Wet Design Senior Clinic Computer Engineering

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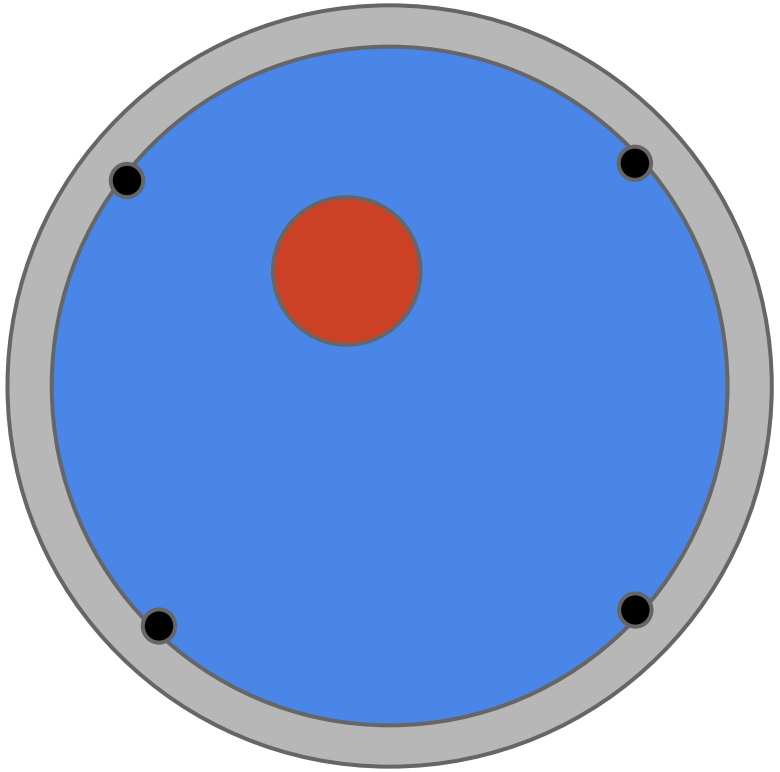
Intro

- Project Summary
- Interface Specifications
- Bill of Materials
- Risk Assessment & Mitigation
- Preliminary Tasking
- Preliminary Timeline

Levitating Sphere

- Four pumps balancing a spherical object
- Range sensor around pool
- Fountains would move object depending on how close a person is



Interface Specifications

- I2C bus for all range finders
    - don't need to have fast constant connection

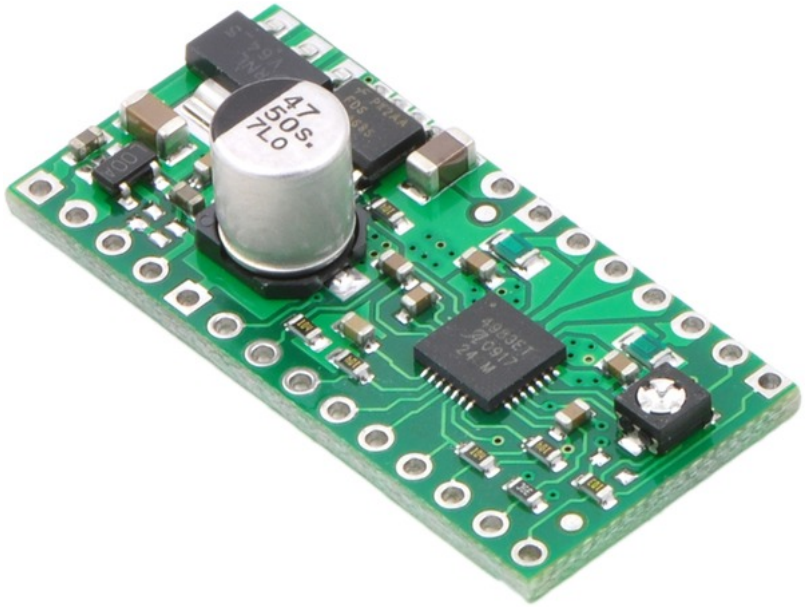
- Devantech SRF02
    - 16 unique I2C addresses

