

# WCP18 Dancing Fountain

BINGHAMTON SMALL SCALE SYSTEMS INTEGRATION AND PACKAGING

DATE: 05/08/2015

LOCATION: ES2008E



## WCP18 Dancing Fountain Team Members:

**Isaac Patka**  
Electrical Engineer

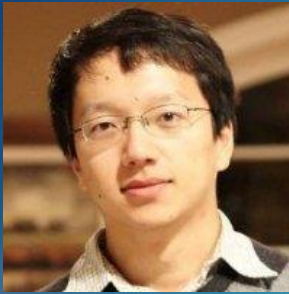
**Vivian Mo**  
Mechanical Engineer

**Mehdi Lamkies**  
Mechanical Engineer

**Priscilla Li**  
Computer Science



2



Dr. Zhang



Dr. Czarnecki

WCP18 Dancing Fountain  
**Advisors:**

Faculty Advisor: Dr. Zi-Ang Zhang  
External Advisor: Dr. Steve Czarnecki

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

3

# Outline

1. INTRODUCTION
2. SOLUTION ANALYSIS
3. DESIGN
4. EVALUATION
5. BUDGET & SCHEDULE
6. SUMMARY

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

4

## Background

- ▶ Sponsored by The Small Scale Systems Integration and Packaging (S3IP)
- ▶ Goal:
  - ▶ Functional Prototype Dancing Fountain
  - ▶ Integration to the Fountain outside Center of Excellence

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

5

## Problem Identification

- ▶ Programmable and Interactive Interface
  - ▶ Customizable Sequences
- ▶ Prototype Dancing Fountain
  - ▶ Water streams exhibit identical characteristics

Modular and Expandable Design



Figure 1. Existing Dancing Fountain

[http://miragewaterworks.com/images/MobileDancingFountains\\_pic1-2.jpg](http://miragewaterworks.com/images/MobileDancingFountains_pic1-2.jpg)

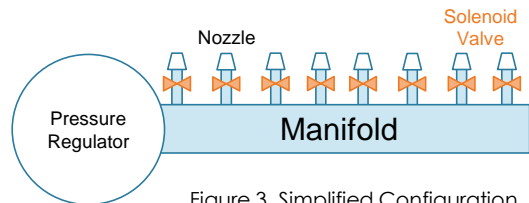
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

6

## Technical Requirements

- ▶ 8-Programmable Nozzles
- ▶ Web-based Interface for Control
- ▶ Graphical Preview of Sequences
- ▶ Maximum and Minimum Height Requirement
- ▶ Uniform Discharge Characteristics



