ENGINEERING PROJECTS IN COMMUNITY SERVICE SUMMER 2019-COPPER TEAM FINAL DESIGN PRESENTATION

COLLEGE OF ENGINEERING, EPICS

PURDUE
UNIVERSITY.

FINAL DESIGN REVIEWERS INTRODUCTION

Summer 2019 Projects:

1. Origin Of Lafayette (OOL)

- We are working on a web-based database for the historical buildings in Lafayette.

2. Deaf Can! Coffee (DCC)

- We are working with the DCC company in Jamaica to design a coffee huller to facilitate their hulling process.

3. Riley Hospital Interactive Wall (RHIW)

- We are currently working in partnership with Riley Children's Hospital in Indianapolis to encourage patients going through physical therapy.

ORIGIN OF LAFAYETTE

Team Members

Sadiq
Albinalshaikh

Computer
Science

Design lead

Tohme
Tohme

Computer
Engineering

**Project Partner
Liaison**

Andrew
Grossman

Electrical
Engineering

Project Archivist

Yunlei
Yan

Computer
Engineering

Team Member

Yuan-Cheng
Chen

Computer
Engineering

Team Member

PURDUE
U N I V E R S I T Y.

About the Project

A database powered web application to maintain records of historical sites in the Lafayette area.

Project Partner

John D. Collier: Member of City of Lafayette Economic Development Department.

John is a Purdue alumni and was one of the designers of the Gateway to the Future Arch.

He is passionate about every historical building and contributed in efforts to preserve historical buildings in Lafayette.

Project Goal

146 C **Duplex**, 222-220 Russell Street; American four-square, c.1915; Vernacular/Construction (333)

147 N **Sigma Pi House**, 230 Russell Street; Tudor Revival, c.1915; Architecture, Education (333)

District Map based on Site Numbers

All Building Data

Site Number	Building Name	Street Address	Location	Ranking	Architecture	Year of Construction	Image
2	Dr. George Beasley House	1104	Columbia Street (North Side)	Outstanding (O)	Colonial Revival	1902	View
7	James Ball House	1214	Columbia Street (North Side)	Contributing (C)	Italianate	1865	View
8	John Williams House	1218	Columbia Street (North Side)	Contributing (C)	Italianate	1860	View
9	Thomas Ward House	1222	Columbia Street (North Side)	Contributing (C)	Gabled-ell	1860	View
10	Apartment Building	1302	Columbia Street (North Side)	Non-Contributing (NC)	Contemporary	1975	View

Current method

Paper book
- Outdated
- No access for the public
- Not able to make changes

Future method

Electronic web application
- Long-term access
- Easy to add or edit database entries
- Searchable

PURDUE UNIVERSITY.

Project Specifications

Needs	Specification	Status
Display Historical Building to the public	• Main page allows navigation to each district.	Completed, Spring 2019
	• Each district page has description of it.	Completed, Spring 2019
	• Organized data based on district and rank.	Completed, Spring 2019
Ability to store/modify the data	• A database able to store 10 historical districts.	Completed, Spring 2019
	• Organized based on district.	Completed, Spring 2019
	• Add/delete/edit buttons to modify building data.	Completed, Fall 2018
Easy and simple to use	• Navigation through the site 4 clicks or less.	**Completed, Summer 2019**
	• Ability to search building information.	**Completed, Summer 2019**
Secure access to data	• A control panel accessible only with signed up users(Lafayette officials)	**Completed, Summer 2019**
	• Signup system with email verification.	**Completed, Summer 2019**
	• Ability to reset password.	**Completed, Summer 2019**
Access to the website	• Host the website through city official server.	To be completed, *Fall 2019*.
	• Provide a step-by-step manual for a full technical access to the website.	To be completed, *Fall 2019*.

Users

There is two types of Users:

- Admins/City Officials: they must have an account in the database.

- Public Users: any person that access the website that does not have an account
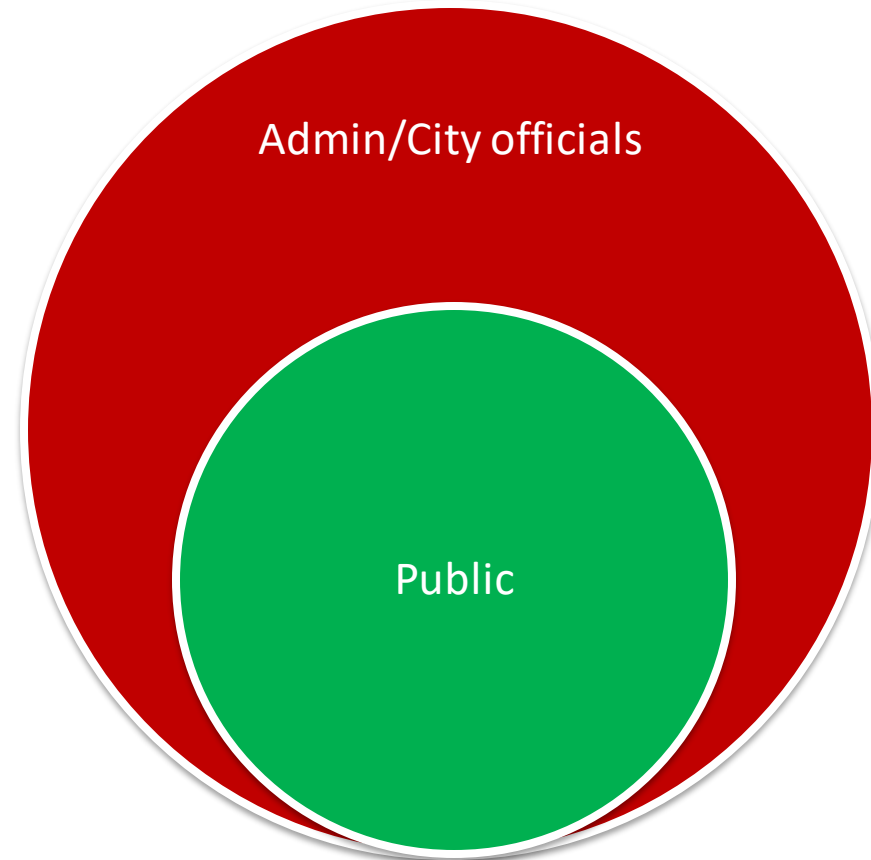
Admin/City officials
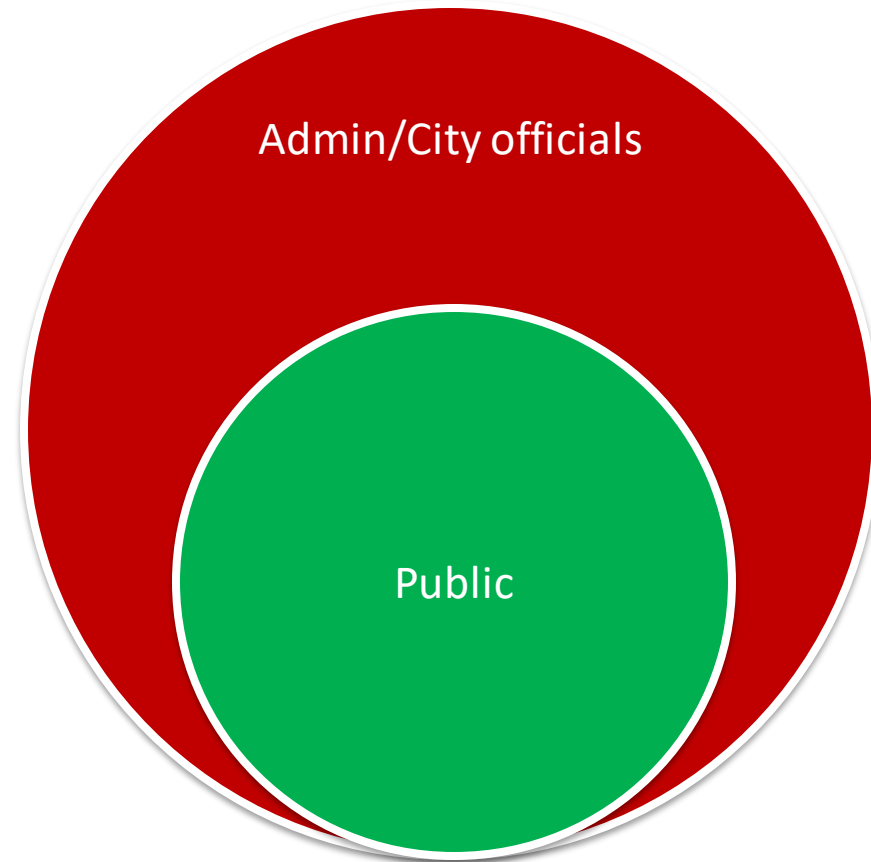
Public

Users

Public User:
- Access the website
- Browse and view the buildings and district in the database.
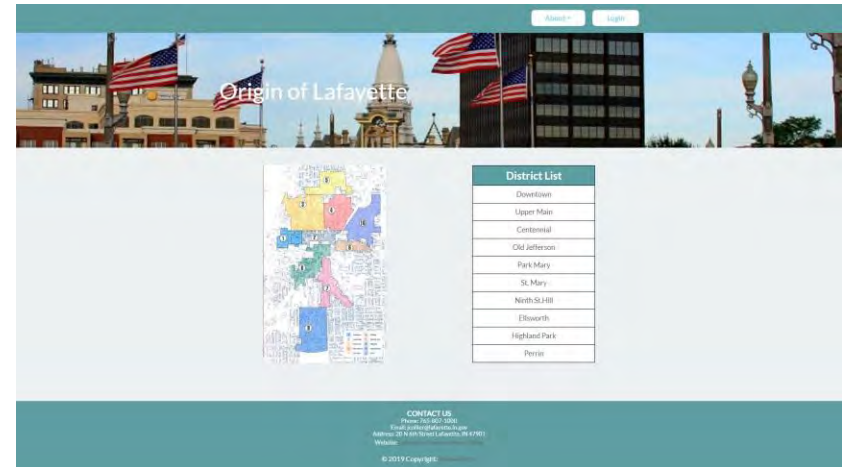- No need for user account.

Admin/ City Officials:
- Everything that Public User do.
- Need to login to access extra features.
- Ability to add, remover, and edit the database of the buildings and distracts.

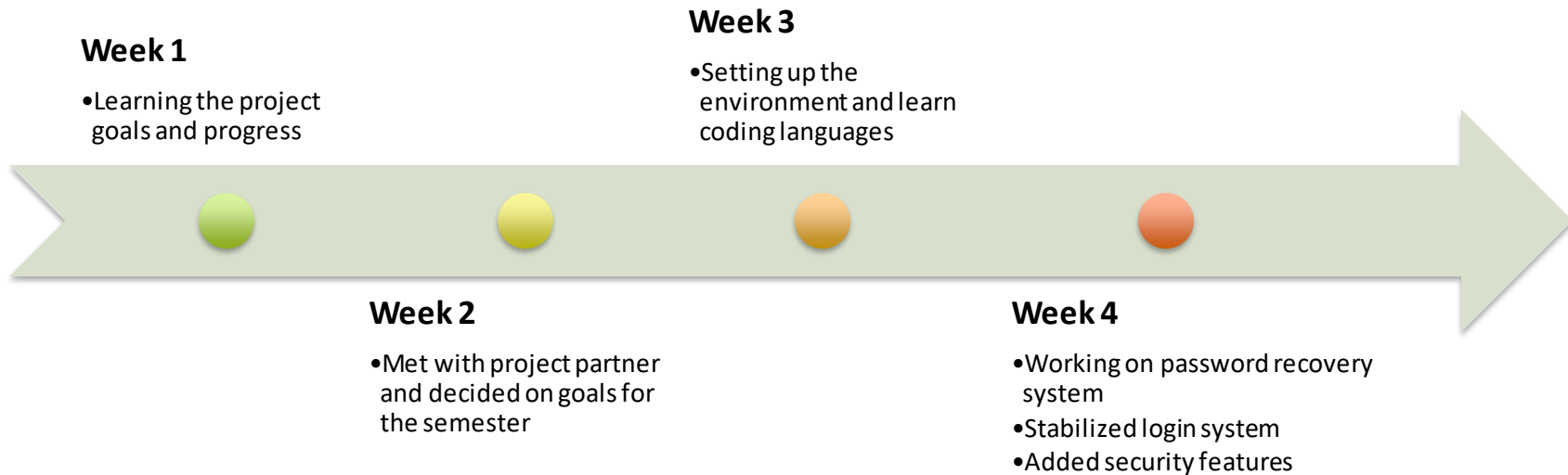Admin/City officials

Public

PURDUE
UNIVERSITY.

Previous Semesters' Work

- Established a database and web-page framework.

- Established login system.

- Completed data entry for the St. Mary's district.

- Refined user interface.

- Hosted the website on Purdue ECN server.

PURDUE
UNIVERSITY.

Semester Timeline

Week 1

•Learning the project goals and progress

Week 3

•Setting up the environment and learn coding languages

Week 2

•Met with project partner and decided on goals for the semester

Week 4

•Working on password recovery system
•Stabilized login system
•Added security features

PURDUE
UNIVERSITY.