Interface Specifications

- A4988 Stepper Motor Driver

- Dir, Step line for each driver

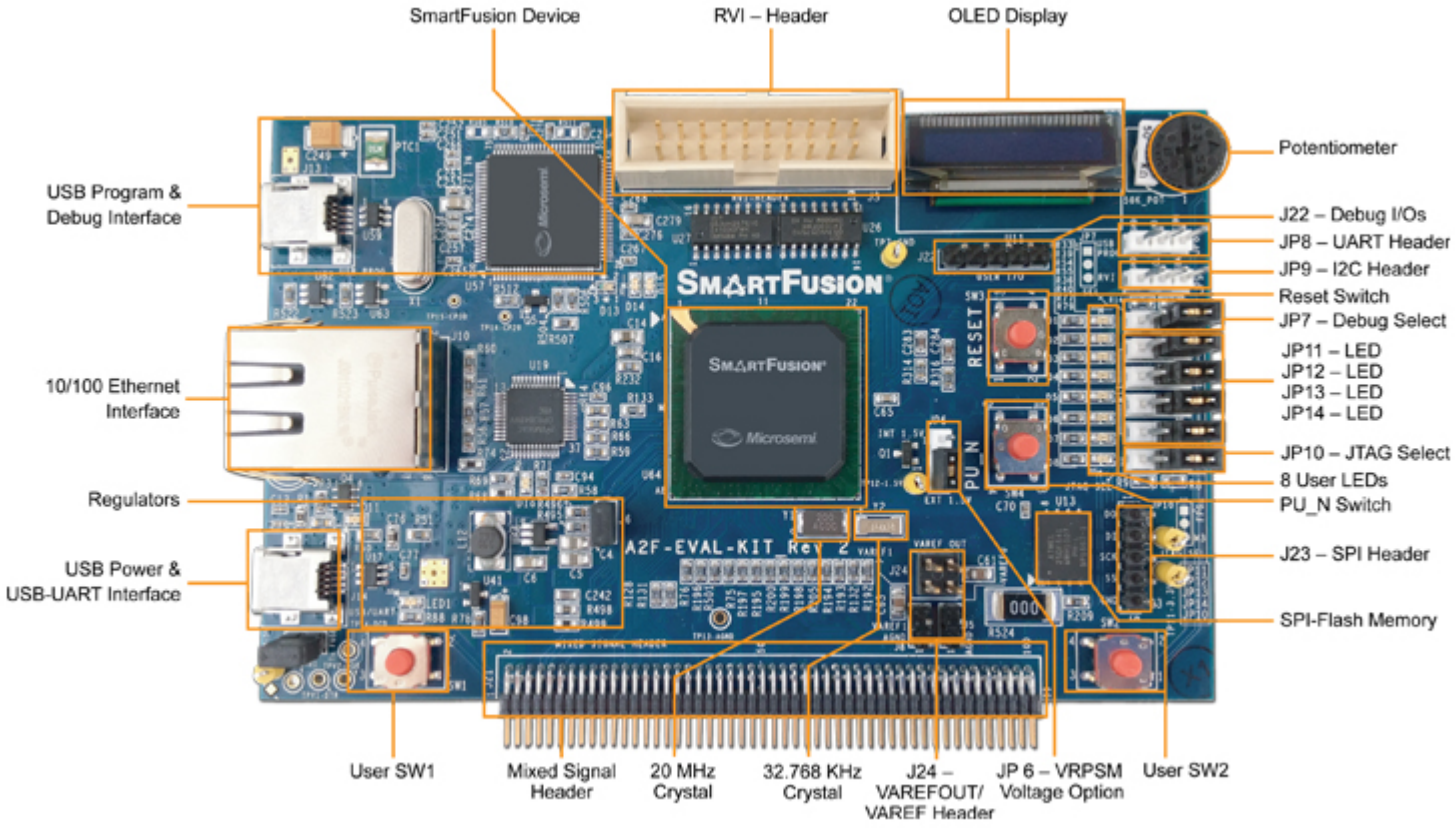
- 16 GPIO pins to control 8 stepper motors



Interface Specifications

- Need central control with
    - I2C hardware support
    - 16 GPIO lines
    - UART for debug/config

Interface Specifications



Final Bill Of Materials

Our Responsibility:

1	SmartFusion Eval Kit	$99	Actel
12	Devantech SRF02 Sonar Range Finders	$294	Acroname Robotics
8	A4988 Stepper Motor Drivers	$240	Pololu
	Misc wire & connectors	$50	

