EPICS PURDUE

# EPICS Design Review

Augmented Reality Sandbox

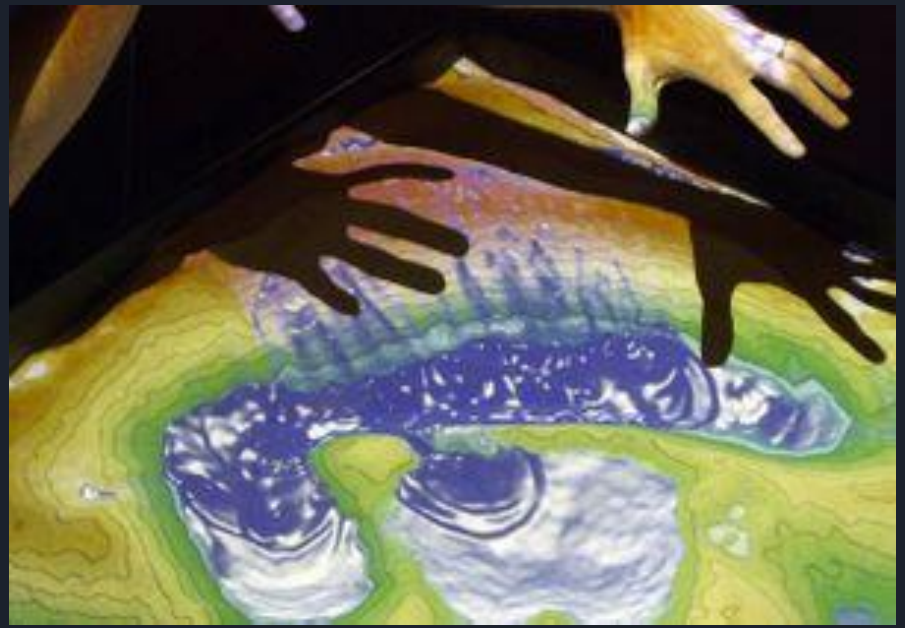
# Project Partner

- Project Partners:
  - Camp Riley
- Stakeholders
  - The children attending the camp
  - The staff working at the camp

# Ideal AR Sandbox

# Why AR Sandbox?

- Tactile experience with sand
- Manipulate virtual water
- Learn about topography
    - Geographic
    - Geologic
    - Hydro-logic
- Fun



# Project Members

## Electrical Team

- **Xi Chen**
  Electrical Engineering
  Senior
  Project Manager

- **Wenyu Jing**
  Electrical Engineering
  Senior
  Design Lead

- **Francis Tengey**
  Computer Engineering
  Junior
  Project Archivist

- **Lingess Rajoo**
  Computer Engineering
  Senior

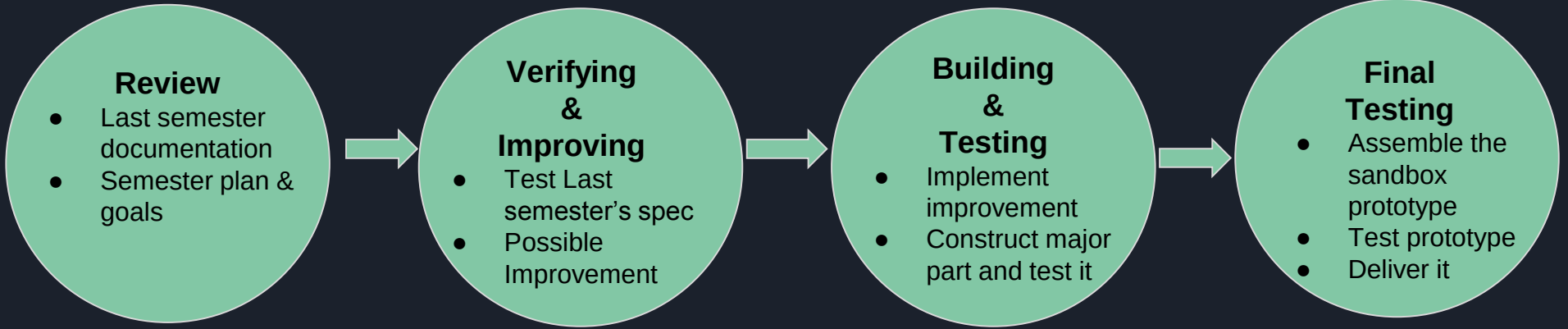
## Mechanical Team

- **Koryn Jozwiakowski**
  Genetics
  Junior
  Design Lead

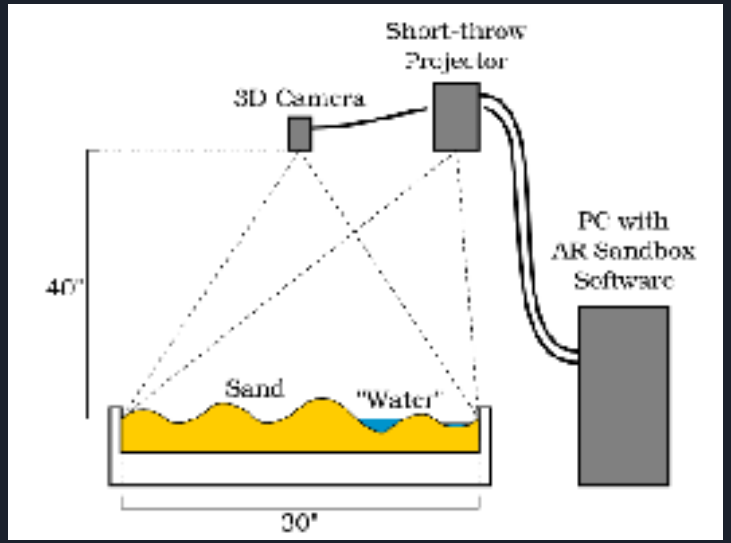
- **Mohammed Bo Khamseen**
  Mechanical Engineering
  Junior
  Financial Officer

- **Nicholas Formica**
  Agricultural Engineering
  Junior
  Project Liaison

# Project Timeline



# What is an AR Sandbox?




Component

- PC with software
- Digital projector
- Depth sensor camera (1st gen Kinect Camera)
- Sandbox
- Stand
- Sand