7

## Outline

1. INTRODUCTION
2. **SOLUTION ANALYSIS**
3. DESIGN
4. EVALUATION
5. BUDGET & SCHEDULE
6. SUMMARY

8

## Design Process



Submersible

Table Mount

Free standing



Watson Capstone Project Team 18 - Dancing Fountain

August 20, 2015

9

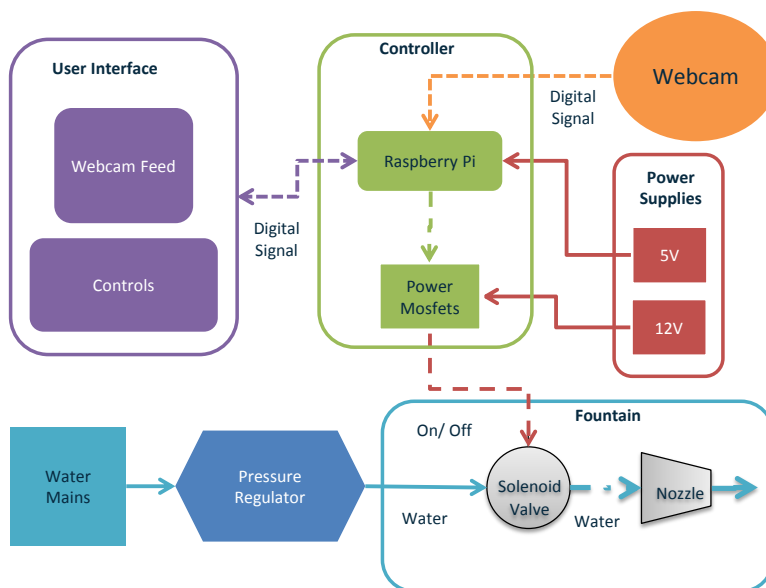


Figure 2. System diagram of prototype Dancing Fountain

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

10

# Outline

1. INTRODUCTION
2. SOLUTION ANALYSIS
3. **DESIGN**
4. EVALUATION
5. BUDGET & SCHEDULE
6. SUMMARY

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

11

## System Controller Web Design

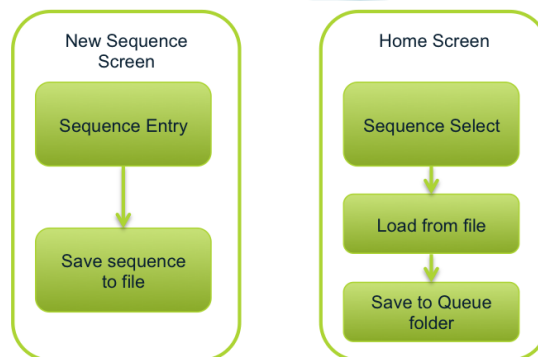


Figure 4a. Flowchart representation of sequence execution

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

12

# System Controller

Web Design

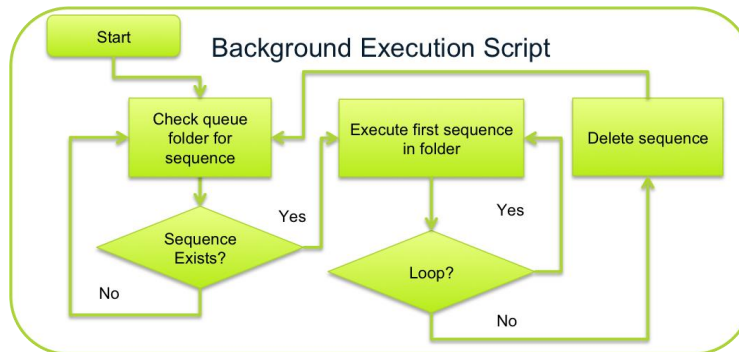


Figure 4b. Flowchart representation of sequence execution

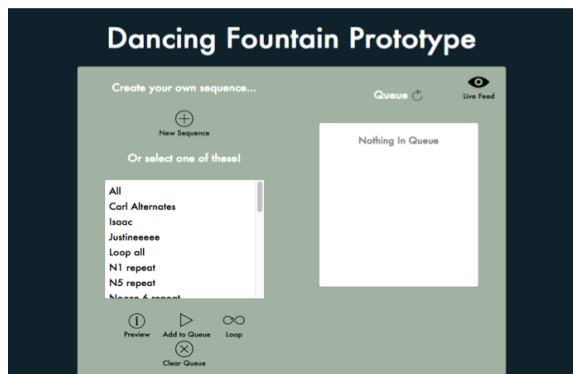
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

13

# Graphical User Interface

Web Design



Welcome Screen

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

14

# Graphical User Interface Web Design

**Dancing Fountain Prototype**

	Nozzle 1	Nozzle 2	Nozzle 3	Nozzle 4	Nozzle 5	Nozzle 6	Nozzle 7	Nozzle 8	Frame Length (s)
frame 1									1
frame 2									1
frame 3									1
frame 4									1

Back Add More Rows Preview

Name Your Sequence! Submit

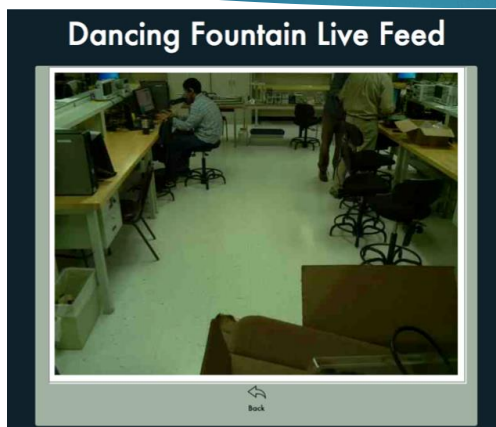
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