Semester Timeline

Week 5

•Implemented search bar
•Debug and test login
 system

Week 7

•Debug and systemize
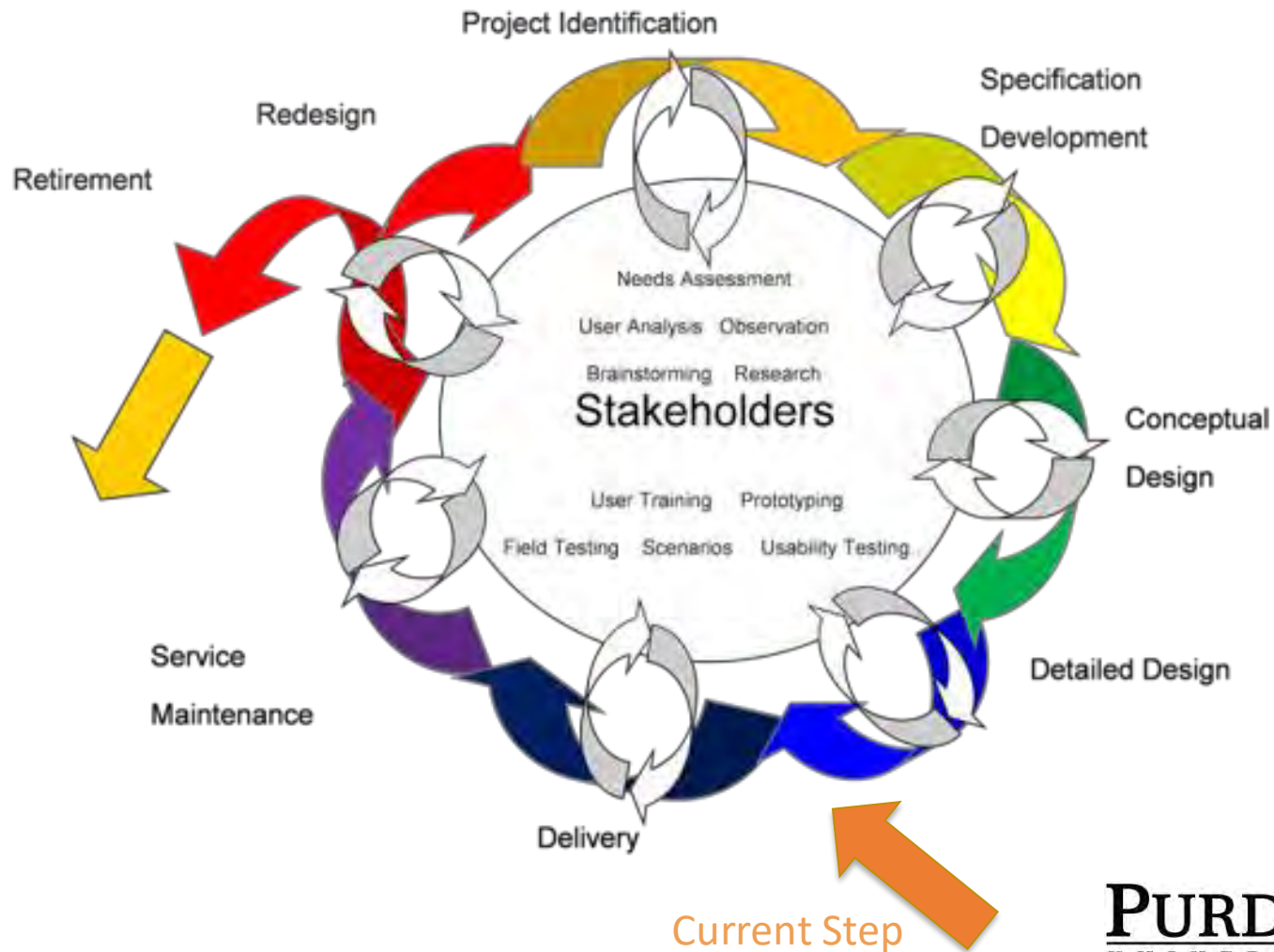 website files
•Organize project
 documentation

Week 6

•Minor refinements of user
 interface(Alignment
 changes and numbered
 districts on homepage)
•Debug and test login
 system
•Organize project
 documentation

Week 8

•Debug and systemize
 website files
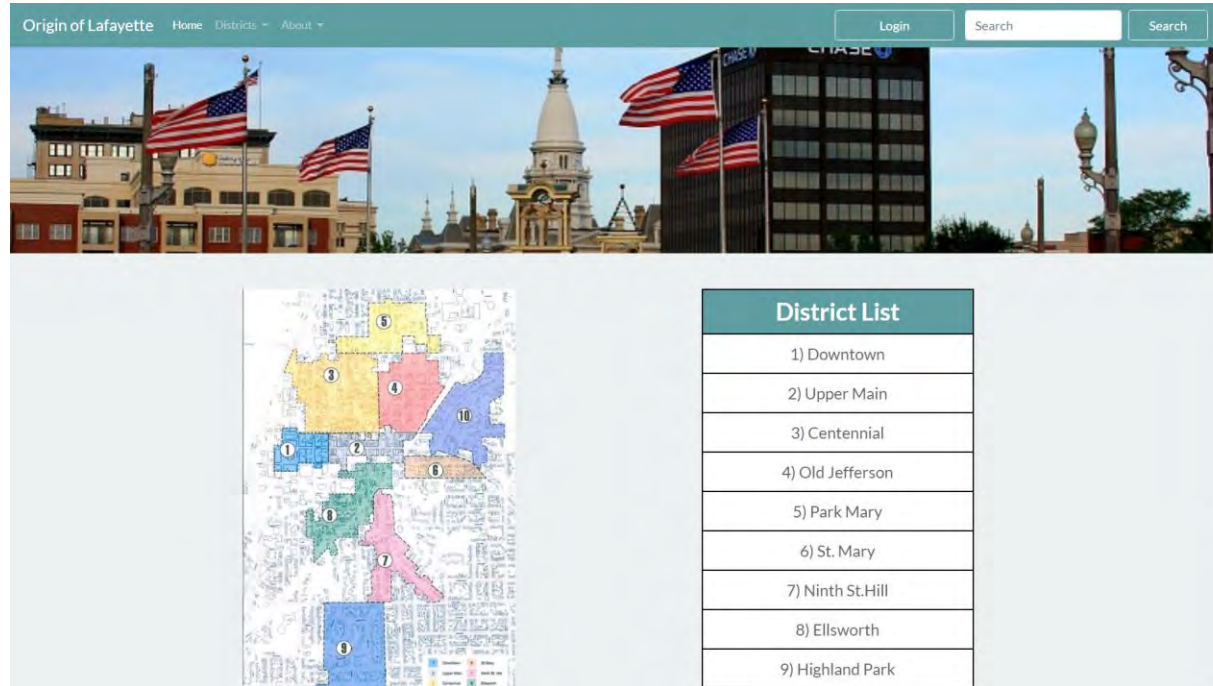•Organize project
 documentation

PURDUE
UNIVERSITY®

Design Summary

Conceptual Design

- User Interface
- Control panel access
- Verification for sign up
- Password recovery
- Search Method

Detailed Design – User Interface

- Refine the navigation bar.

- Numbered districts.

- Alignments of content in the pages.

Detailed Design – Control Panel Access

- Issues:

  - Non-consistent login session.

  - Non-logged in users access the control panel from the link.

  - Public users could sign up with fake emails then login to the control panel.

PURDUE
UNIVERSITY.

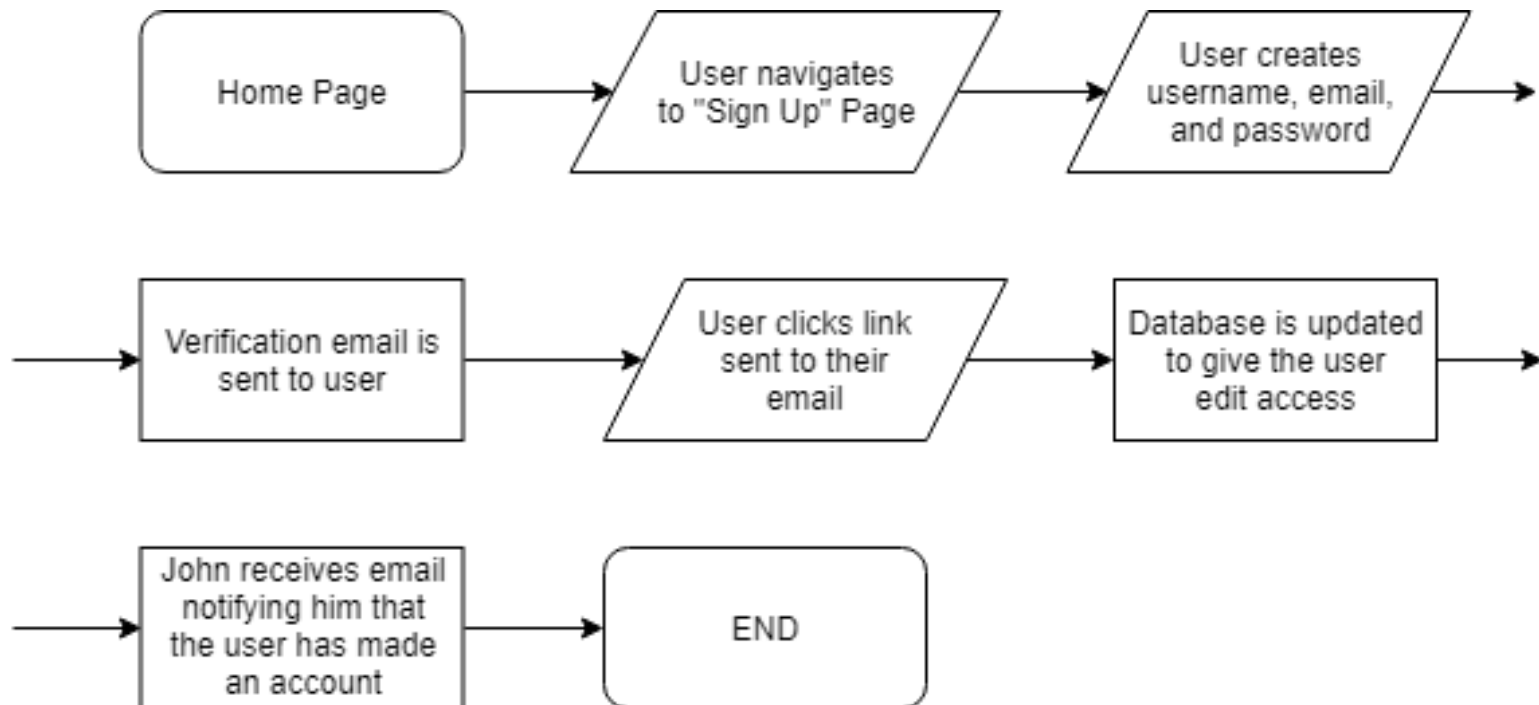# Detailed Design – Control Panel Access

Detailed Design – Verification for signup

Process Diagram for User Sign Up

Detailed Design – Verification for signup

Detailed Design – Password Recovery

The process of recovering the password

Email does not match database

Forget Password → "Reset Password" in login page → Enter Email used for register → Create Email with token → Pending page & Send Email → Click link in the email

Link modified, info in the link failed to match database

Reset Password and update database → Send Confirmation Email

Detailed Design – Password Recovery

Email you used for register

Email Address

[   ]

[Submit]

Cancel

Origin of Lafayette - Password Reset ➤ 收件匣 ×

ooltest9@gmail.com 下午2:50 (3 分鐘前)
寄給 我 ▾

Your email account is: get33021@gmail.com
Click here to reset your password: http://localhost/ool/recover-password.php?email=get33021%40g
mail.com&token=918ce794e643aa4093b6010c39063503
This link will expire on: 2019-07-24 21:50:28

Account Verification

Thank you, a confirmation email has been sent!

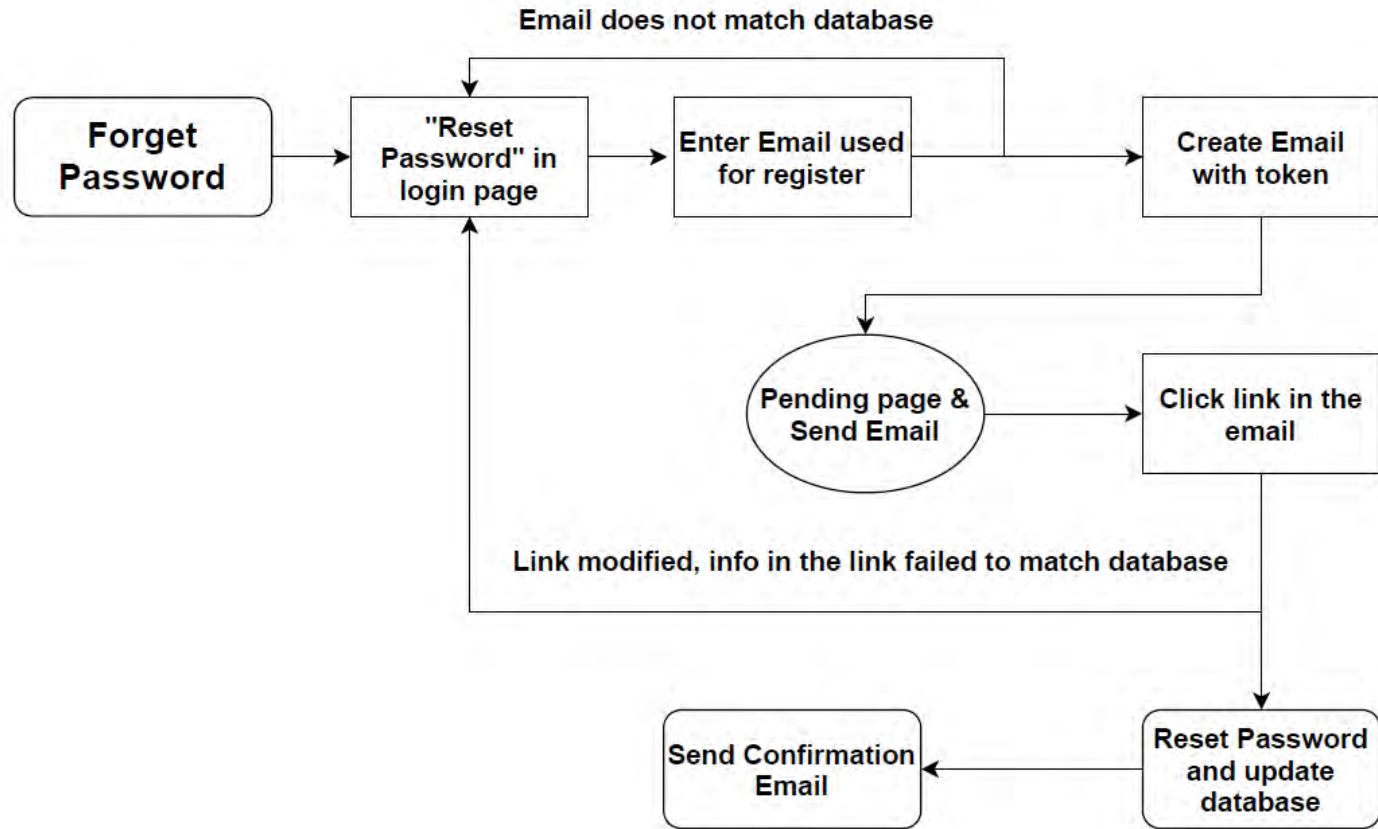Please check your inbox and click the link to verify your account.