# Camp Riley Visit

Understanding site constraints,

- Electrical
  - Operating Conditions
  - Lighting
  - Power Supply
- Mechanical
  - Dimensions
  - Design
  - Storage

# Imagination Station Visit

- Existing built product
- Examined projector and desktop specifications
- Validate current progress

# Imagination Station Visit

# Design Goals

- Easy operation for children and staff
- Reliability in daily use
- Smooth graphics
- Transportable for storage

# Previous Progress

- Hardware purchased
  - Desktop & Monitor
  - Kinect Camera
  - Projector
- Software installed
  - Open-Source software package


https://arsandbox.ucdavis.edu/

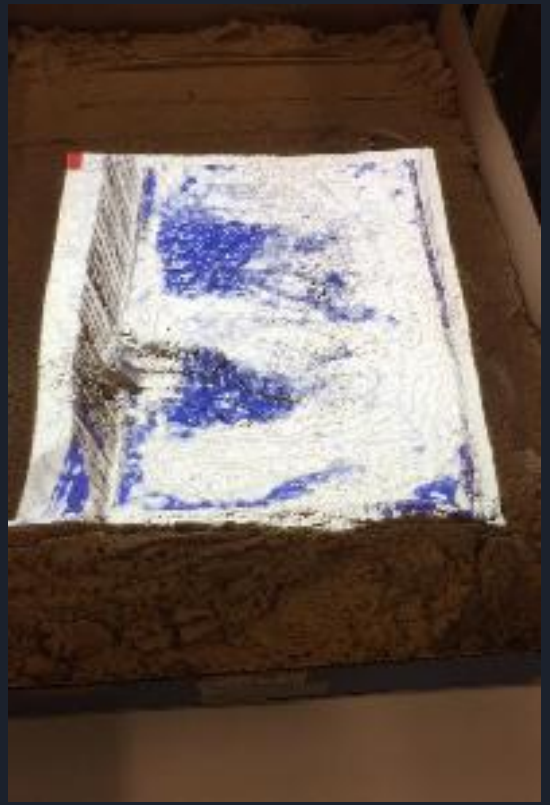
# Midterm Progress

- Software updated
- Sensor range (30’’ - 40’’)
- Testing environment setup
- Calibration and test run

# Issues

- Small image (solved)
- Response lag (solved)
- Lengthy calibration (solved)
- Hard disk damage (solved)

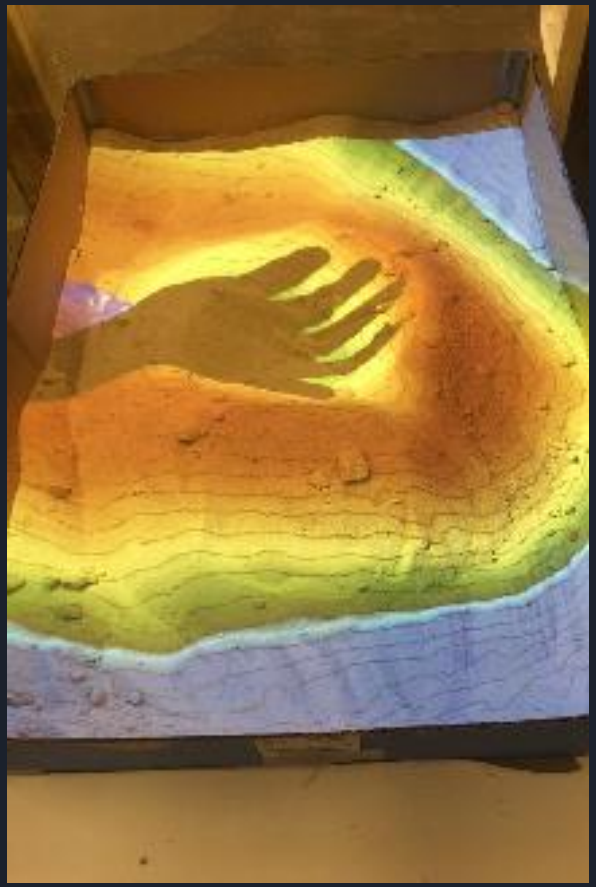
# Issues



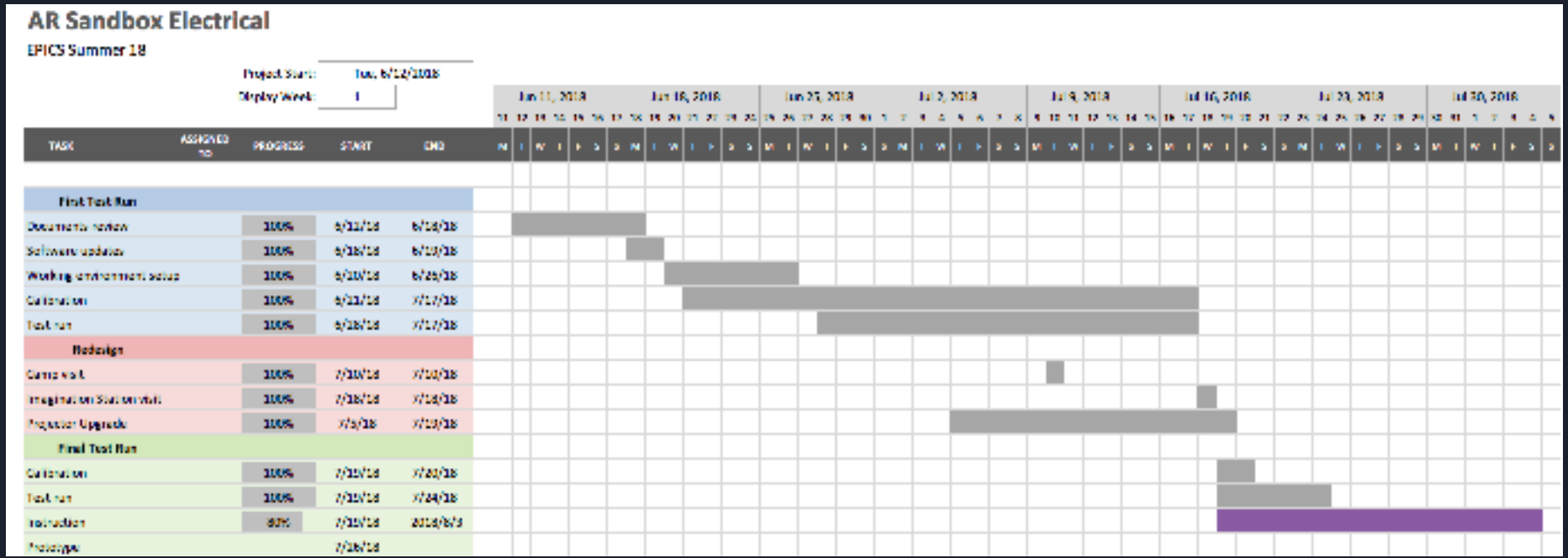
# Final progress

- New projector
- Expected performance
- User instruction (in work)
- Ready to be assembled