EEs & MEs Responsibility

Motors

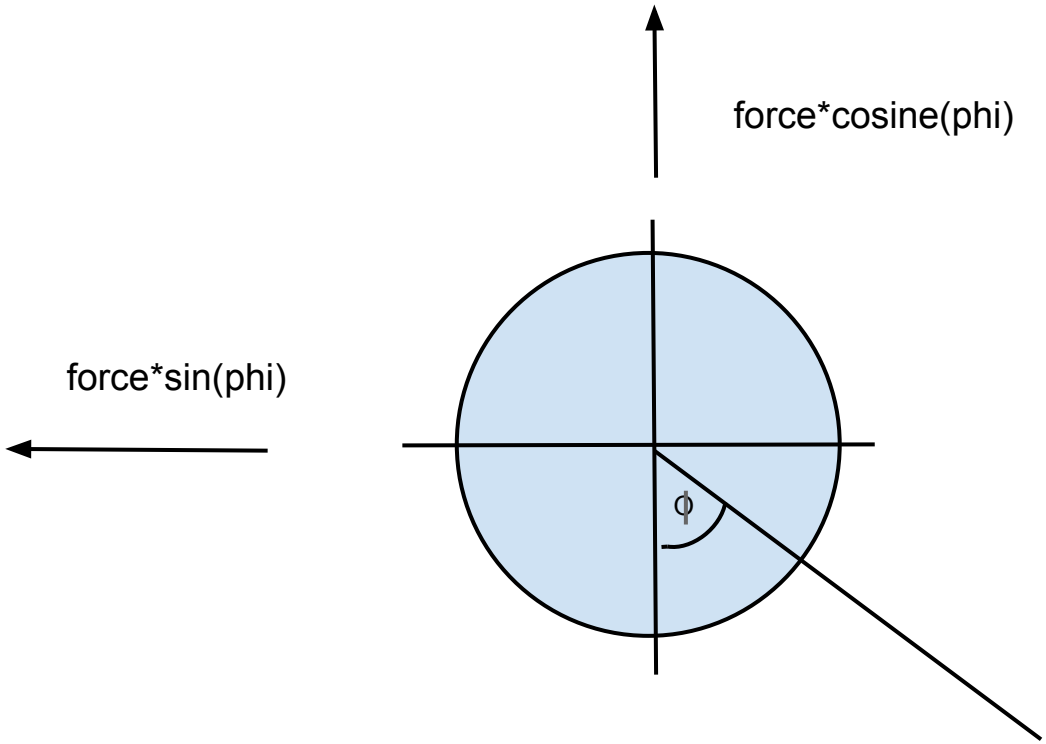
Water Pump(s)