New Sequence

15

# Graphical User Interface Web Design



Watson Capstone Project Team 18 - Dancing Fountain

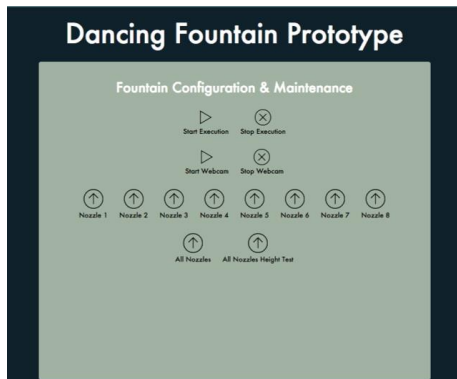
May 8, 2015

Webcam



16

# Graphical User Interface Web Design



Setup

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

17

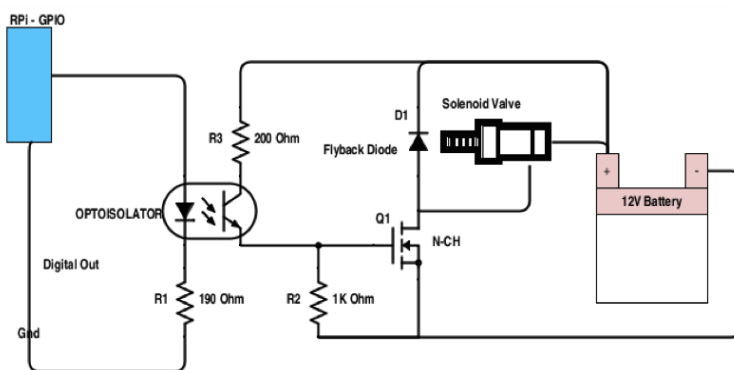
Circuitry EE Design

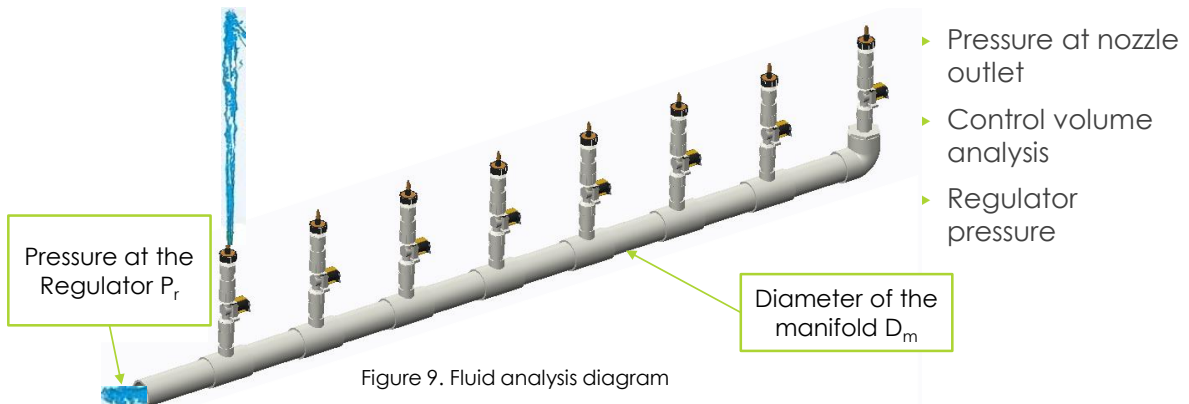
Figure 5. Electrical schematic from system controller to solenoid valve

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

18

## Fluid Mechanics Analysis



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

19

## Computer Aided Design Model ME Design

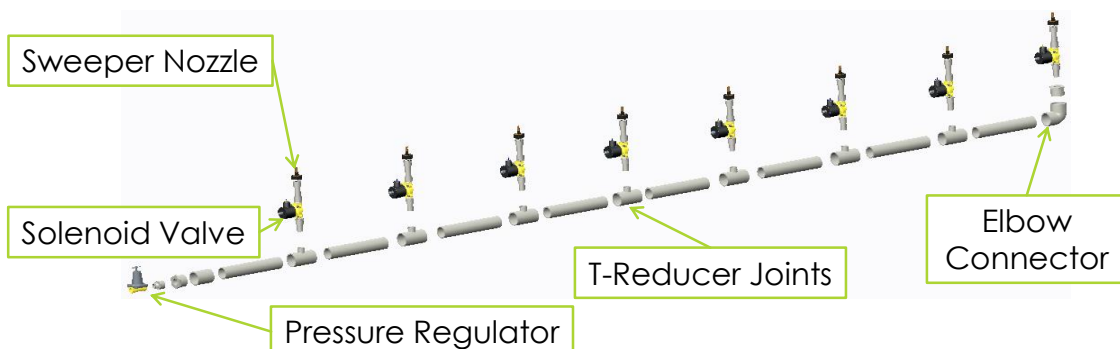


Figure 6. CAD model of Dancing Fountain configuration

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

20

# Solenoid Valve<sub>ME</sub>

Design

## Solenoid Valve Subassembly



Figure 8. Solenoid Valve Subassembly

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

21

# Waterproofing

## Spray Foam

## Flex Hose

## Spray Tape



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

22

# Outline

1. ~~INTRODUCTION~~
2. ~~SOLUTION ANALYSIS~~
3. ~~DESIGN~~
4. ~~PROJECT BUDGE~~
5. ~~PROJECT SCHEDULE~~
5. **EVALUATION**
6. SUMMARY

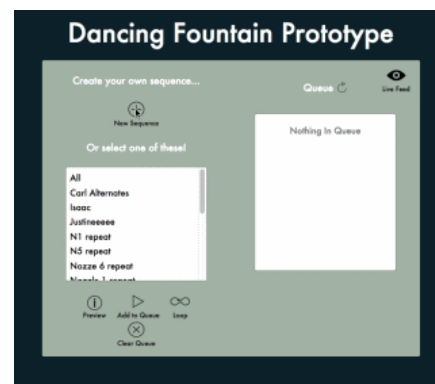
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