# Test Run



# Gantt Chart for Electrical Team



# Not done yet…

Mechanical Team

# Previous Semester Progress

| **Pros** | **Cons** |
|---|---|
| Accessible on all four sides | Not Durable/Stable |
| Hidden Projector/Sensor | Top mount too heavy/tall |
| Transportable | Sand tray too high for wheelchair accessibility |
| Able to be disassembled | Very tall when completely assembled |

# Constraints

- Detachable for storage/transportation purposes
- Movable for storage
- Will be set up in a corner (only 2 sides accessible)
- Needs to fit through standard size door
    - 35” wide

# Specifications

- Wheelchair accessible
  - ADA standards: 28-34” high with 24” knee clearance
- Durable/Stable
- Wires need to be concealed so kids don’t pull/trip
- Lid to cover sand when not in use
- Wheels for moving it
- Desktop/Monitor setup on side table

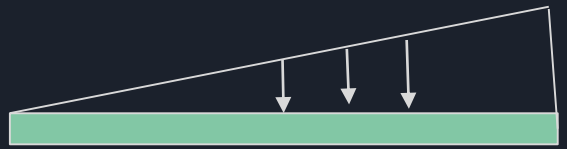
# Formulas for Calculations

$$\Sigma f(x,y,z)=0$$

- Static Reaction Equations
- Angle of Repose vs Fluid Mechanics
- Stress and Strain on the Screws

Density

- Types of Forces applied:
  - Point, Uniformly Distributed, Triangular Load

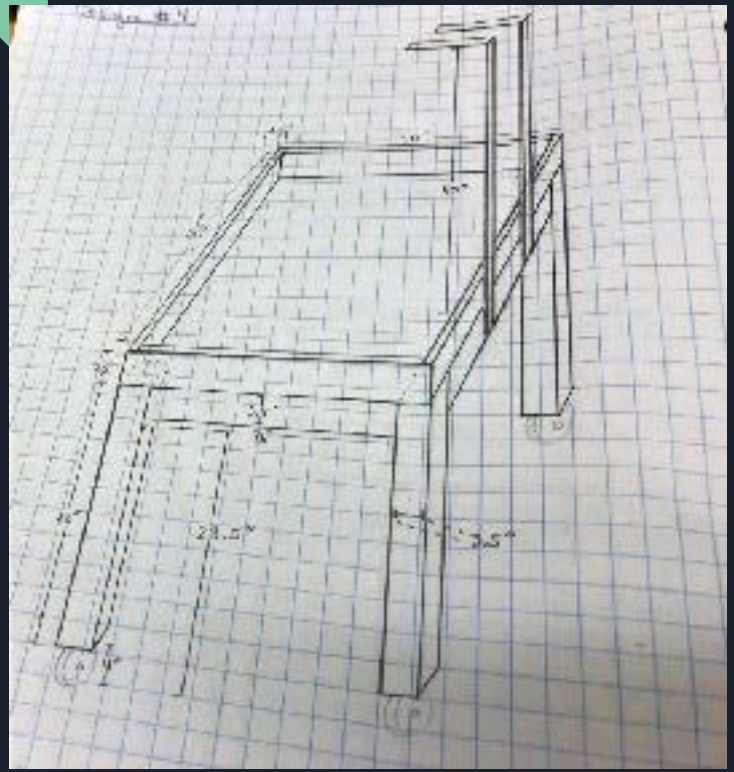


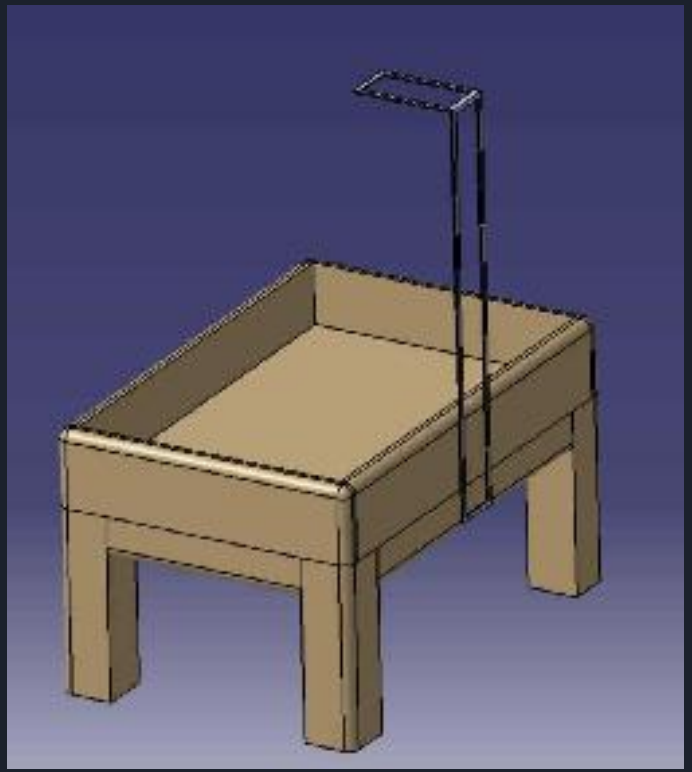
$$\text{Stress} = F/A$$

# Testing of Structure

- Plywood Tray Testing
  - Set 2 supports and have 3 people stand on it to mimic weight of sand
- Side Railing Testing
  - Multiple people pushing against side to test screws
- Projector/Sensor Calibration
  - Put projector and added weight to see if it’ll hold