Reservoir

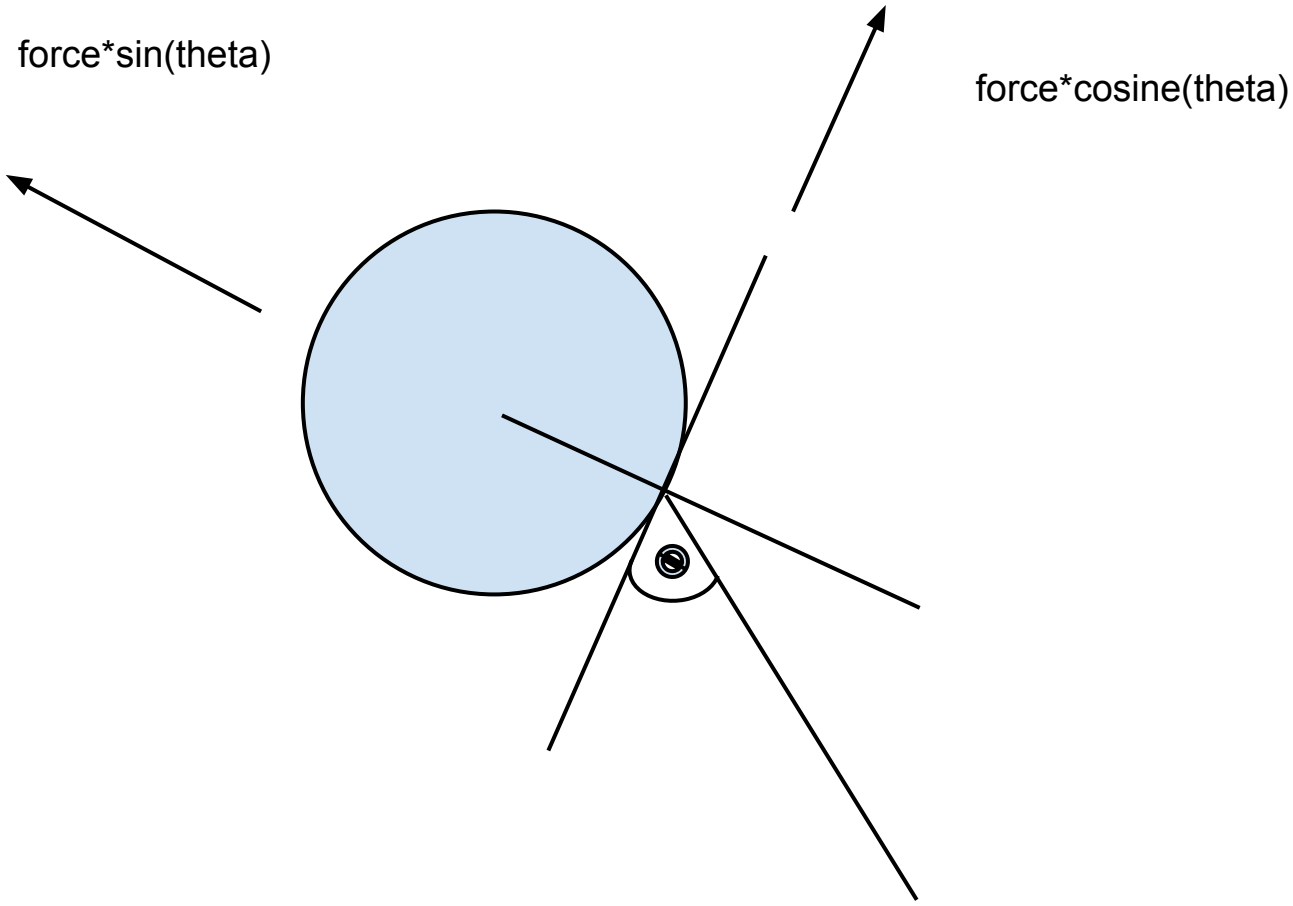
Materials for Fountains

Risk Assessment

Deriving an accurate mathematical model that reflects the control of the sphere



The straightforward physics.



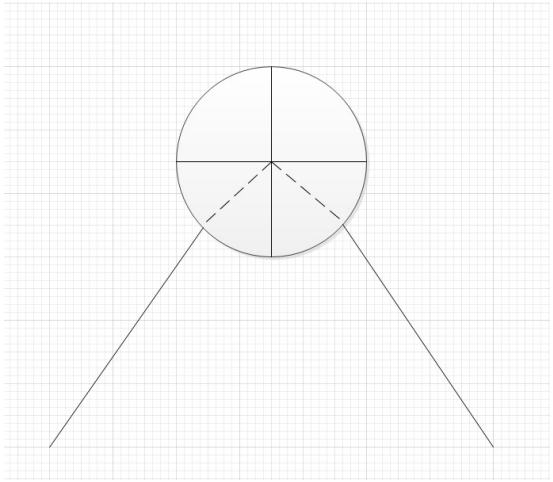
Challenging physics.

Risk mitigation

Deriving an accurate mathematical model that reflects the control of the sphere

-Preliminary work on this points towards it being more reasonable than previously thought.

-Mechanical engineers have a strong skill set that is applicable to this part of the project.



Risk Assessment

Design and implementation of mathematical model that fits the control loops timing constraints

Risk mitigation

Design and implementation of mathematical model that fits the control loops timing constraints.

-Implementation of this does not appear to be as computationally intensive as it first appeared, so the risk of timing issues seems unlikely.

Risk Assessment

Tracking of Sphere, because of wind we may need to track the sphere.

Risk Mitigation

Tracking of sphere, because of wind we may need to track the sphere.

-Instead of tracking the sphere we can measure wind speed and direction. From this we can derive the force on the sphere and compensate with the water jets.

