continually. Power from the charger in the wall will provide the main power for our instruments.

### 2.1.1 Wall Adapter

Our water pump and potential speaker would be powered from an wall outlet. The power would go through a wall adapter and go through the voltage regulator.

<https://www.sparkfun.com/search/results?term=wall+adapter>

### 2.1.2 battery

We consider using Li-ion battery for our light sets and actuators to provide 10 to 12 volts.

<https://www.sparkfun.com/categories/54?page=all>

### 2.1.3 Voltage regulator

We plan to implement a voltage converter or use the voltage regulator to get different voltages. We will use a flyback converter with two secondary coil transformer ( one primary side and two secondary side ). We are trying to control the range into  $\pm 1$ Volts. In this way we can control our actuator charging with using one wall charging.

<http://www.analog.com/en/products/landing-pages/001/fundamentals-of-voltage-regulators.html>

## 2.2 Control Unit

### 2.2.1 Microcontroller

We intend to use either a raspberry pi or an arduino board as our control unit. As for which one, we have not really decided which one. We may consult our TA or ECE store again in this.

(We may purchase from ECE store or Sparkfun.)

### 2.2.2 Strobing Light

We talked to people in ECE store. After listening to our description, they advised us to purchase strobe light rather than using LEDs. The first reason being LED might not be able to shut off fast enough (expecting as fast as about 30-60Hz). Second reason being there exists strobing light for us to use. However we do realize we need to have specific control over each single light bulb, if we buy a bulk of strobe light set, we may not be able to rule out LED completely. We might purchase both and see which one gets the job done. (Or we could do more research before we do any more purchase.)

<http://www.goldmine-elec-products.com/prodinfo.asp?number=G17891>

(did not include frequency, would ask for further specification), worst case scenario we build something like this.

<https://www.superbrightleds.com/cat/rgb-led-controllers/>

### 2.2.3 Actuator

Luke mentioned solenoid actuator and we looked into it. We believe it could potentially for a great fit for our project. But as for how well it would perform we need to have the device on hand to tell how well it would do. If it does not perform well we would switch over to an set of audio speakers.

Potential Purchase:

[http://www.robotshop.com/en/5v-solenoid.html?gclid=CjwKEAiAoOvEBRDD25uyu9Lg9ycSJAD0cnBy6JpQBWK8M3Lvllc\\_6dXcP1WUS1LBf9Z\\_T-7UmSL09RoCUCRw\\_wcB](http://www.robotshop.com/en/5v-solenoid.html?gclid=CjwKEAiAoOvEBRDD25uyu9Lg9ycSJAD0cnBy6JpQBWK8M3Lvllc_6dXcP1WUS1LBf9Z_T-7UmSL09RoCUCRw_wcB)

<https://www.sparkfun.com/products/11015>

## 3.Procedure by Steps

We project to work on this project in the following steps.

1. We would purchase the water pump, make sure water is running alright, preferably controlled by our controller. Get the easy part out of the way. (This is probably going to take the first two to three weeks)
2. Meanwhile get LED and speaker. Connect it to the controller we design. Attempt to make levitating effect. (Preferably this would take us one week to finish the controller coding and the lights and actuator to work accordingly. )
3. Evaluate remaining time, if we have time, implement the additional music component, if not, ready to proceed to encapsulation.

4. We would reserve enough time to make sure we get to design the illusion pattern for the droplets.

Luke mentioned no one has done anything like this before, for example a drop going in a loop.

Meanwhile evaluate the potential of doing other medium. (For example apply the system to an huge hourglass.

Wrap up, finish final report and presentation.

#### 4. Safety and Ethics

We understand that there is a strict policy of having no water in the lab. We plan to follow exactly what the lab instruct us to do. We were going to test our project by parts. The power system, actuator and light system can be tested as one part. Water pump, water tank and the waterproof system can be tested as the second part. The combination of two system would be done outside of the Electrical and Computer Engineering Building. We would submit that in the form of video recording.

All members of our team would complete the safety training before entering the ECE senior design laboratory. And we would strictly follow the safety guideline posted on

<https://courses.engr.illinois.edu/ece445/guidelines/safety.asp>.

As for engineering ethics, we would follow Code of Ethics published by IEEE and ACM and we would read, understand and comment on any sections of the code that bear directly on the project.

Also our team would keep an high personal standards of conduct consistent with the IEEE and ACM Code of Ethics. By the end of the project we believe we can proudly attach our name to our project and let it signify the effort we spent and knowledge we acquire from our college career.

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