Return to Login

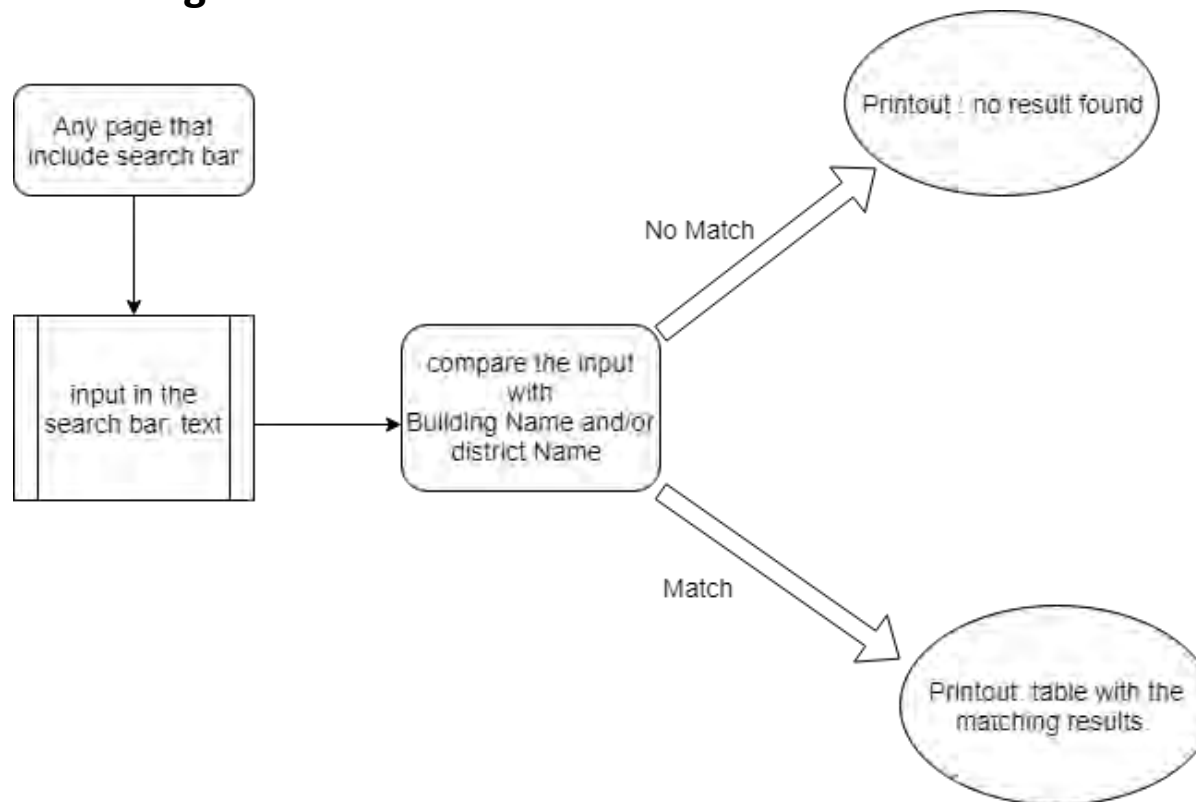## Reset Password

Password

[   ]

Confirm password

[   ]

Confirm

PURDUE
UNIVERSITY.

Detailed Design – Search Bar

The process of searching

PURDUE
UNIVERSITY.

Detailed Design – File Organization

Before

centennial	2/4/2019 12:12 PM	File folder
css	2/15/2019 9:01 PM	File folder
downtown	1/28/2019 9:04 PM	File folder
ellsworth	2/4/2019 12:14 PM	File folder
fonts	1/26/2019 12:52 PM	File folder
highlandpark	2/4/2019 12:14 PM	File folder
images	3/20/2019 12:50 PM	File folder
js	3/19/2019 9:26 PM	File folder
ninthhill	2/4/2019 12:12 PM	File folder
OLD	2/17/2019 10:14 PM	File folder
oldjefferson	2/4/2019 12:12 PM	File folder
parkmary	2/4/2019 12:12 PM	File folder
perrin	2/4/2019 12:14 PM	File folder
stmary	3/19/2019 9:43 PM	File folder
upload_image	1/26/2019 12:52 PM	File folder
uppermain	2/4/2019 12:12 PM	File folder
vendor	1/26/2019 12:53 PM	File folder
AboutWebsite	4/2/2019 8:04 PM	PHP File
buildingForm	4/2/2019 11:29 PM	Chrome HTML Do...
databaseManageAdmin	4/16/2019 11:17 A...	PHP File
databaseManageAdmin2	4/1/2019 10:07 PM	PHP File
errors	1/26/2019 12:22 PM	PHP File
form	1/26/2019 12:22 PM	PHP File
form2	4/2/2019 10:32 PM	PHP File
index	6/24/2019 1:52 PM	Chrome HTML Do...
index	2/7/2019 1:04 PM	PHP File
indexAdmin	4/2/2019 11:30 PM	PHP File
indexAdminBackup	2/6/2019 4:00 PM	PHP File
indexBackup	2/8/2019 5:04 PM	Chrome HTML Do...
insert	4/2/2019 11:24 PM	PHP File
log	1/26/2019 12:22 PM	Text Document
login	6/30/2019 5:00 PM	PHP File
page2	1/26/2019 12:22 PM	Chrome HTML Do...
page2	1/26/2019 12:22 PM	PHP File

After

css	7/20/2019 6:07 PM	File folder
districts	7/21/2019 3:51 PM	File folder
fonts	7/11/2019 1:28 PM	File folder
images	7/21/2019 1:55 PM	File folder
js	7/21/2019 9:05 PM	File folder
pear	7/11/2019 1:28 PM	File folder
vendor	7/11/2019 1:28 PM	File folder
admin-building-form	7/21/2019 7:44 PM	PHP File
admin-manage-district	7/21/2019 4:39 PM	PHP File
complete-recovery	7/22/2019 1:04 PM	PHP File
complete-registeration	7/21/2019 9:48 PM	PHP File
control-panel	7/21/2019 7:45 PM	PHP File
district-data	7/21/2019 7:46 PM	PHP File
errors	7/11/2019 1:28 PM	PHP File
index	7/21/2019 9:33 PM	PHP File
insert	7/21/2019 10:04 PM	PHP File
login	7/22/2019 1:12 PM	PHP File
login-request	7/21/2019 7:43 PM	PHP File
pending-password	7/22/2019 1:05 PM	PHP File
pending-register	7/22/2019 1:03 PM	PHP File
rating-system	7/21/2019 8:38 PM	PHP File
recover	7/22/2019 1:49 PM	PHP File
recover-password	7/22/2019 1:17 PM	PHP File
register	7/21/2019 9:39 PM	PHP File
register-request	7/22/2019 2:01 PM	PHP File
search	7/22/2019 2:18 PM	PHP File
server	7/22/2019 1:59 PM	PHP File
tippecanoe-history	7/21/2019 9:08 PM	PHP File

PURDUE
UNIVERSITY®

Demo

https://epics.ecn.purdue.edu/disc/origin/

PURDUE
UNIVERSITY.

Future Plans

- Move the website to Lafayette government server.

- Test website with project partner and work on feedback.

- Instruct Lafayette officials how to use the site (modifying building information, managing users, etc.)

- Complete data entry for the rest of the districts.

PURDUE
UNIVERSITY.

Origin of Lafayette

QUESTIONS?

PURDUE
UNIVERSITY®

DEAF CAN COFFEE!

PURDUE UNIVERSITY®

Team Members

Abdulrahman Alsalem

Mechanical Engineering

Design Lead

Riyadh Alghamdi

Electrical Engineering

Project Archivist

Safi Khayyat

Mechanical Engineering

Team Member

Mohammed Alhazmi

Electrical Engineering

Partner Liaison

Khalid Alothman

Mechanical Engineering

Team Member

PURDUE UNIVERSITY.

Presentation Agenda

1. Project Identification
2. Economic Analysis
3. Different Designs
4. Decision Process
5. Prototyping
6. Future Work
7. Questions

PURDUE
UNIVERSITY.

Project Partner

Deaf Can! Coffee

- Co-founder: Blake Widmer

- A social enterprise that empowers Jamaican youth with hearing impairments to become professional baristas and equips them with the knowledge and confidence to operate a sustainable coffee venture.
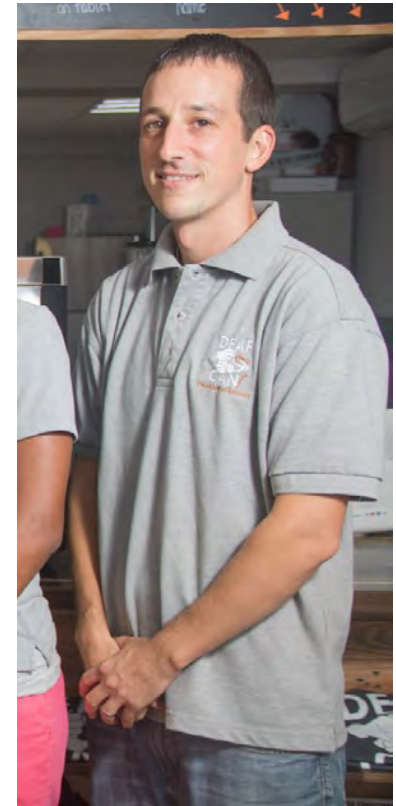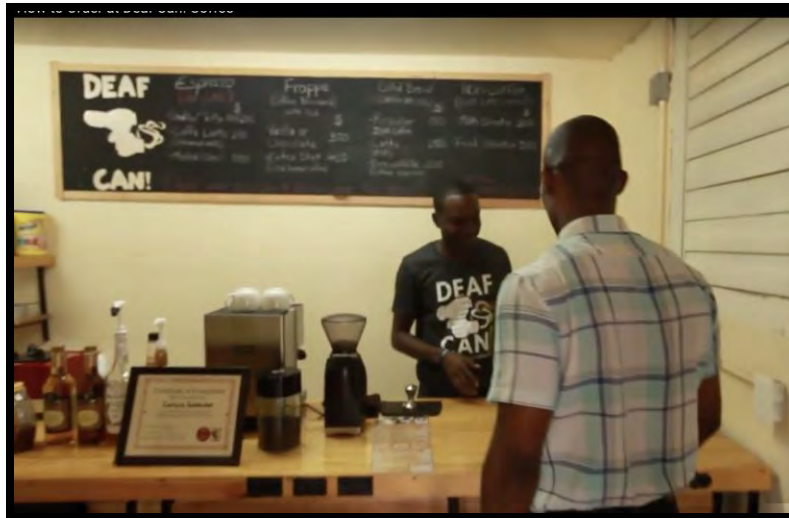
Hulling Process
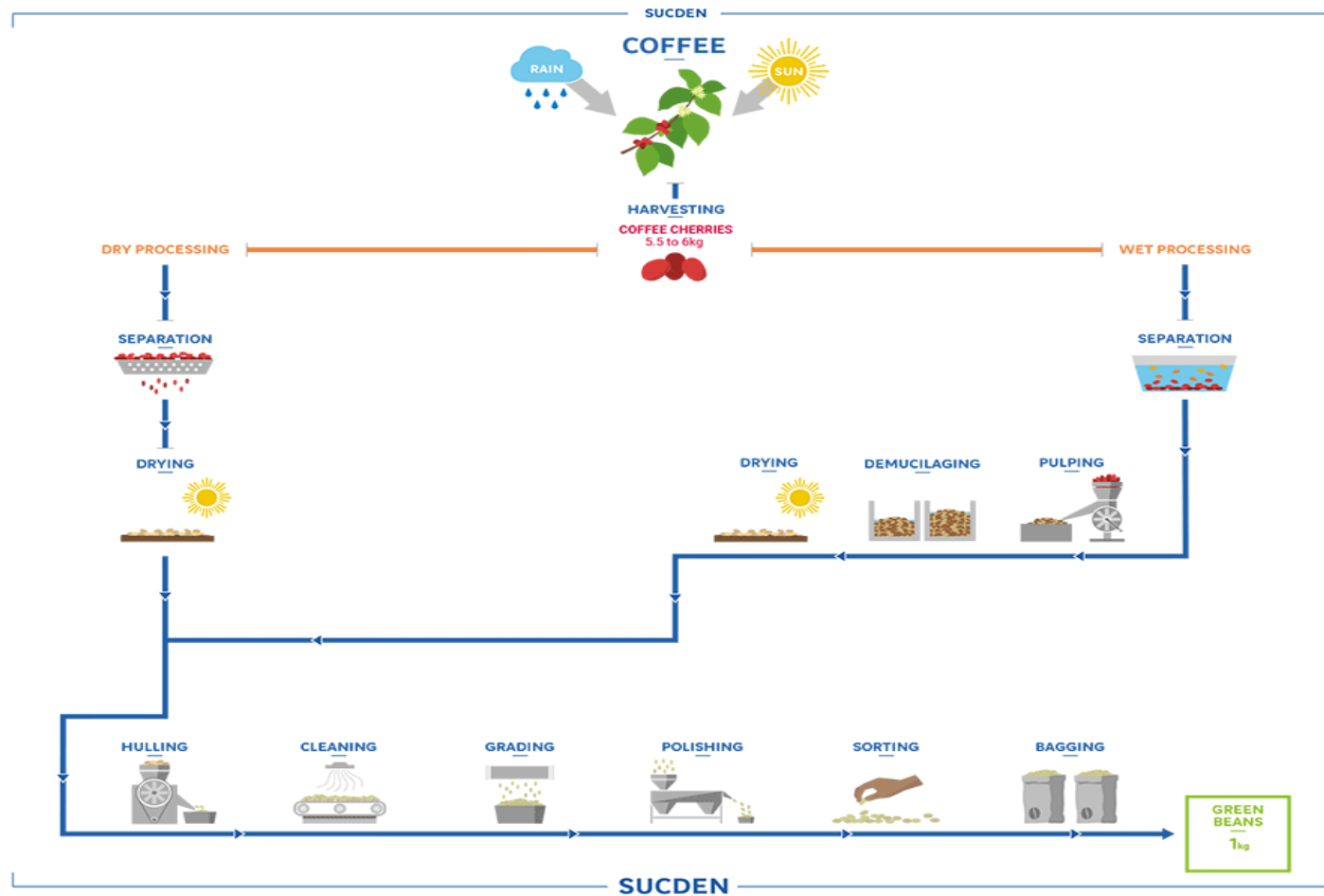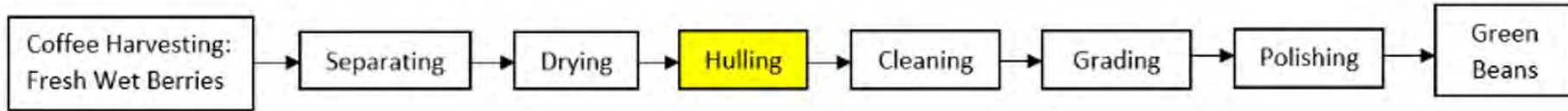
Hulling Process

What is hulling:

to remove the hull

to produce hulled beans

Problem Statement

Our partner is not satisfied with the current way of hulling coffee because it is inefficient.