Risk Mitigation

$$R = \frac{1}{2} * D * p * A * V^2$$

P = density of air ≈ 1.29

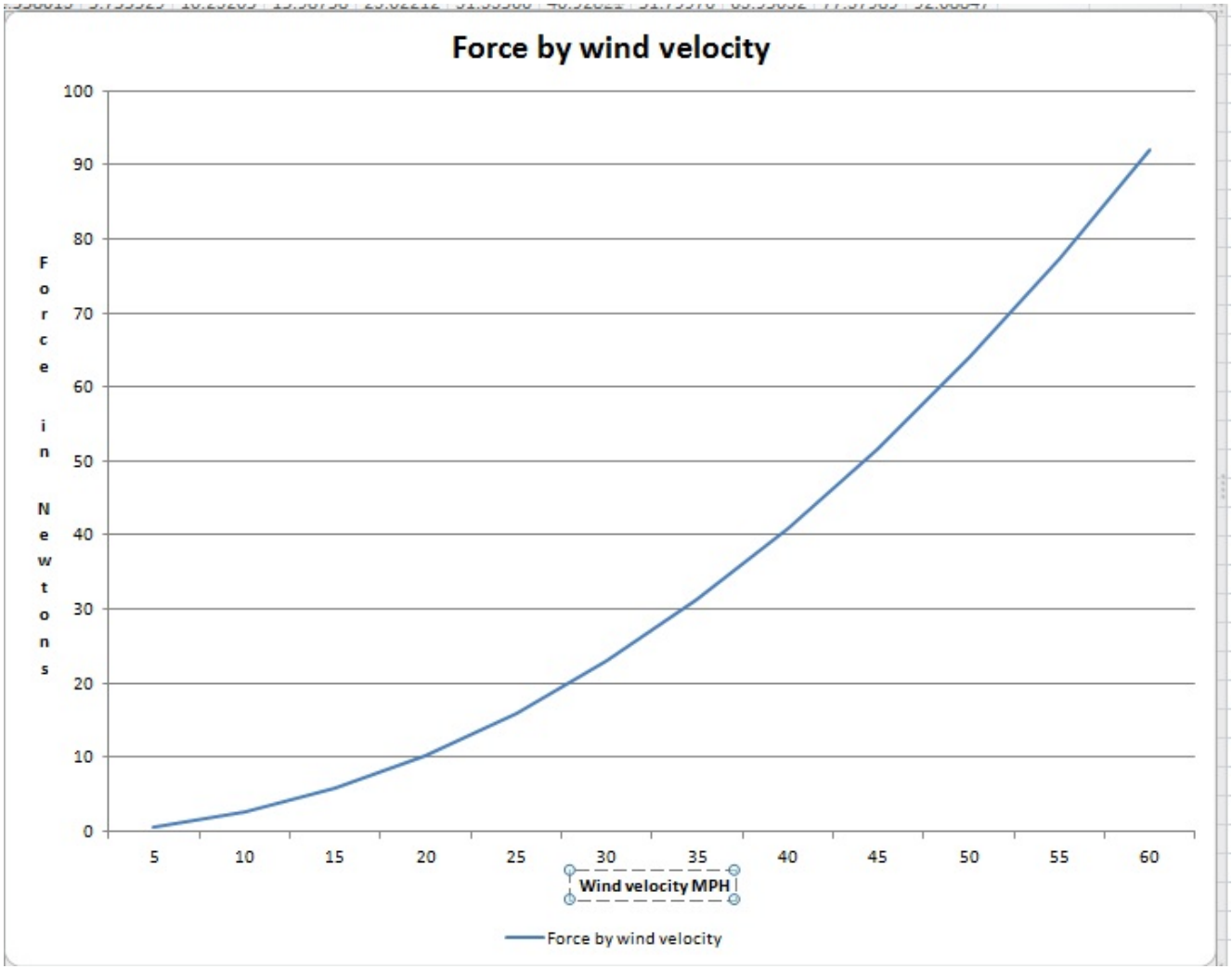
D = drag coefficient, for spherical objects ≈ 0.5

A = cross sectional area of sphere $\approx 0.397 m^2$

V = velocity of air

$$R = 0.128 * V^2$$

Risk Mitigation



Risk Assessment

Actual building of fountains capable of sustaining and controlling pressure

Risk mitigation

Actual building of fountains capable of sustaining and controlling pressure.

-Bell & Gossett pump can achieve 125 psi

-Capable of 25 GPM at 4 feet of head pressure

Risk mitigation

Actual building of fountains capable of sustaining and controlling pressure.
-Bell & Gossett pump can achieve 125 psi
-Capable of 25 GPM a 4 feet of head pressure
-Dayton holding tank
-Can handle 125 psi
-26 gallon capacity

Risk Assessment

Finding an appropriate space may be difficult. We may only be able to simulate.

Risk mitigation

Finding an appropriate space may be difficult. We may only be able to simulate.

-If we need to, we can set up outdoors.

-Limited to days with temps above freezing.

image from utne.com

Preliminary Tasking

Mechanical

- Design & Construction of Fountains

Electrical

- Design & Construction of motor circuits

Computer

- Simulator
- Interfacing with sensors, motors & PC
- Writing control logic based on physical model derived with help of ME/EE

Preliminary Timeline

Summer- Risk mitigation

- Develop mathematical model
- Determine appropriate environment
- Acquire parts & supplies

Preliminary Timeline

Fall - Design and prototype

- Build pump, fountain & get specs
- Prototyping
  - Range finders
  - Motor Drivers
  - PC output

Preliminary Timeline

Spring - Final Phase

- Model refinement
- Final construction
- Testing
- Demo

Questions?