# Original Design for Sandbox

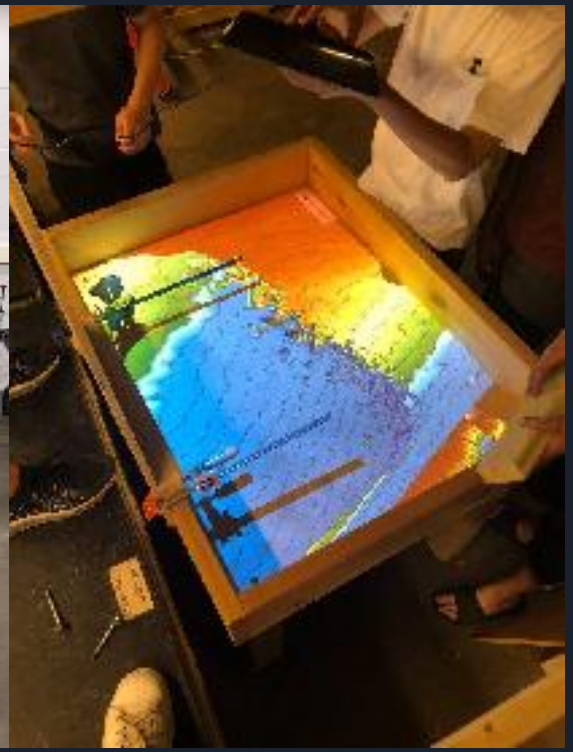




# Final Design for Sandbox



# Final Design for Sandbox cont.



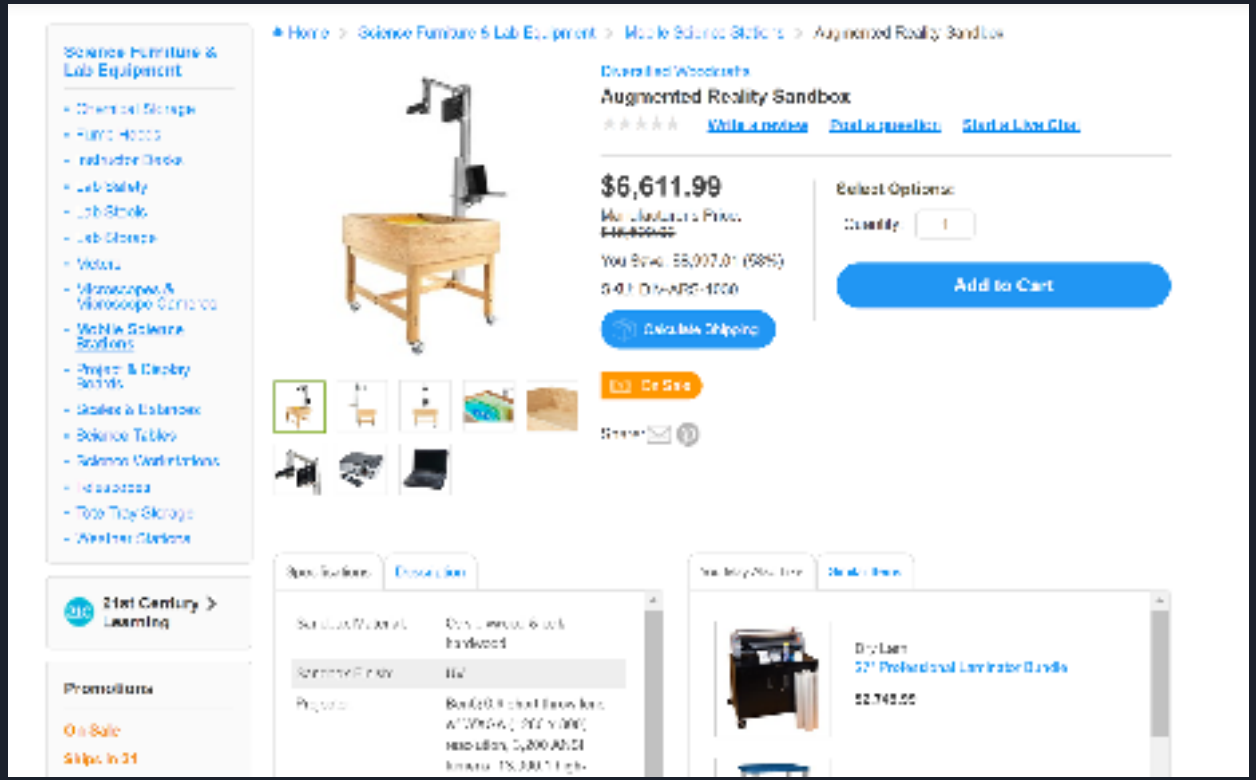
# Features of our Design

- Wheelchair accessible
- Transportable
- Storable
- Easily detachable mount
- Simple design
- Less expensive than what's on the market

# Weight Test

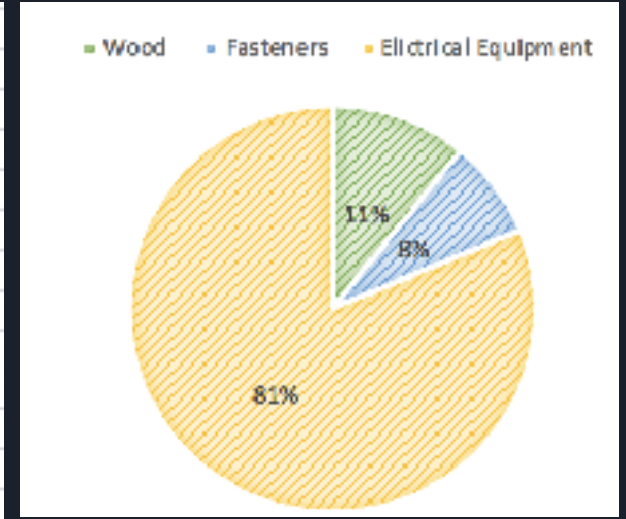
- Total test weight: 288 lbs
- Estimated weight of sand in tray: 180 lbs