Project's Goal

A Coffee-hulling Machine

- Our objective is to design a dry, low-cost, portable, and automated coffee-hulling machine that accommodates for the needs of the deaf kids in Jamaica.
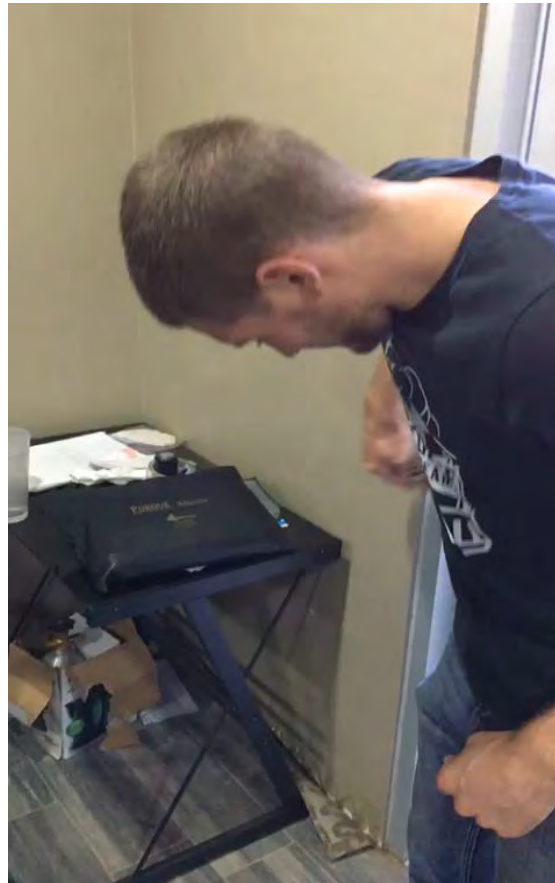

parchment → [machine] → green

Semester Plan

Week 1	Week 2	Week 3	Week 4
▪ Review documents ▪ Brainstorming ▪ Rough sketches	▪ Make a timeline ▪ Estimate budget ▪ Inventory Check	▪ Partner Meeting ▪ Started conceptual design	▪ Midsemester DR ▪ Improved conceptual design

Week 5	Week 6	Week 7	Week 8
▪ Choosing a prototype ▪ Test materials ▪ Build Prototype	▪ Modify prototype ▪ Testing materials ▪ Choosing material	▪ Review design ▪ Finalize design paper	▪ Review inventory ▪ Set up transition documents

PURDUE
UNIVERSITY.

Design Process
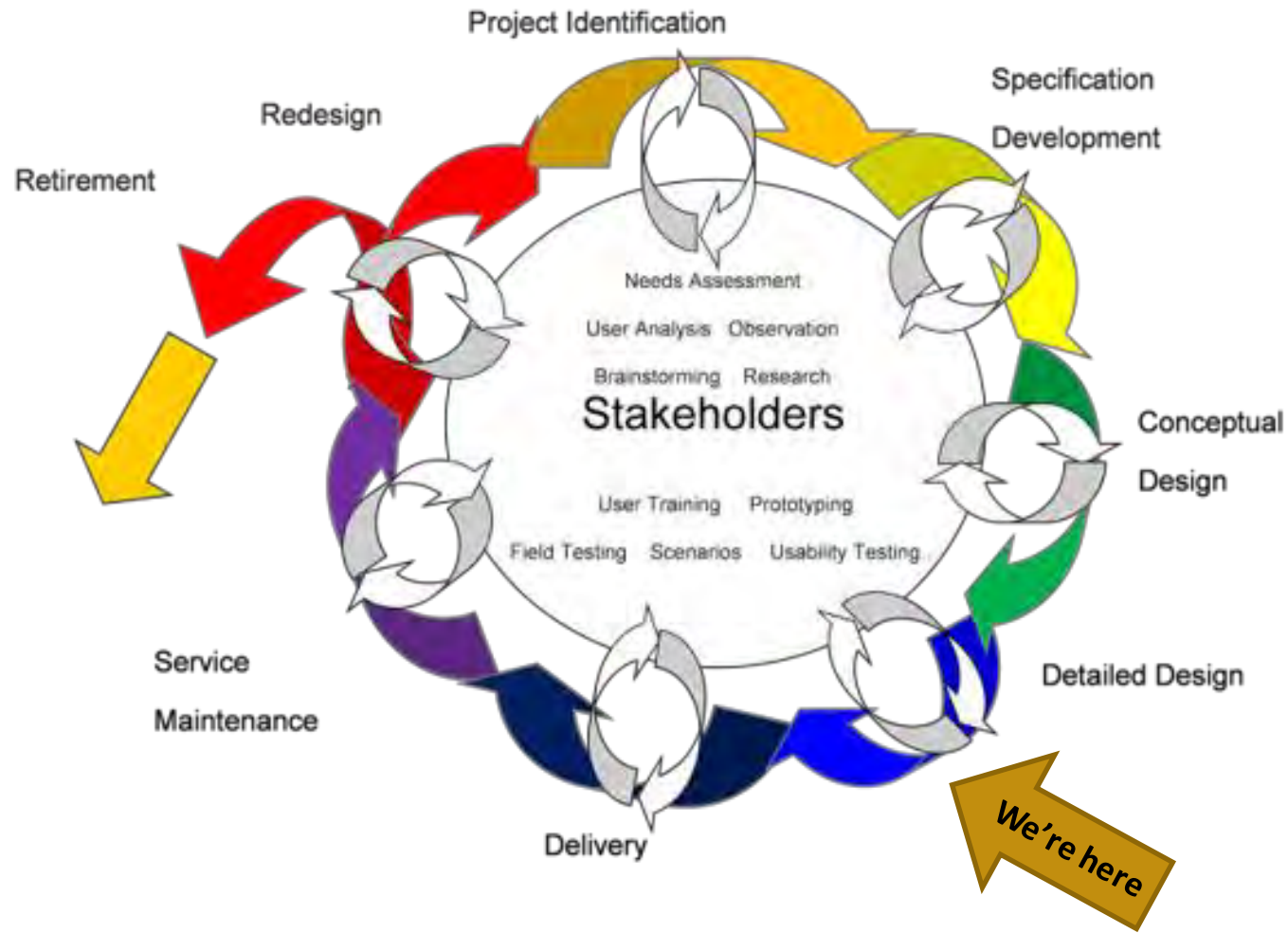
Previous Team's Work

3 Prototypes

Lazy Susan
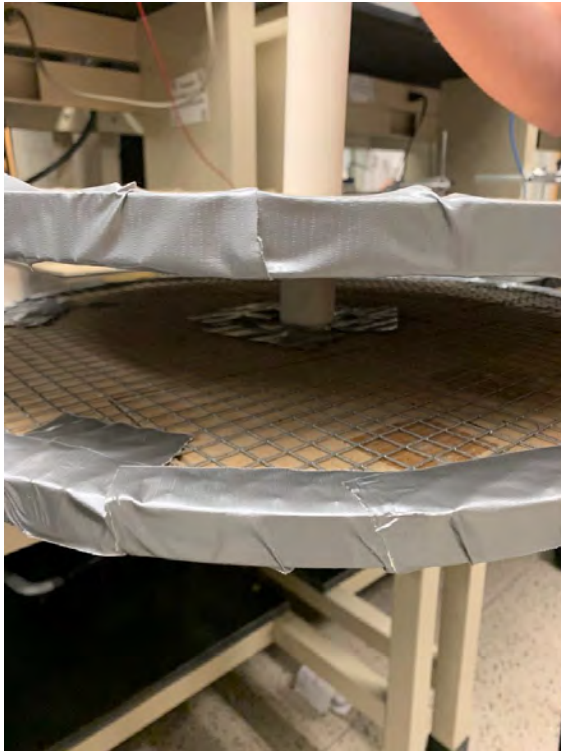
The Pinwheel

The Pepper Grinder

Previous Team's Work

Pros & Cons of Each Prototype

01	Lazy Suzan	• Great for testing • Simple and brute force concept • Heavy and bulky • Easy to use
02	The Pinwheel	• Easy to automate • Very complex and difficult to construct • Time consuming
03	The Pepper Grinder	• Inexpensive • Durable and easy to construct • Requires custom support structure

PURDUE UNIVERSITY.

Meeting Results

Meeting with Partner:

- Previous team design was not preferable to the project partner because it wasn't fully automated.

- He corrected design parameters and gave us new ones.

- We need to implement separation post-hulling process.

- Huller needs to be able to hull different bean sizes without damaging them.

- The hullers available online where preferable yet costly.

- They need one product by September.

PURDUE
UNIVERSITY.

Specification Development

Project Specifications:

- Is less than 1 m³ in volume

- Has an efficiency rate of 20 lbs./hr.

- Has a separation system

- Huller needs to be able to hull different bean sizes without damaging them.

- At least 70% success rate

- Portable

- Fully automated

PURDUE
UNIVERSITY.

Economic Analysis

Table 1: Existing Coffee Bean Hullers			
Item #	Item name	Distributor	Cost
1	Professional coffee bean skin removing machine on hot sale[1]	Alibaba	$ 300.00
2	PNG Best-Selling Hand Coffee Bean Huller[2]	Alibaba	$ 450.00
3	High Efficiency Spectrum Coffee Huller[3]	Spectrum Industries	$ 800.00
4	coffee husk removing machine[4]	Alibaba	$ 1350.00
5	stainless steel dry coffee bean parchment peeler[5]	Alibaba	$ 1800.00

1 https://www.alibaba.com/product-detail/Professional-coffee-bean-skin-removing-machine_60357988001.html?spm=a2700.7724857.normalList.2.6dff3c3a7HEbC7
2 https://www.alibaba.com/product-detail/PNG-Best-Selling-Hand-Coffee-Bean_60714849121.html?s=p
3 http://www.color-sorter.com/coffee-huller.html
4 https://www.alibaba.com/product-detail/coffee-husk-removing-machine-dry-coffee_60544917481.html
5 https://www.alibaba.com/product-detail/stainless-steel-dry-coffee-bean-parchment_60768291845.html

PURDUE
UNIVERSITY.

Economic Analysis

PROS				
Small, cheap	Medium capacity, small, cheap	Aesthetically pleasing	Large capacity, Automated, Fast	Large Capacity, Automated, Fast

CONS				
Only bulk orders, Small capacity	Wrong type of huller, only bulk orders (20 min)	too large for stakeholders, too expensive	Too large for DCC's needs, unsafe for use by deaf, too heavy	Not portable, requires special training to use, very large

Conceptual Design Process

Concept idea 1:
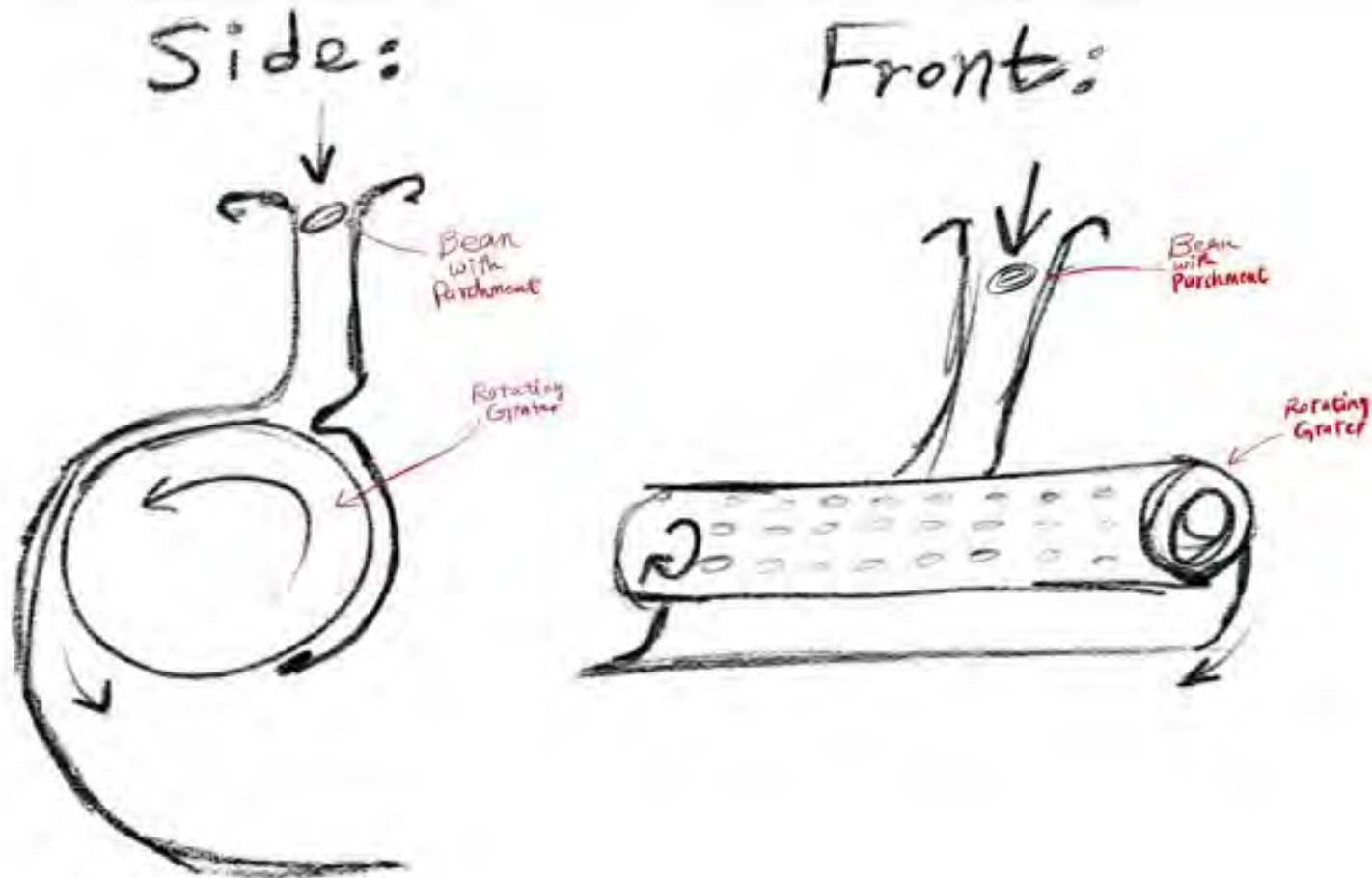
Conceptual Design Process