23

# Testing

- The prototype DF shall provide means for user to program the DF via a nozzle control schedule



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

24

## Testing

- The DF programming system shall provide event-based simulation of user nozzle control schedules



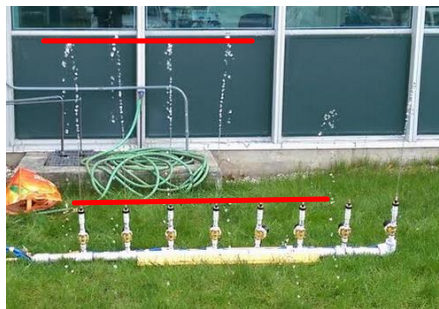
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

25

## Testing

- The discharge characteristics (e.g., pressure, flow rate, stream dimensions, and projected stream height) for all nozzles shall be identical, whether actuated singly, or simultaneously with others.



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

26

## Recommendations- Mechanical

- ▶ Weatherproofing
- ▶ Structural Integrity



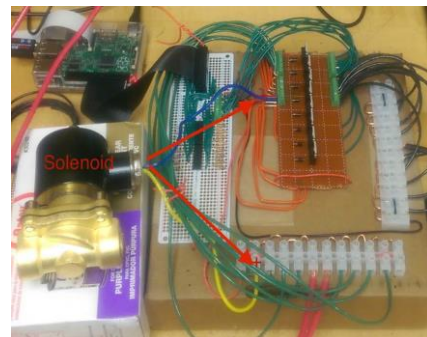
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

27

## Recommendations- Electrical

- ▶ PCB
- ▶ Quick Connections



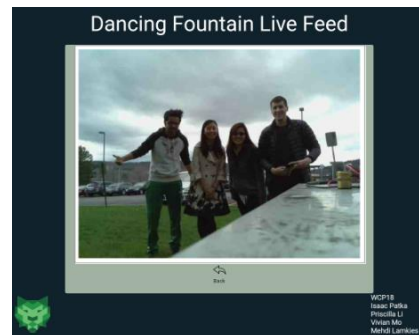
Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

28

## Recommendations- Computer

- ▶ Server upgrades
- ▶ Web traffic
- ▶ Short burst requirement



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

29

## Demonstration



Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015



30

# Outline

- ~~1. INTRODUCTION~~
- ~~2. SOLUTION ANALYSIS~~
- ~~3. DESIGN~~
- ~~4. EVALUATION~~
- 5. BUDGET & SCHEDULE**
6. SUMMARY

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

31

## Project Budget

**Total Budget: \$900.00**

Item	Original Estimate	Completion
Pressure Regulator	\$100.00	\$100.00
Valves (8)	\$120.00	\$208.00
Nozzles (8)	\$60.00	\$30.00
PVC Parts	\$50.00	\$40.00
Raspberry Pi	\$40.00	\$40.00
Camera	\$25.00	\$25.00
Circuit components	\$100.00	\$88.33
Power supply	\$60.00	\$130.00
Prototyping	\$100.00	\$105.17
Waterproofing	\$20.00	\$15.13
<b>Total</b>	<b>\$675.00</b>	<b>\$781.63</b>

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015



32

# Fall 2014

September

▶ Project Kick-Off

October

- ▶ Project Requirements Specification
- ▶ Product Development Plan
- ▶ Purchase Parts

November

- ▶ Architecture Report
- ▶ Start Prototyping
- ▶ Interim Report

December

▶ Final Presentation

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

33

# Spring 2015

December –  
January

- ▶ Build Website
- ▶ Order Parts and Basic Testing
- ▶ Begin Construction of Prototype

February –  
March

- ▶ Integrate System Controller and Website Interface
- ▶ Integrate Electronic and Mechanical Components
- ▶ Test System

April –  
May

- ▶ Debug and Repair Faulty Components
- ▶ Final Adjustments on Prototype
- ▶ Demonstration and Final Presentation

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

34

# Outline

- ~~1. INTRODUCTION~~
- ~~2. SOLUTION ANALYSIS~~
- ~~3. DESIGN~~
- ~~4. EVALUATION~~
- ~~5. BUDGET & SCHEDULE~~
- 6. SUMMARY**

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015

35

# Summary

- ▶ Clearly define project purpose
- ▶ Brainstorm and evaluated solutions
- ▶ Design
- ▶ Budget and Schedule

Watson Capstone Project Team 18 - Dancing Fountain

May 8, 2015



Thank you!  
Questions?