# What's on the Market



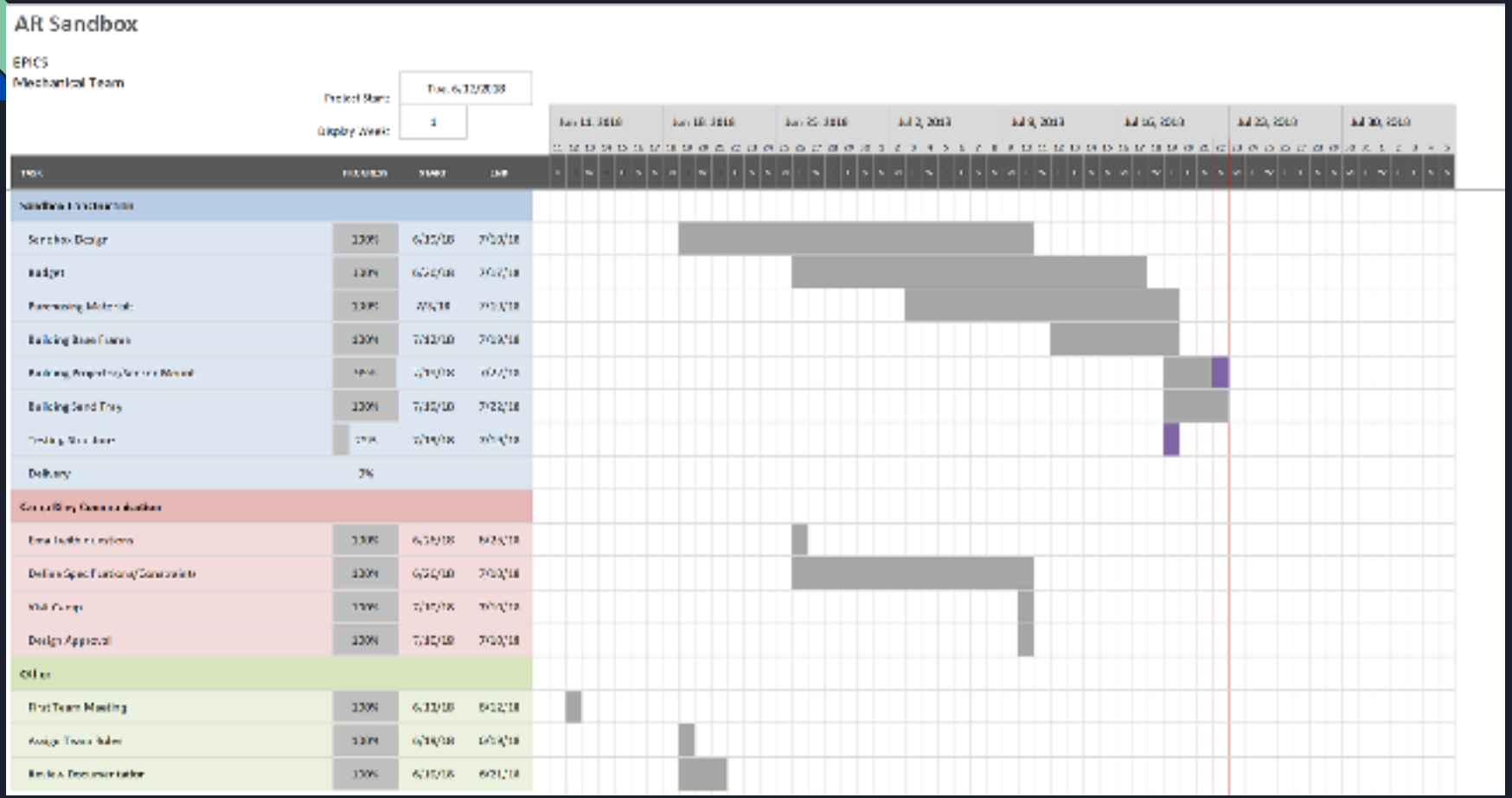
# Project Cost

| Items bought for project | Cost | Category |
|---|---|---|
| 1/4" x 3" Yzinc Power Lag (43 pcs) | 14.62 | Fasteners |
| 3" Lag screws (4pcs) | 3.8 | |
| 5" Lag screws (6pcs) | 12.32 | |
| Corner Braces 6.25 X 1.5 X 1 (6 pcs) | 38.94 | |
| Kinect Mount | 16.12 | |
| 4 Pack Caster Wheels Swivel Plate Stem Brake Casters | 28.99 | |
| ALEX PLUS® Acrylic Latex Caulk Plus Silicone - 10.1 oz | 1.96 | |
| 2 x 8 x 8' Cedar Lumber (2pcs) | 59.98 | Wood |
| 4 x 4 x 8' Cedar lumbr (2pcs) | 52.54 | |
| 1 x 12 x 10 ' Cedar Board | 48.69 | |
| Microsoft XBOX 360 Kinect Sensor(Certified Refurbished) | 34.99 | Electronic Equipments |
| BenQ WXGA DLP Short Throw Projector (MW632ST) | 609.89 | |
| Dell Optiplex 980 Desktop Computer (refurbished) | 168.29 | |
| Used Nvidia GeForce GTX 970 | 321.7 | |
| 19" Dell 1905FP DVI /VGA LCD Monitor | 44.99 | |
| AmazonBasics Keyboard and 3-Button USB Mouse Combo | 20.98 | |
| StarTech.com 6 ft Powe Extension Cord | 5.99 | |
| **TOTAL** | $1,484.79 | |




| | |
|---|---|
| EPICS AR Sandbox | $1,484.79 |
| Cheapest Commercial Alternative | $6,661.99 |

# Gantt Chart


AR Sandbox
EPICS
Mechanical Team
Project Start:
Display Week:
1
Jun 13, 2018
Jun 18, 2018
Jun 25, 2018
Jul 2, 2018
Jul 9, 2018
Jul 16, 2018
Jul 23, 2018
Jul 30, 2018
TASK
DURATION
START
END
Sandbox Construction
Sandbox Design
100%
6/13/18
7/13/18
Budget
100%
6/13/18
7/13/18
Purchasing Materials
100%
6/13/18
7/13/18
Building Base Frame
100%
7/12/18
7/13/18
Building Projector/Sensor Mount
100%
6/13/18
6/27/18
Building Sand Tray
100%
7/12/18
7/22/18
Testing Sandbox
0%
6/13/18
7/13/18
Delivery
0%
Communication
Email Invitations
100%
6/13/18
6/25/18
Define Specifications/Constraints
100%
6/13/18
7/13/18
Visit Camp
100%
6/13/18
7/13/18
Design Approval
100%
7/12/18
7/13/18
Other
First Team Meeting
100%
6/13/18
6/13/18
Assign Team Roles
100%
6/18/18
6/18/18
Review Documentation
100%
6/13/18
6/21/18

# List of things to be finished

- Attach projector and sensor to mount
- Test structure and calibrate
- Get approved for delivery
- Delivery

Any Questions for Both Teams?