Concept idea 2:
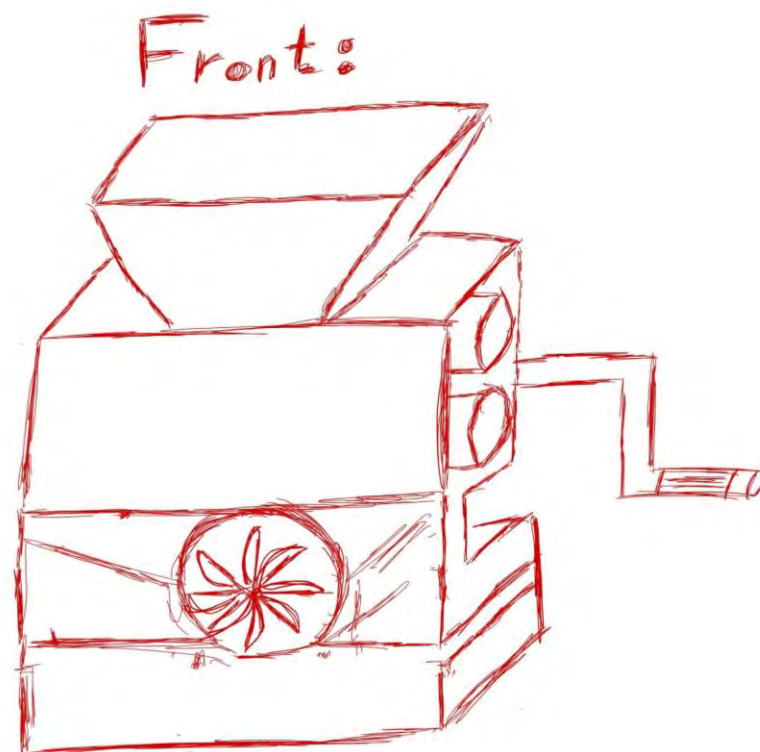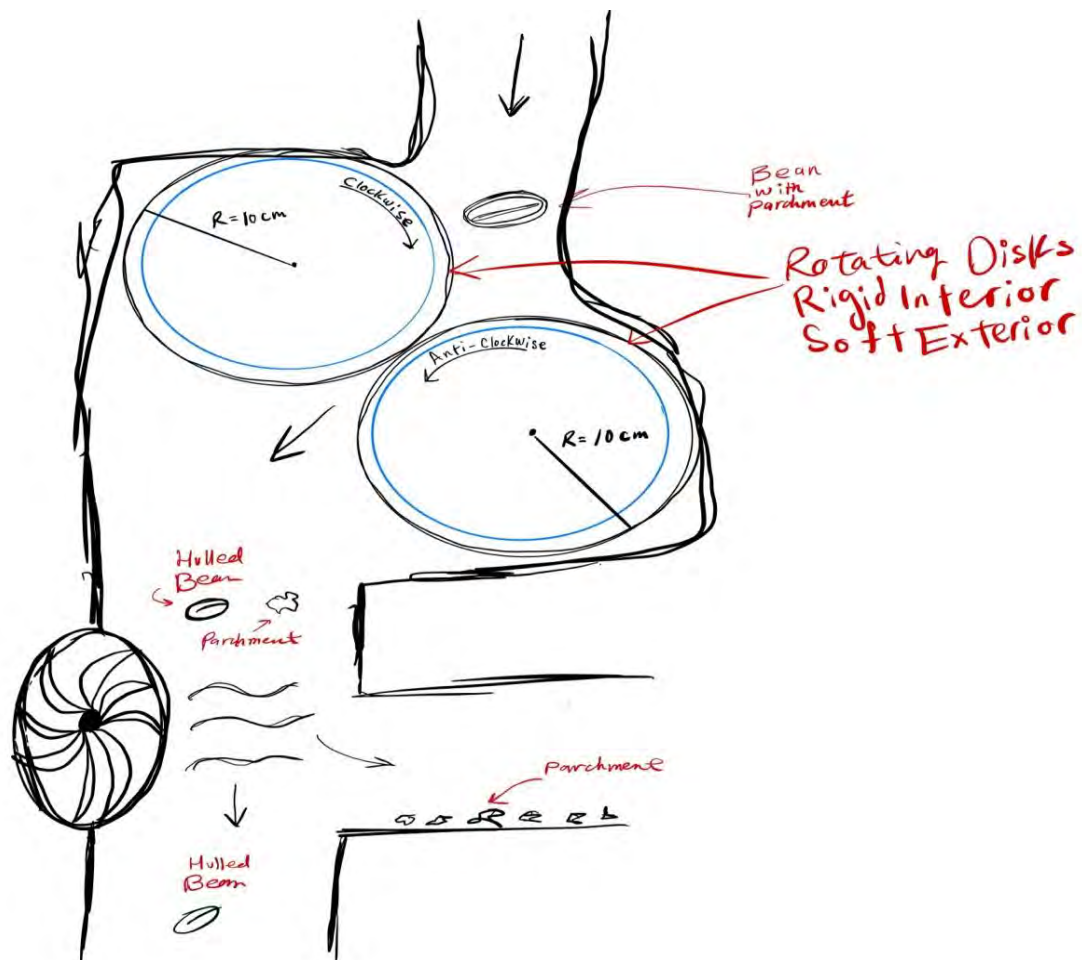
Conceptual Design Process

Concept idea 3:
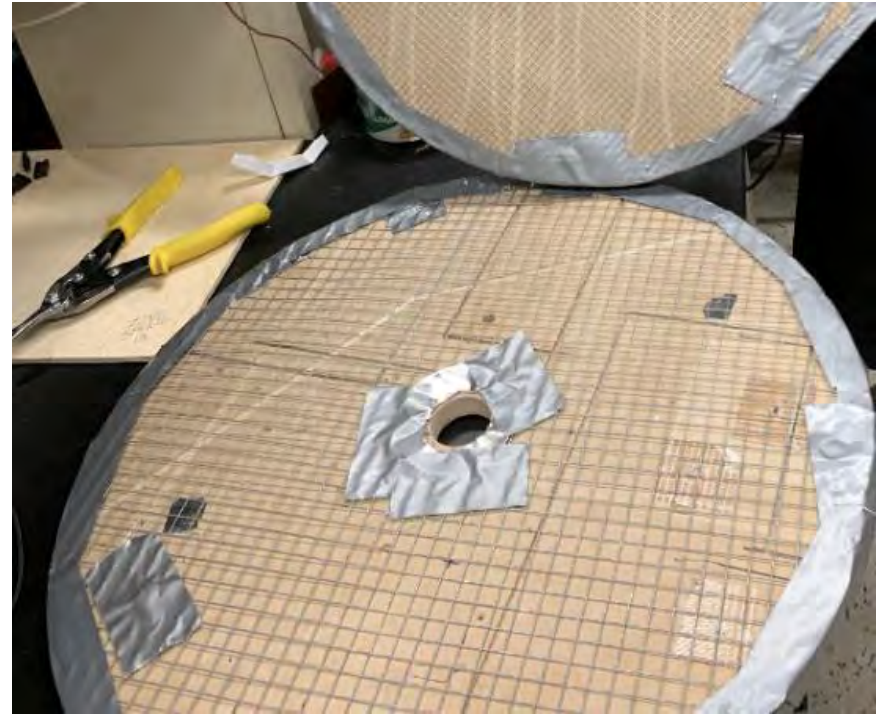
Decision Process

Concept ideas costs:

Idea 1 items	Price ($)
Cylindrical grater	40
Aluminum Sheet	18
Metal Funnel	10
Total	68

Idea 2 items	Price ($)
Cylinders	25
Rubber sheet	20
Superglue	15
Fan	20
Total	80

Idea 3 items	Price ($)
Corn grinder	25
Rubber sheet	20
Superglue	15
Total	60

PURDUE
UNIVERSITY.

Decision Process

Weighted Decision Matrix

Weighted Decision Matrix													
Critera:			**Weighting:**	**OPTIONS**									
				Lazy Susan		Pinwheel		Pepper Grinder		Idea 1: Grater		Idea 2: Cylinders		Idea 3: Corn Grinder Hybrid	
cost;	0 = costly,	5 = cheap	5	5	25	2	10	4	20	2	10	2	10	3	15
efficiency;	0 = inefficient,	4 efficient	4	4	16	0	0	2	8	2	8	4	16	4	16
portability;	0 = bulky and heavy,	4 lightweight and portable	4	3	12	2	8	4	16	2	8	2	8	3	12
size;	0 = x,y, or z axis > 1m ,	4 = less than $\frac{1}{4}$ m^3	4	1	4	0	0	2	8	2	8	2	8	3	12
automation; 0 = cannot be automated, 3 = can be automated			3	2	6	1	3	2	6	3	9	3	9	3	9
separation; 0 = can't separate, 3 = can separate			3	0	0	1	3	0	0	2	6	3	9	3	9
TOTAL				63		24		58		49		60		73	

PURDUE
UNIVERSITY.

Decision: Corn Grinder Modification

Reasons of Decision

- High potential for efficiency
- Very portable and within size range
- High potential for automation and separation
- Low Cost

1. Lazy Susan was not efficient according to previous team (2 lbs./hr.) and it needs constant unclogging.
2. Pinwheel is not within size range. It needs experience to operate and is too complex to manufacture.
3. Pepper grinder is very low on efficiency and not within size range in on of the axes.

PURDUE
UNIVERSITY.

Issues in Prototyping

- Spacing

- Plate Material

PURDUE
UNIVERSITY®

SPACING

PURDUE
UNIVERSITY®

Adjusting the Spacing
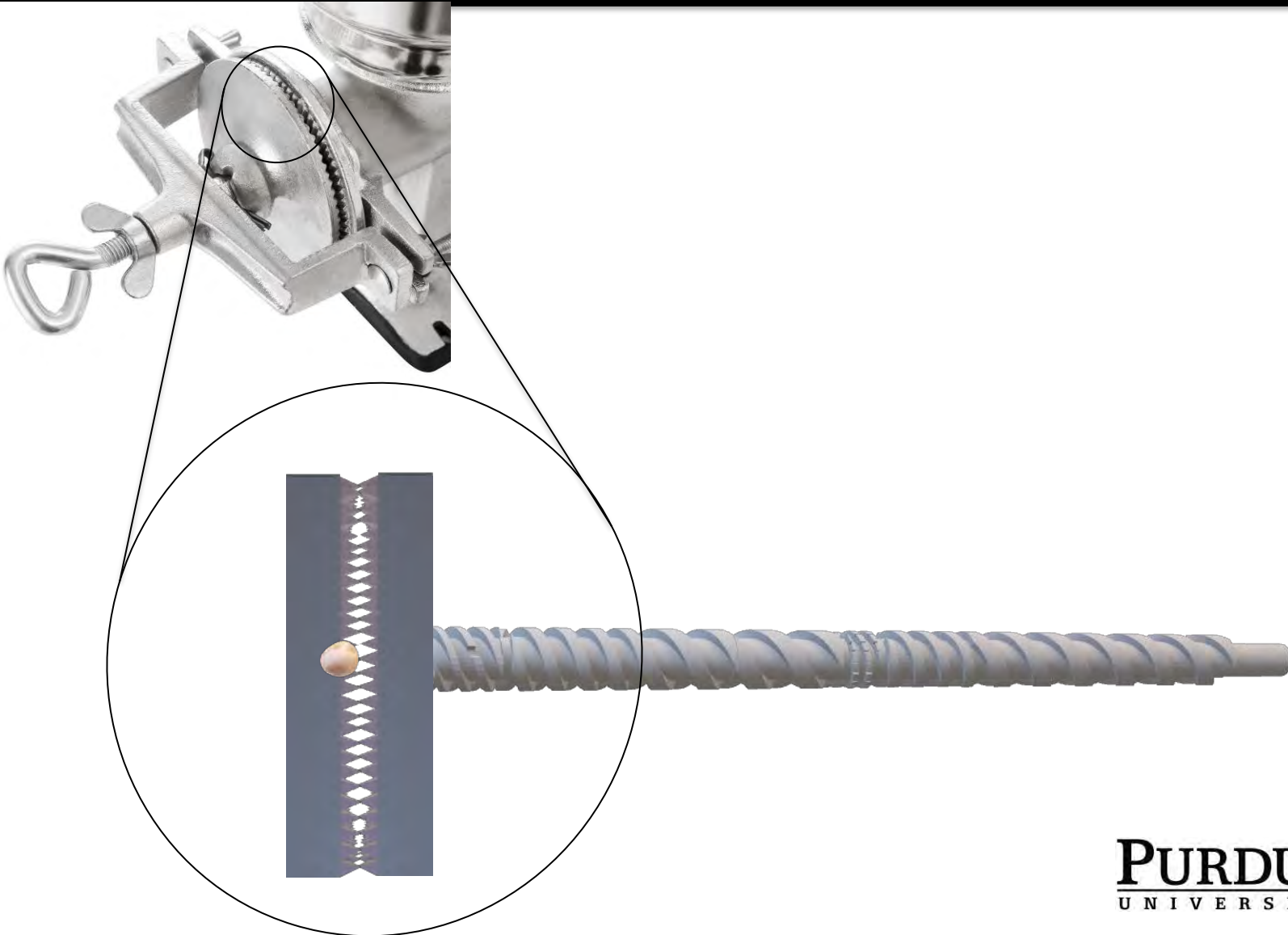
Adjusting the Spacing

Trials:

Both sides of the grinder	On the worm screw next to the handle	On the worm screw, but inside the grinder.

Adjusting the Spacing

Adjusting the Spacing

Results:

1. Putting washers inside the grinder was a success.

2. Each washer increases the distance by 0.2 inches.

PURDUE
UNIVERSITY.

PLATE MATERIALS

PURDUE
UNIVERSITY®

Plate Materials

Material Pros and Cons

Silicon Sheet		Liquid Rubber Mold		Rubber Sheets	
Pros	Cons	Pros	Cons	Pros	Cons
Cheap	Not durable	Very cohesive	Expensive	Adheres the best	Needs super glue
Easy to apply	Does not adhere	Easy to cut out	Needs time to apply	Most durable	Hard to cut out
Thin	Easy to remove	Easy to obtain	Not durable	Hard to remove	Too thick

PURDUE
UNIVERSITY.
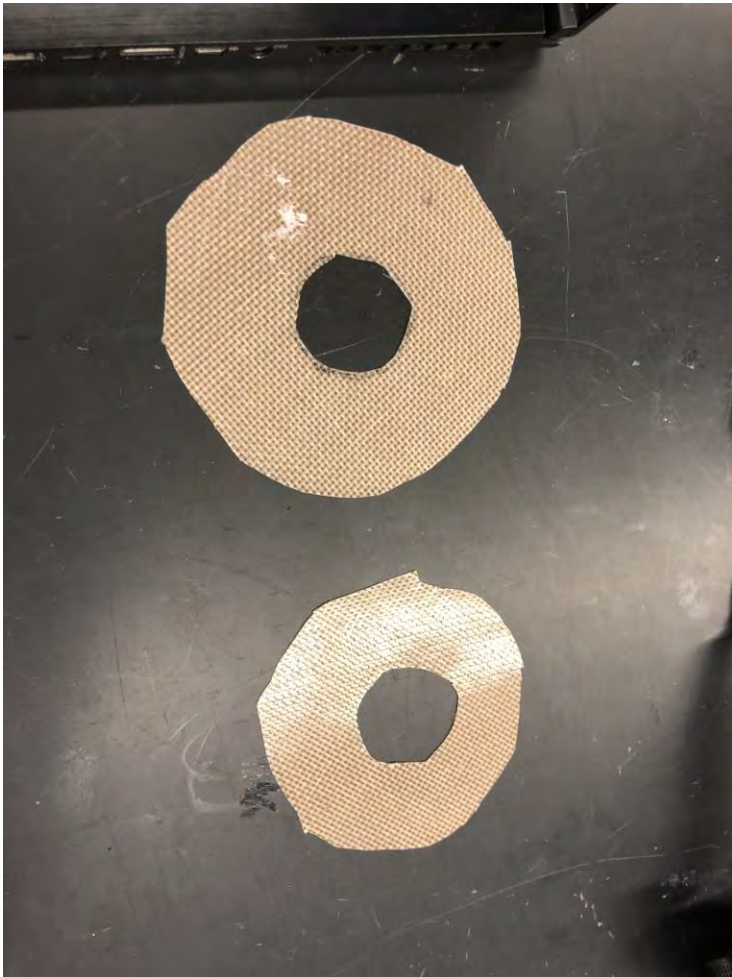
Plate Materials

Silicone Paper:

Features:

- Cheap
- Easily replaceable

Problems:

- Did not adhere to plates
- Does not adjust to different coffee bean sizes

Plate Materials

Solving the problems:

- Tried different types of glue

Unsuccessful:

- Yet, the beans were grinded

Plate Materials

Liquid Rubber (Silicon Mold)

Features:

- Cheap
- Padded
- Easy to apply

Problems:

- The liquid rubber was loose

- When turned, the mold grinded itself and it ripped

PURDUE UNIVERSITY.

Plate Materials

Solving the problems:

- Tried hot gun, to make the material adhere to the disks

Unsuccessful:

- The mold was burned.

PURDUE
UNIVERSITY.

Plate Materials

Merging both materials:

- Lack of flexibility was solved with the padding of the rubber.
- Yet the rubber was still not stuck to the plates.

Unsuccessful:

- The liquid rubber did not adhere to the plates.

PURDUE
UNIVERSITY.

Plate Materials

Rubber Sheet:

Features:

- Flexibility allows for hulling different bean sizes.
- Has high endurance.
- Adhered perfectly to plates
- Hulls the beans efficiently.
- Affordable.

Problems:

- The material was thick, which means we need to add more washers.

PURDUE
UNIVERSITY.

Plate Materials

Experiment results:

Experiment number	Blend Type	Space (cm)	Total number of beans	Number of Hulled Beans	Number of Unhulled Beans	Number of broken beans
1	Espresso Blend	0.5	50	38	4	8
2	Ethiopia Blend	0.75	50	6	44	0
3	Ethiopia Blend	0.6	50	37	7	0

Successful

PURDUE
UNIVERSITY.

FUTURE OF THE PROJECT

PURDUE
UNIVERSITY.

FUTURE OF THE PROJECT

Draft Plan for Fall 2019 Semester						
Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Implement hull removal mechanism			Design automation mechanism			
Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Develop concept design 3 into an actual product				Delivery and final presentation		

PURDUE
UNIVERSITY.

QUESTIONS ?

PURDUE
UNIVERSITY.

RILEY HOSPITAL INTERACTIVE WALL

Riley Hospital Interactive Wall Team:

Talah Tayeb
- **Role:** EPICS Project Manager
- **Major:** Geology and Geophysics

Elise Tessero
- **Role:** Project Partner Liaison
- **Major:** Environmental and Ecological Engineering

Cameron Keiper
- **Role:** Design Lead
- **Major:** Electrical Engineering

Maggie Pogue
- **Role:** EPICS Financial Advisor
- **Major:** Electrical Engineering

Elizabeth Manes
- **Role:** Project Archivist
- **Major:** Biomedical Engineering

Ali Alkahtani
- **Role:** Team Member
- **Major:** Mechanical Engineering

Presentation Agenda

1. Introduction

2. Project Partner

3. Project Identification

4. Project Specifications

5. Semester Timeline

6. Design Process

7. Projects

8. Budget

9. Looking Ahead

10. Questions

PURDUE
UNIVERSITY.

Project Partner

Project Partner

Riley Children's Health
Indiana University Health

- Ranked among the top children's hospitals in the country
  - 2019-2020:
    - Ranked in 9 individual pediatric specialties
    - Remains the only nationally ranked children's hospital in Indiana

- Project Partner Contact
  - Taylor Cole:
    - Administrative Assistant
    - Division of Pediatric Physical Medicine and Rehabilitation

PURDUE
UNIVERSITY.

Project Identification

Our project's goal is to increase the interactive features of the child-friendly wall wraps at Riley Pediatric Hospital's Rehabilitation Wing.

Users are patients who:
- Need rehabilitation
- Are children

PURDUE
UNIVERSITY.

Project Purpose

Developmental Focus Areas

Fine motor skills are the small movements of primarily the hands, wrists, and fingers

Gross motor skills are larger movements of primarily the arms, legs, or even the entire body

Cognitive thinking skills is the usage of mental activities for the purpose of learning, memory, reasoning

PURDUE
UNIVERSITY.

Project Team Focus

Our Team's Focus is to enhance the developmental proficiency of the patients in the Division of Pediatric Physical Medicine and Rehabilitation by integrating uniquely interactive multisensory elements into the existing murals of the hospital.

Project Specifications

1. Motivational focus

2. Use available outlets

3. Should not damage murals

4. No hanging from the ceiling

5. Approved materials by Hospital Building Manager

6. Durable

7. Safe usage

8. Accessible

9. Target Audience: 2 months-18 years

Semester Focus

Our Semester Focus was based around creating two products:

1. A simple deliverable with a relatively short timeline to build partner relations
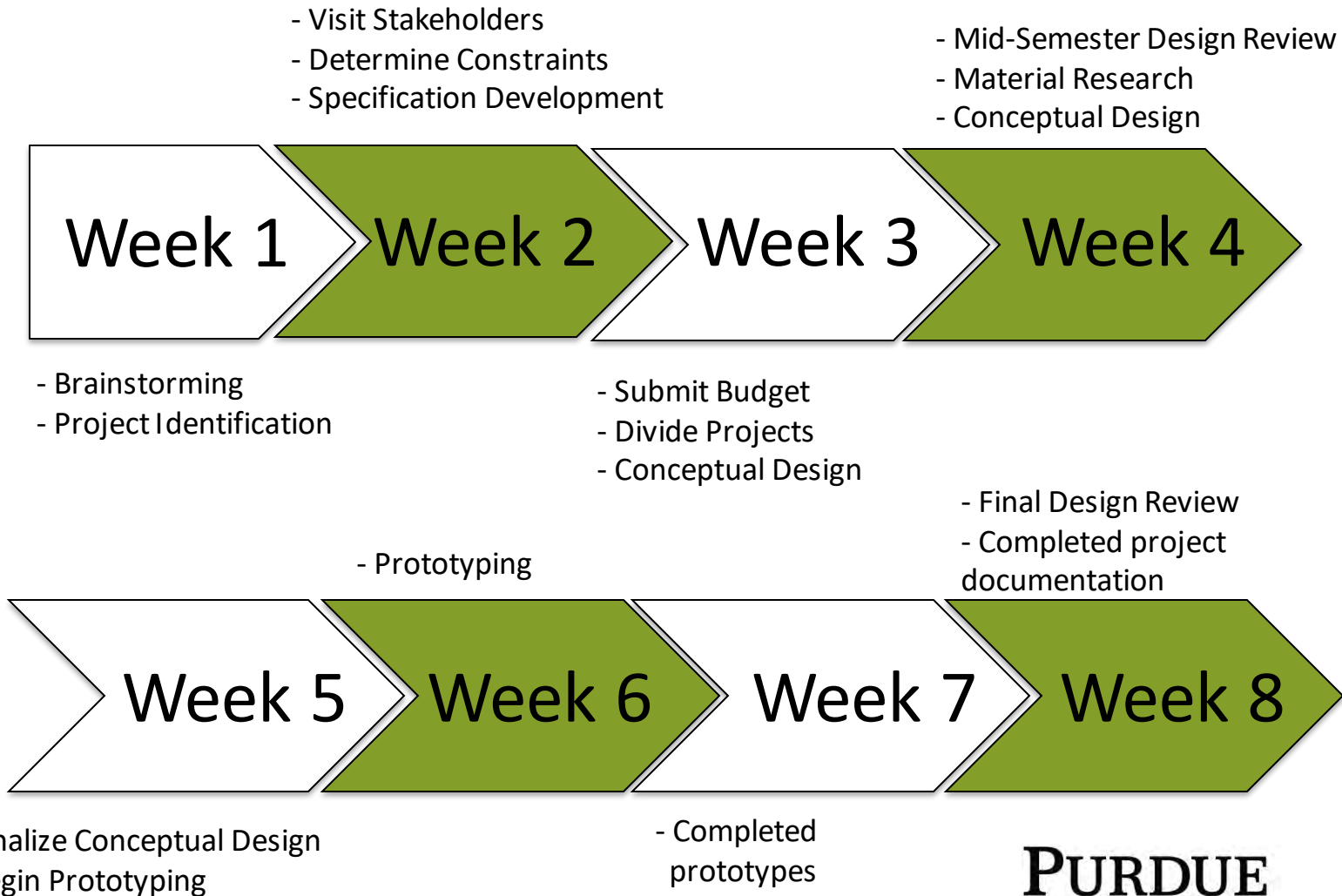   - Butterfly Stand and Interactive Mechanism

2. A more complex multi-semester product that is expandable for future team ideas and redesign
   - Indy 500 Interactive Cheer system

Semester Timeline

- Visit Stakeholders
- Determine Constraints
- Specification Development

- Mid-Semester Design Review
- Material Research
- Conceptual Design

| Week 1 | Week 2 | Week 3 | Week 4 |

- Brainstorming
- Project Identification

- Submit Budget
- Divide Projects
- Conceptual Design

- Final Design Review
- Completed project documentation

- Prototyping

| Week 5 | Week 6 | Week 7 | Week 8 |

- Finalize Conceptual Design
- Begin Prototyping

- Completed prototypes

PURDUE
UNIVERSITY.

Design Process

Start

Current position

SUB-PROJECTS:

1. INTERACTIVE CHEER SYSTEM

2. INTERACTIVE BUTTERFLY

PURDUE
UNIVERSITY.

Therapy Course: Interactive Cheer System

Interactive Cheer System Project Specifications
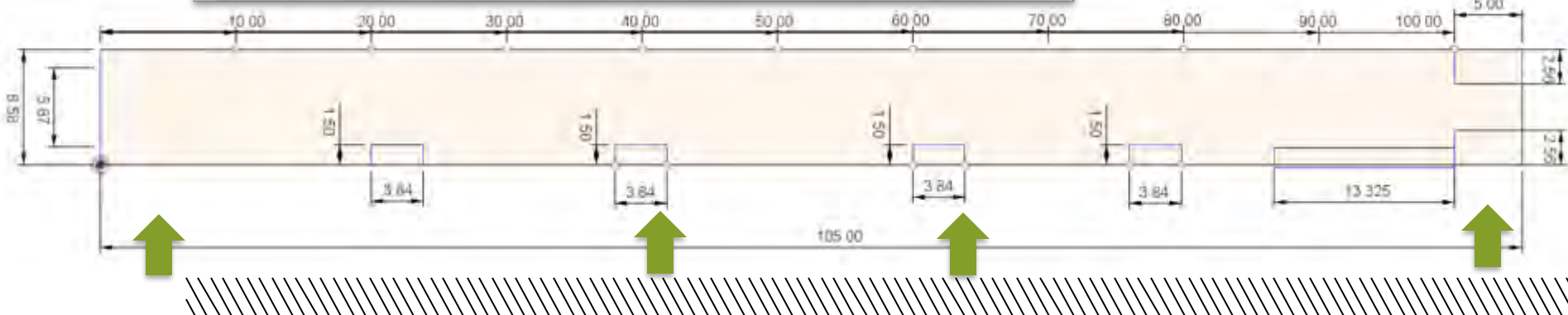

1. Provides Visual Feedback

2. Provides Auditory Feedback (Below 50dB)

3. Accurate Distance Markers

4. Toggleable

5. Matches Current Design

6. Removable

PURDUE UNIVERSITY

Interactive Cheer System (ICS)

Interactive Cheer System (ICS)

Initialization
- On/Off
- Red Light On
- Audio

Countdown
- Requires User Input
- Yellow Flashing Light
- Audio

Start
- Begins following Countdown
- Green Light On
- Audio

Sensors
- Separate Systems
- PIR Motion
- Audio

Finale
- Requires User Input
- All lights on
- Audio

PURDUE
U N I V E R S I T Y.
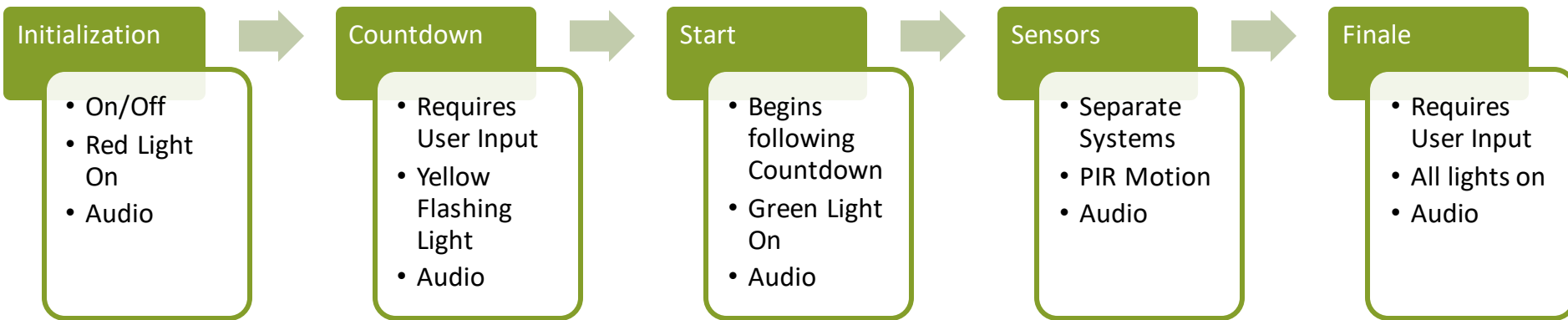
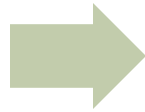# Subsystems

Audio Subsystem   Traffic Light Subsystem

Audio Sub-System

Sensor

- Reads Motion
- Outputs Logic High (5V)
- Use NPN for inversion to Logic Low (0V)

Board

- Takes Logic Low (0V) as input
- Triggers Sound File

Speaker

- Plays Sound
- Small form factor

PURDUE UNIVERSITY.