EPICS PURDUE

# EPICS Design Review

Trophic Cascades

# Project Members

## Kimberly Mac Kay

Electrical Engineer
Senior

# Project Partner

- Project Partners:
  - Wolf Park
- Stakeholders
  - The children attending the camp
  - The visitors to the park
  - The park workers
  - The animals at wolf park

# What Is Wolf Park

- Research Location
- Education
- Protection of Animals

"Wolf Park is a 501(c)(3) not-for-profit organization dedicated to behavioral research, education and conservation, with the objective of improving the public's understanding of wolves and the value they provide to our environment."

# Pictures From The Visit



# Pictures of Trophic Cascades

# Pictures of Trophic Cascades

# Information about real life trophic cascades

# Wolf Park Visit

Understanding Wolf Project Constraints

- Ages 5-15
- Interactive
- Hold attention
- Easy to play
- Easy to assemble

# Design Goals

- Easy operation for children and staff
- Reliability in daily use
- Supplemental to their Education process
- Usable by ages 5-15
- Easily programmable for future iterations

# My solution

Hardware

Raspberry Pi

Software

Scratch

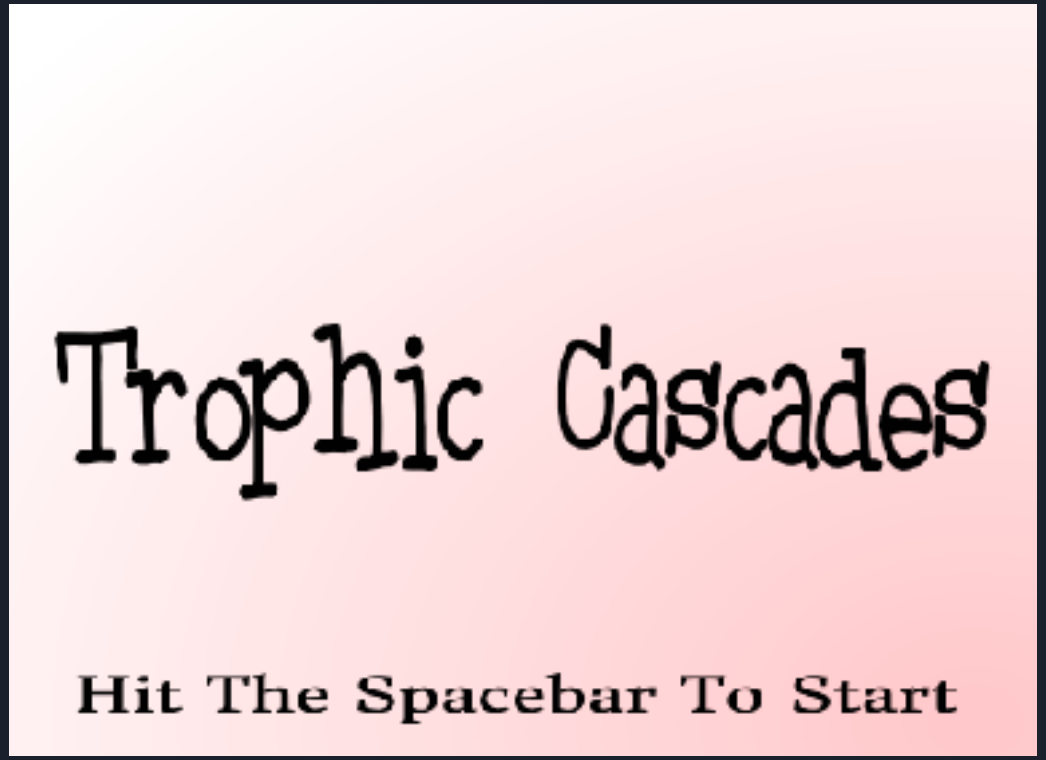
# Raspberry pi

- HDMI Port
- USB Ports
- Network of forums for advice
- Own operating system to utilize

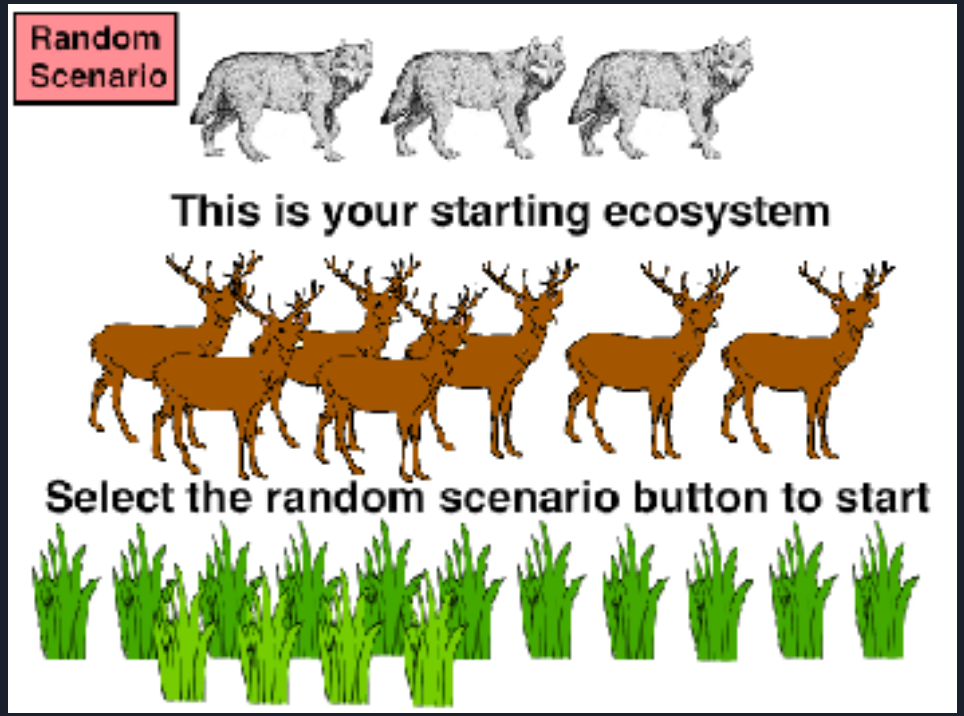
# Scratch

- Interacts with Python for experienced users
- Uses blocks for inexperienced users
- Program accessible right from Raspberry Pi

# First Attempt



# First Attempt



# First Attempt

# First Attempt

Try to guess if the population will go up or down for each animal.