Traffic Light Sub-System

Input
- Takes input from other portion of ICS
- Dependency on other sub-systems

Board
- Process inputs
- Board only operates in range of 3.3V - 5.5V

Relay
- Functions as high voltage switch (12V)
- Takes 5V outputs of the board as inputs to trigger N.O. switch

Traffic Light
- Has traditional Red, Yellow, Green lights
- Operates at 12V
- Buzzer functionality

PURDUE
UNIVERSITY.
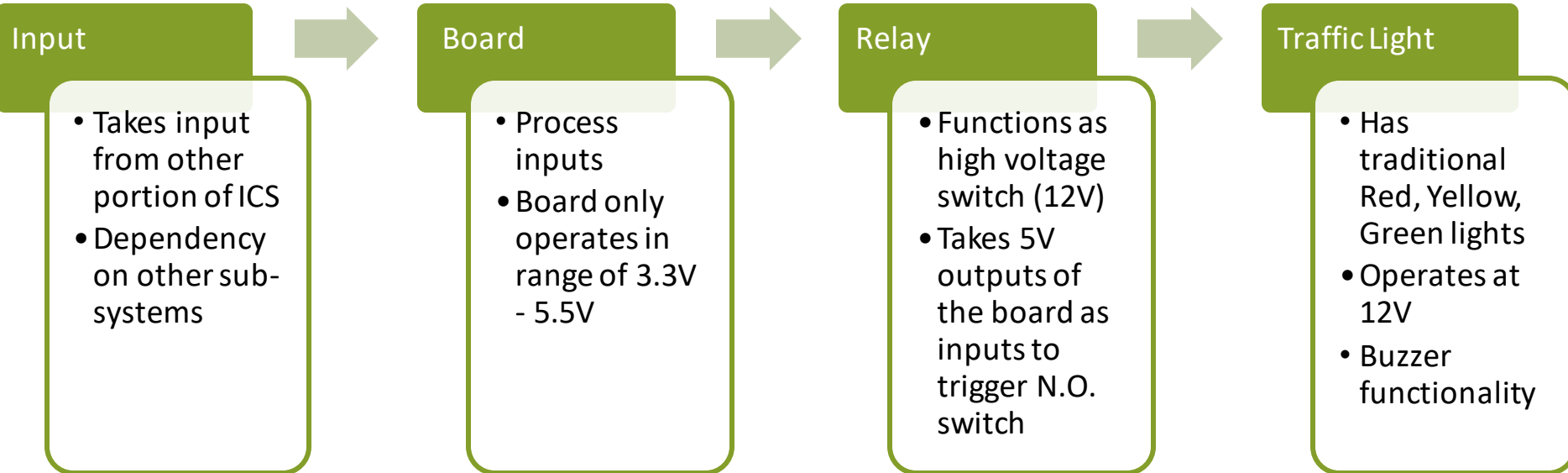
Looking Ahead
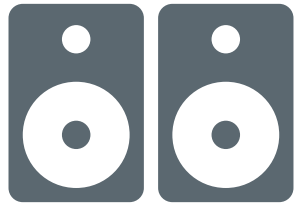
Audio Sub-System Housing Design & Prototyping

Traffic Light Implementation Brainstorming

Graduation Wall: Interactive Butterfly

Butterfly Stand and Mechanism Specification:

1. Create a butterfly project in which all patients could interact with

2. Chosen butterfly mechanism requires the capacity to hold 3 interactive butterfly mechanisms in jars

3. Chosen jars must be made of non-breakable material

4. Height of butterfly mechanisms must accommodate to all possible ability levels and ages of hospital patients (Height assumptions next slide)

5. Design must disguise different height levels to prevent patient discouragement of in reaching highest mechanism

6. Stand material must meet Riley Children's Hospital fire rating requirements

PURDUE
U N I V E R S I T Y.

Butterfly Stand and Mechanism Specifications

Height Specifications and Assumptions:

1. Information found:
    - Typical children's wheelchair height: 8" to 20"
    - Average height of standing child from 2 to 18 years of age: 33.7" to 69.2"

2. Wide range of possible heights led to assumptions of following heights for prototype testing and height feedback:
    - Heights:
        » 17 inches
        » 26 inches
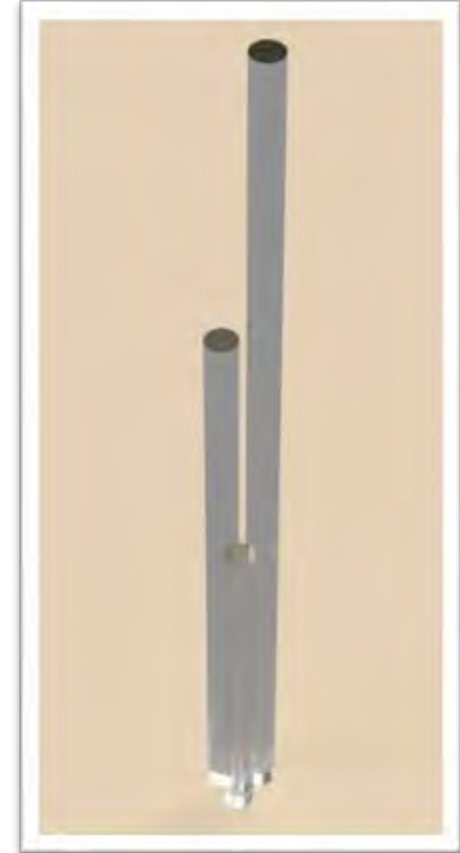   » 36 inches

Butterfly Stand: 3 Basic Prototypes

Tree with Shelves

Pillar Tree

Pillar Whimsical

PURDUE
UNIVERSITY.

TREE WITH SHELVES

ROUGH PROTOTYPE/
MINIMUM VIABLE PRODUCT

PURDUE
UNIVERSITY®

Ideas Behind Design: Tree with Shelves

Resemble a tree

Each shelf being a tree branch

Further decoration will be added through paint and decorative foliage

PURDUE
UNIVERSITY.

Prototype: Tree with Shelves

Shelf heights starting from the bottom:

17"   25.5"   37"

PILLAR TREE

ROUGH PROTOTYPE/
MINIMUM VIABLE PRODUCT

PURDUE
UNIVERSITY®

Ideas Behind Design: Pillar Tree
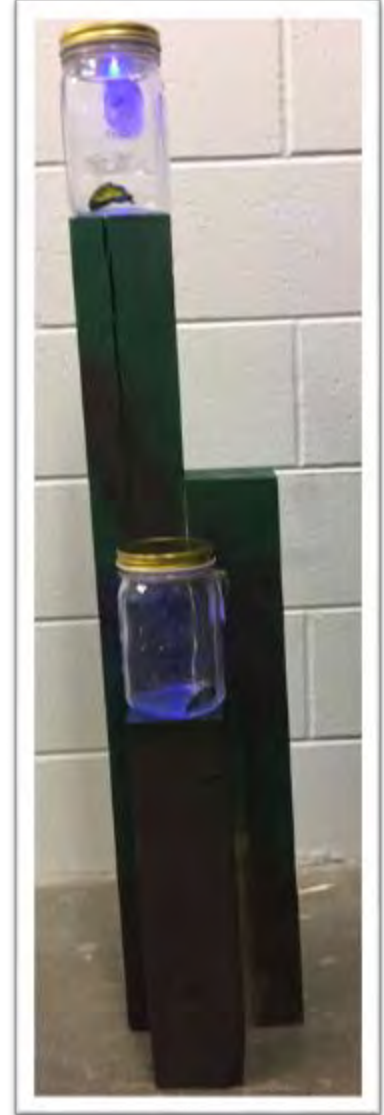
Each height is a branch beginning

Forms around the wall

Will be decorated with paint and foliage to add to the branch design

PURDUE
UNIVERSITY.

Prototype: Pillar Tree

Shelf heights starting from the bottom:

17"   26"   36"

TREE WHIMSICAL

ROUGH PROTOTYPE/
MINIMUM VIABLE PRODUCT

PURDUE
UNIVERSITY.
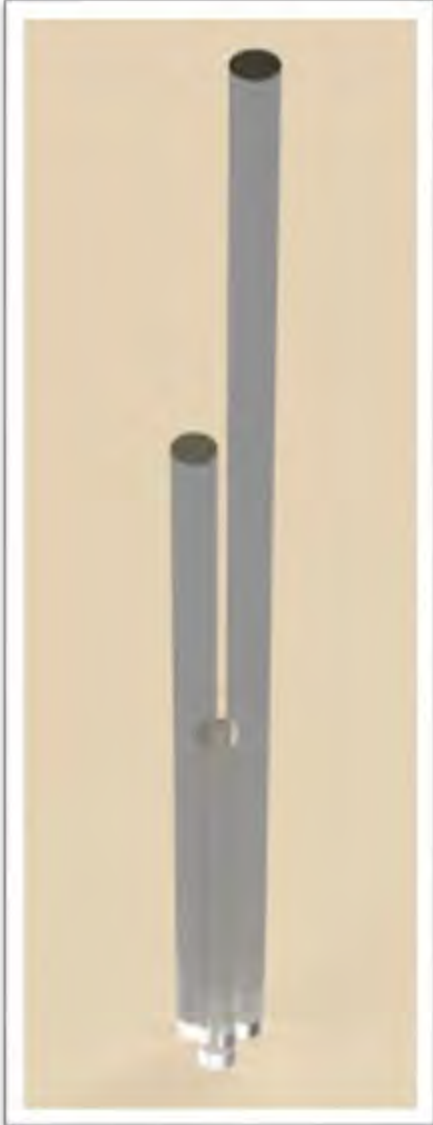
Ideas Behind Design: Tree Whimsical

Forms around the wall.

More fairytale like. Sand dyed purples, blues, and pinks.

Disguise different levels through lights, paint, and paper butterflies.

PURDUE
UNIVERSITY.

Prototype: Tree Whimsical

Shelf heights starting from the bottom:

16"

24"

34"

JAR PROTOTYPES

ROUGH PROTOTYPE/
MINIMUM VIABLE PRODUCT

PURDUE
UNIVERSITY.

Jar Prototype: Tennis Ball Container

Jar Prototype: Decorative Rock Container

Jar Prototype: Candle Lantern Container

Looking Ahead: Interactive Butterfly

Finish Prototype and Deliver for user input

Detail Design

Implementation

PURDUE
UNIVERSITY

■ Applied for the Service-Learning Grant from Purdue

Actual Budget

Sub-Project 1: The Interactive Cheer System	
Items required for sub-project	*Estimated Cost*
2.1 Vinyl floor stickers with install	$700.00
2.2 Arduino/sensors/electric components	$204.39
2.3 Decorative materials	$100.00
TOTAL = **(USED)** + **(LEFT)**	$1004.39 = **($204.39)** + **($800.00)**

Sub-Project 2: Butterfly Stand	
Items required for project	*Estimated Cost*
1.1 Prototype Materials	$12.00
1.2 Butterfly Mechanism	$98.94
1.3 Structural materials	$200.00
1.4 Decorative Materials	$150.00
TOTAL = **(USED)** + **(LEFT)**	$460.94 = **($110.94)** + **($350.00)**

Looking Ahead
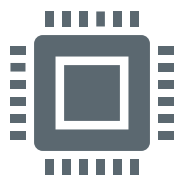
Final Prototype of
Interactive Cheer System

Modular Expansion of
Interactive Cheer System

Butterfly Stand
Refinement and Redesign

PURDUE
UNIVERSITY.

Riley Hospital Interactive Wall

QUESTIONS?

PURDUE
UNIVERSITY.

THANK YOU

Idea Process and Determination

Weighted Decision Matrix Categories

1. Cost

2. Ease of installation

3. Materials

4. Complexity

5. Importance to partner

6. Building code adherence

Weighted Decision Matrix values:

The values for each design specification are assigned on a scale of 1 to 5 where the larger values indicate a better match.

PURDUE
UNIVERSITY.

Weighted Decision Matrix

	Cost	Ease of Installation	Materials	Complexity	Importance to Partner	Building Code Adherence	Total:
Painting Ceiling Tiles	3	1	2	2	3	1	12
LED Display	1	2	2	2	3	2	12
Racecar on Track	4	2	4	2	2	3	17
Vinyl Stickers	1	5	3	5	4	4	22
Flashing Lights in Audience	3	3	3	2	3	2	16
Butterfly Jars	4	4	4	3	4	5	24
Stop Light	4	4	2	3	2	3	18
Removable Name Tags	3	3	4	3	4	2	19
Flapping Butterfly Wings	2	3	3	2	3	3	16
Interactive Cheer System	2	3	3	4	5	4	21

Projected Next Semester Timeline

Week 1
- Get familiar with overall project details to include both subprojects.

Week 2
- Visit stakeholder

Week 3
- Become familiar with prototypes and completed conceptual design for both subprojects
- Begin project updates

Week 4
- BSIM: Recieve feedback from project partner on which prototype design chosen to deliver to hospital for testing
- ICS: Begin conceptual design for adding speakers to hallway

Week 5
- BSIM: Complete prototype and deliver for testing
- ICS: Complete conceptual design for adding speakers to hallway

Week 6
- BSIM: Take collected data, plan detailed design, and order final design materials
- ICS: Create prototypes

Week 7
- BSIM: Complete detailed design and prepare product for delivery
- ICS: Move into detailed design

Week 8
- Mid-semester design review
- BSIM: Deliver final product

Week 9
- BSIM: Complete - move team to ICS team for decorative material design (ICSDM). Design floor decals and flag materials
- ICS: Detailed design for adding speakers to current system

Week 10
- ICSDM: Order, test, and integrate decorative material into full ICS system.
- ICS: Install new speakers and test sensors.

Week 11
- Delivery of full ICS system

Week 12
- Project identification for LED wall project

Week 13
- Project identification for LED wall project

Week 14
- Specification Development for LED wall

Week 15
- Specification Development for LED wall

Week 16
- Final design review
- Update Design Document

PURDUE UNIVERSITY®

Appendix

```
int led = 13;            // the pin that the LED is attached
int sensor = 2;      // the pin that the sensor is attached
int state = LOW;      // by default, no motion detected
int val = 0;             // variable to store the sensor
status

void setup() {
 pinMode(led, OUTPUT);    // initialize LED output
 pinMode(sensor, INPUT);   // initialize sensor input
 Serial.begin(9600);          // initialize serial
}

void loop(){
 val = digitalRead(sensor);   // read sensor value
 if (val == HIGH) {          // check if the sensor is HIGH
   digitalWrite(led, HIGH);   // turn LED ON
  delay(100);                // delay 100 milliseconds
```

```
void loop(){
 val = digitalRead(sensor);   // read sensor value
 if (val == HIGH) {          // check if the sensor is HIGH
  digitalWrite(led, HIGH);   // turn LED ON
  delay(100);                // delay 100 milliseconds

  if (state == LOW) {
   Serial.println("Motion detected!");
   state = HIGH;       // update variable state to HIGH
  }
 }
 else {
   digitalWrite(led, LOW); // turn LED OFF
   delay(200);             // delay 200 milliseconds

   if (state == HIGH){
    Serial.println("Motion stopped!");
    state = LOW;      // update variable state to LOW
  }
 }
}
```

PURDUE
UNIVERSITY.

PIR Pseudocode

Sensor Code:
1. The Arduino receives an input from the sensor
   - As HIGH or LOW
   - Continuously searching for these inputs

2. The Arduino then outputs a 5V voltage to the pin (which is defined as pin 13)
   - The output lights up the LED at pin 13

https://bit.ly/2YiGh4X

PURDUE
UNIVERSITY.