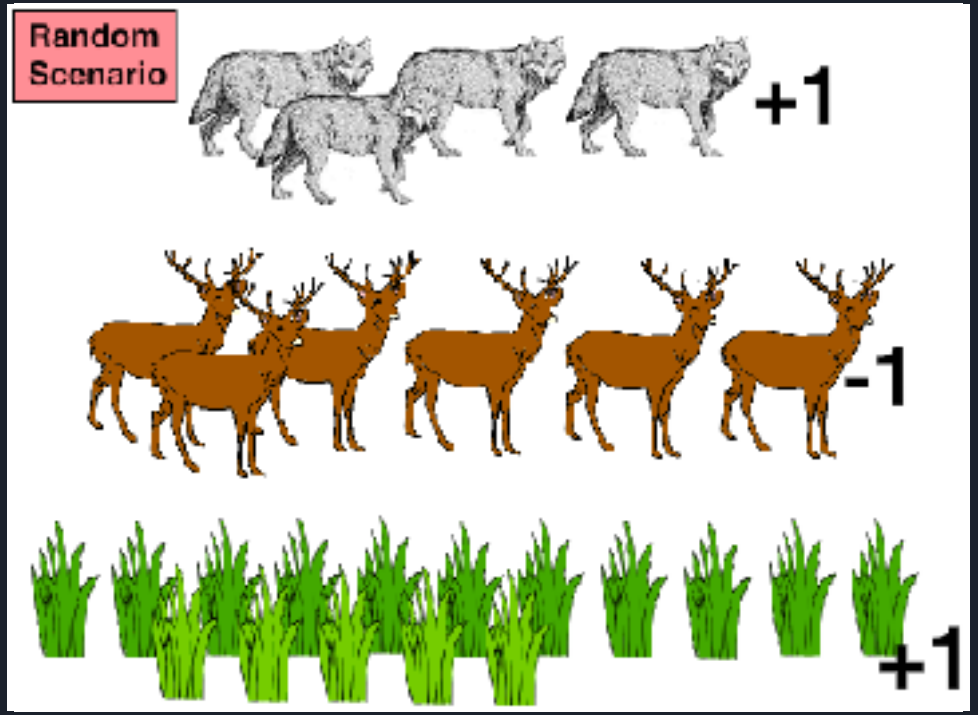
Will wolves increase or decrease?

Will deer increase or decrease?

Will vegetation increase or decrease?

Check Answer

# First Attempt



# First Attempt

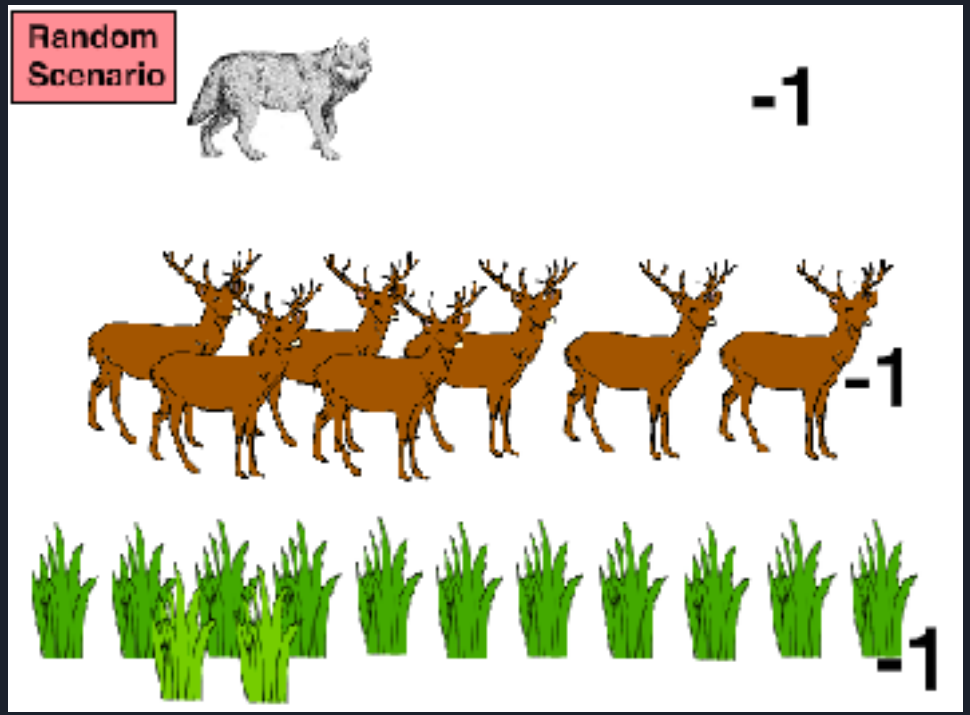
Since wolves are introduced, there will be more wolves, as well as less deer, and more vegatation.

# First Attempt

# Going Back to Wolf Park

- Met with Ryan and Khaz
- Showed them the prototype
- Learned more about what they are using the project for
- Brainstormed ways to make to game fit their needs
- Came up with a new direction for the project

# Future Game



# Future Game

**You have reached a critical limit with your wolves. You have three options.**

**A) Introduce more wolves**
**B) Allow more hunting permits to eliminate deer**
**C) Remove all the grass**

**What will you choose?**

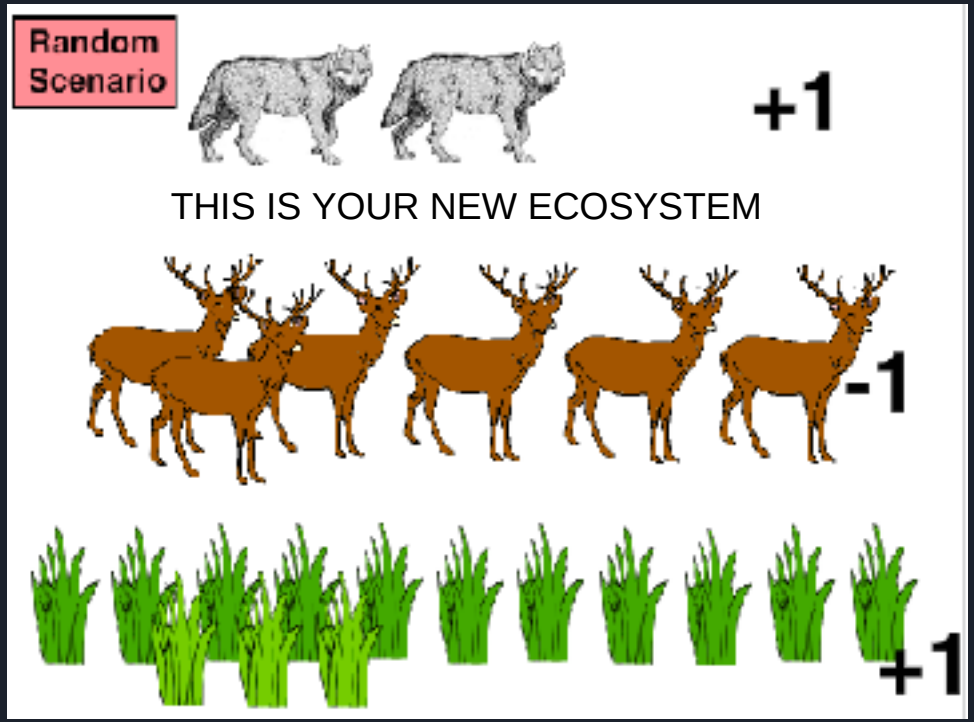
# Future Game

**CONGRATS!**

**You have saved you wolves**

**By making this choice you have also lost 1 deer, but increased 1 vegetation.**

# Future Game



# Future Game

**SORRY!**

**You have no more wolves left**

**You were able to survive 18 rounds and 3 generations!**

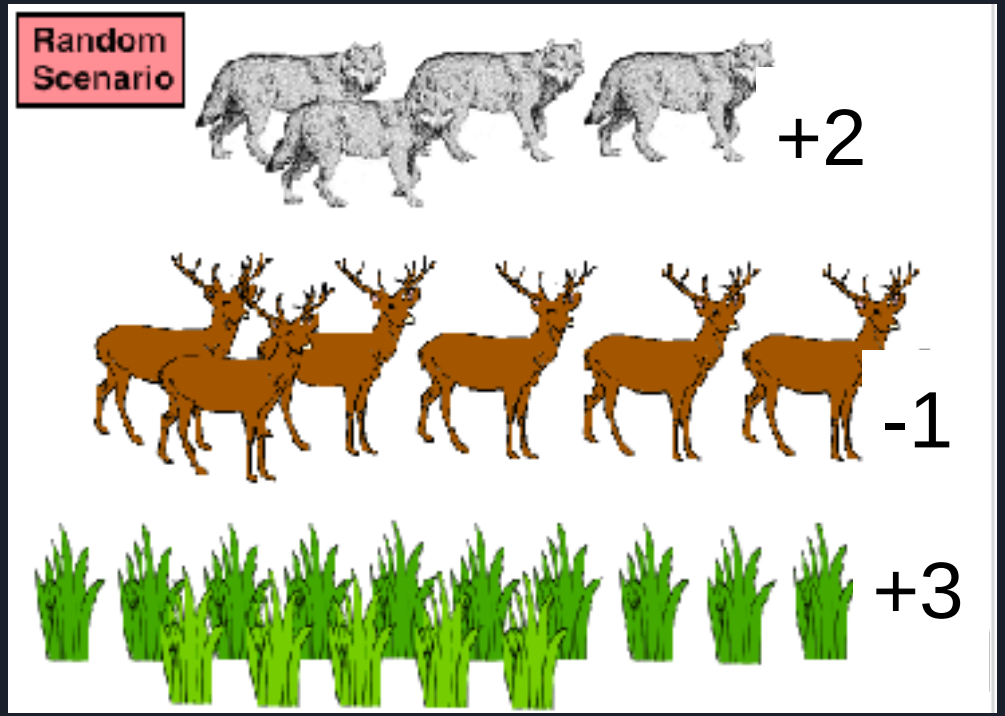
# Future Game

**You just reached another 5 rounds!**

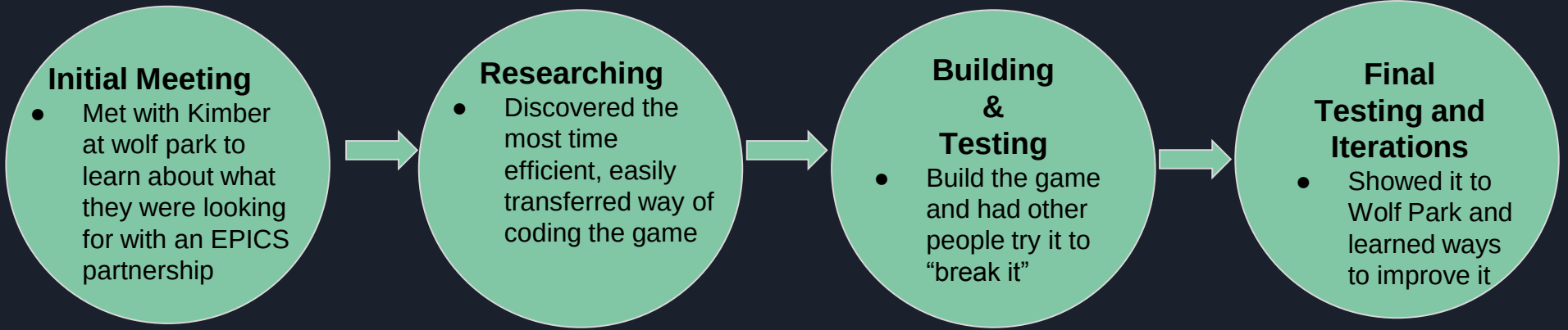
**That means you have another generation**

**Based on the current number of wolves, deer, and vegetation, this is your new ecosystem**

# Future Game



# Project Timeline



# Expected delivery date

August 2, 2018

# Project Cost

| Item | Price |
|---|---|
| Raspberry Pi | $35.00 |
| Mouse | $5.00 |
| Keyboard | $10.00 |
| Monitor | $30.00 |
| | **$80.00** |