PIR CODE

One PIR Sensor Triggers Two Speakers

1. The PIR sensor is triggered by motion in the hall
   – The output of the sensor is 5V which goes to the transistor gate
   – The Adafruit Sound Board requires a LOW instead of a HIGH to trigger the speaker Pin which holds the necessary sound file
2. The transistor inverts the signal and creates a LOW to trigger the sound for the speakers
3. The signal is taken to a built-in amplifier in the board and then out to the speakers to play the .wav file

PURDUE
UNIVERSITY.

Audio System Prototype

Speaker with sensor input
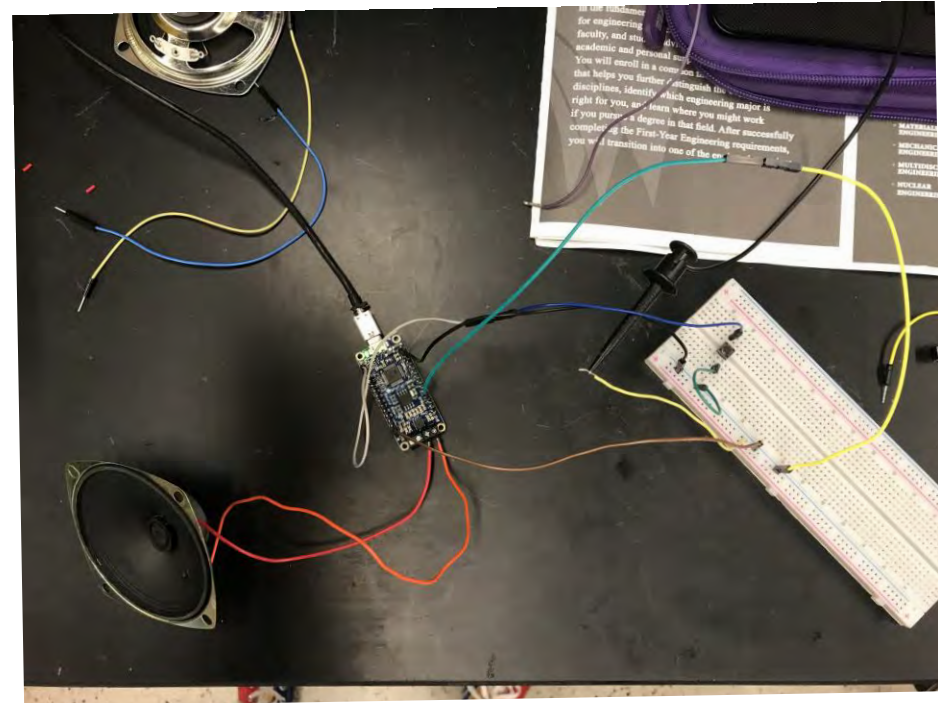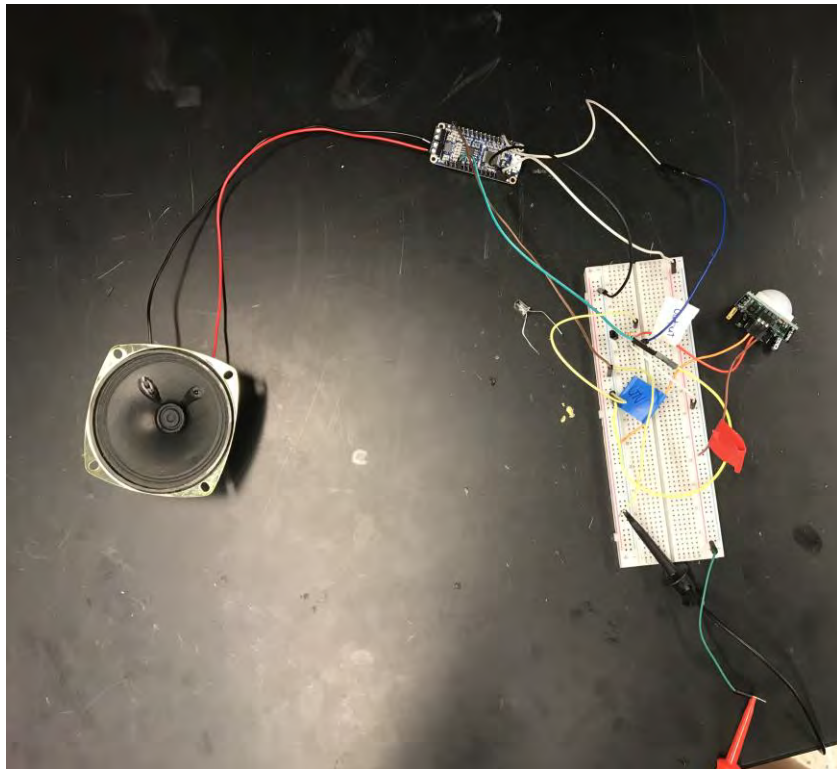
Speaker with button input

PURDUE
UNIVERSITY.
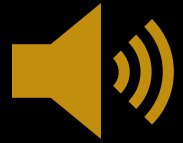
Audio System Prototype
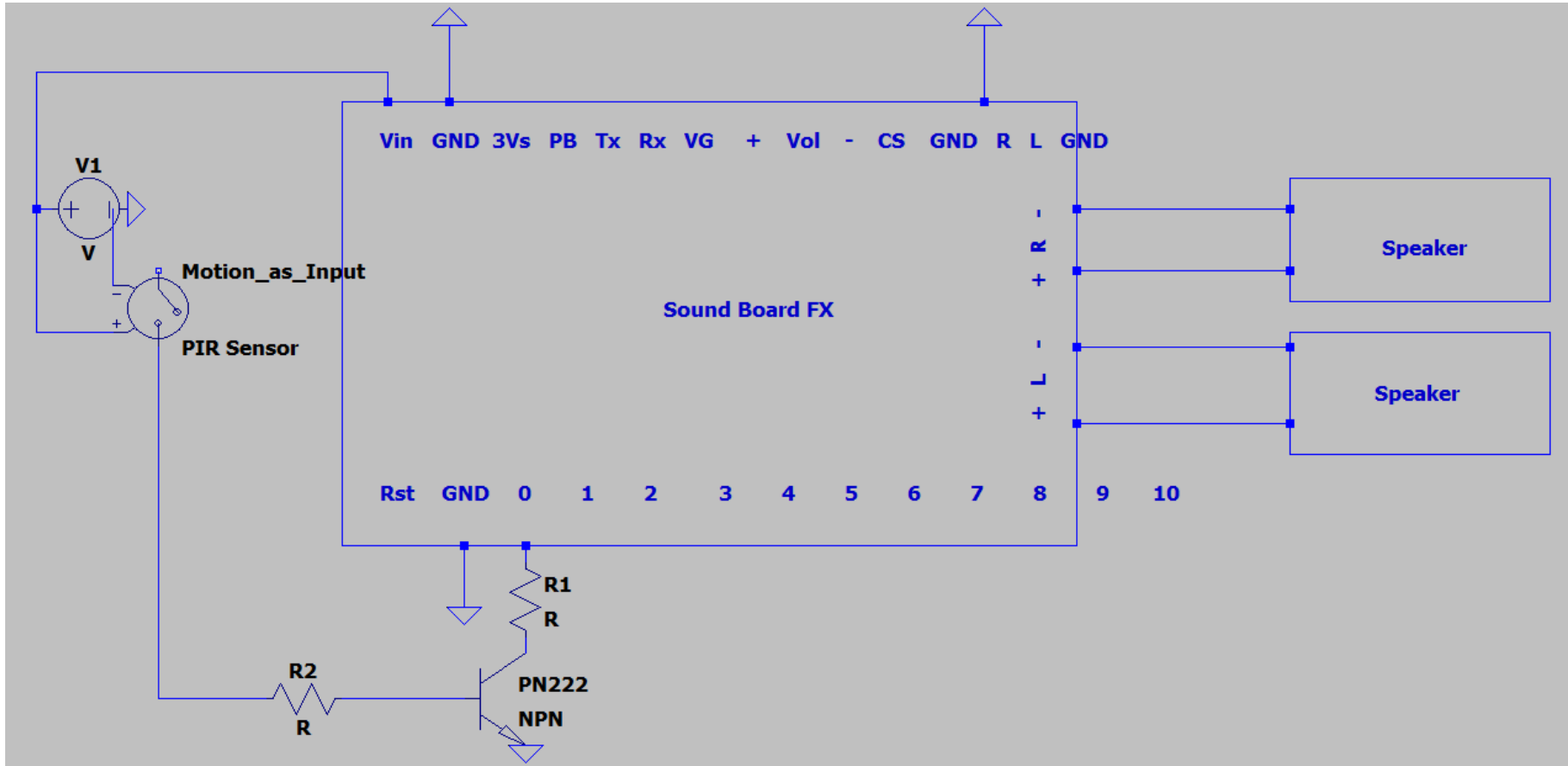
Traffic Light Prototype

```
void setup() {
 pinMode(1, OUTPUT);
 pinMode(2, OUTPUT);
 pinMode(3, OUTPUT);
}

void loop() {
 digitalWrite(1, LOW);
 delay(250);
 digitalWrite(1,HIGH);
 delay(250);
 digitalWrite(2,LOW);
 delay(250);
 digitalWrite(2,HIGH);
 delay(250);
 digitalWrite(3,LOW);
 delay(250);
 digitalWrite(3,HIGH);
 delay(250);
}
```

PURDUE UNIVERSITY.

Integrated Systems
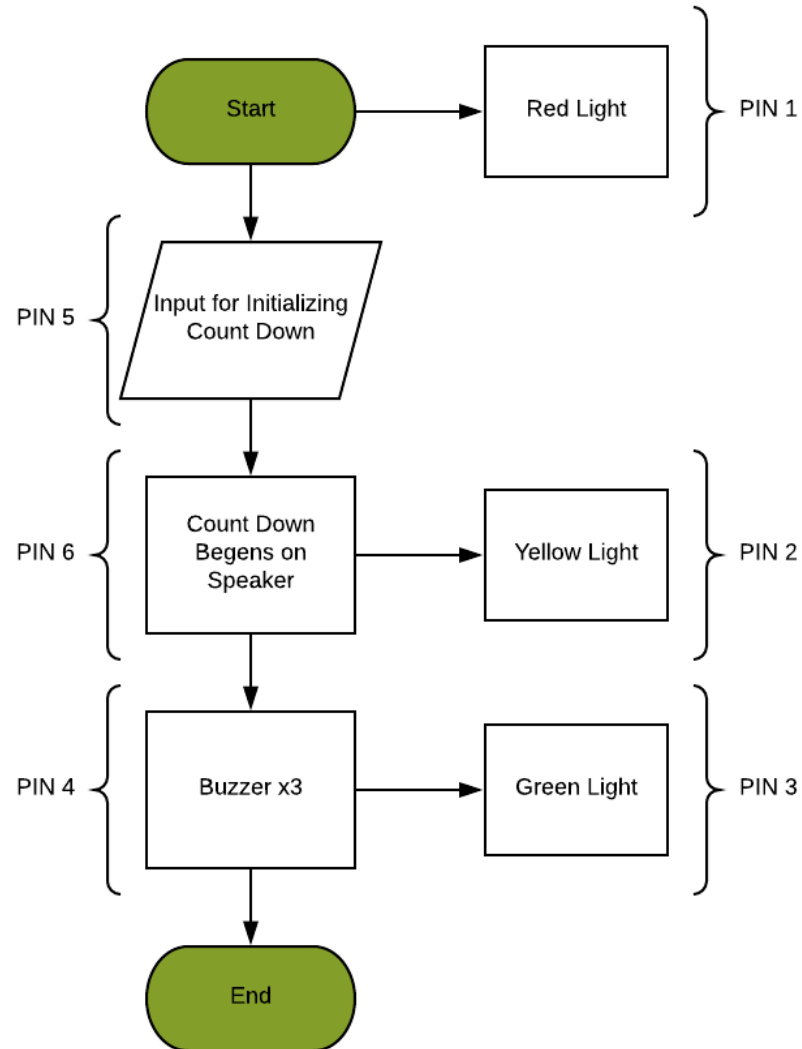
Initializing Sequence

```
// Initializing Variables
// Set pin numbers and Constants
Const int (buttonPin)  = (whatever pin you want to use);
Const int (redLightPin)  = (whatever pin you want to use);

// Changing Variables
Int buttonState = 0;    // Variable for understanding
                        //the status of the button or input

Make a function to call for input and output
Pass in 3 variables
        Two pin values (input and output pin)
        One for the state of the input

Void setup()
{
// Initialize the pin as an output
pinMode(redLightPin, OUTPUT);
// Initialize the pushbutton pin as an input
pinMode(buttonPin, INPUT);
}

Void loop()
{
// Read the state of the pushbutton value:
buttonState = digitalRead(buttonPin);
```

```
//check for the pushbutton which has been pressed now
//If the button has been pressed HIGH
//Else the button has not been pressed and is LOW
If (buttonState == HIGH)
{
//The red light will be turned on
        digitalWrite(redLightPin, LOW);
}

        Else
        {
        //The red light will be off
        DigitalWrite(redLightPin, HIGH);
        }
}
```
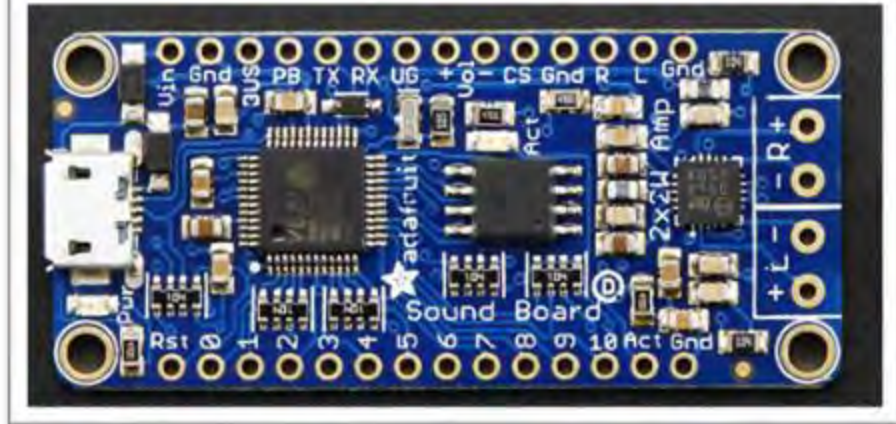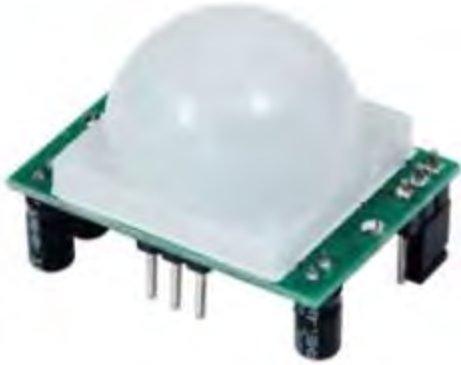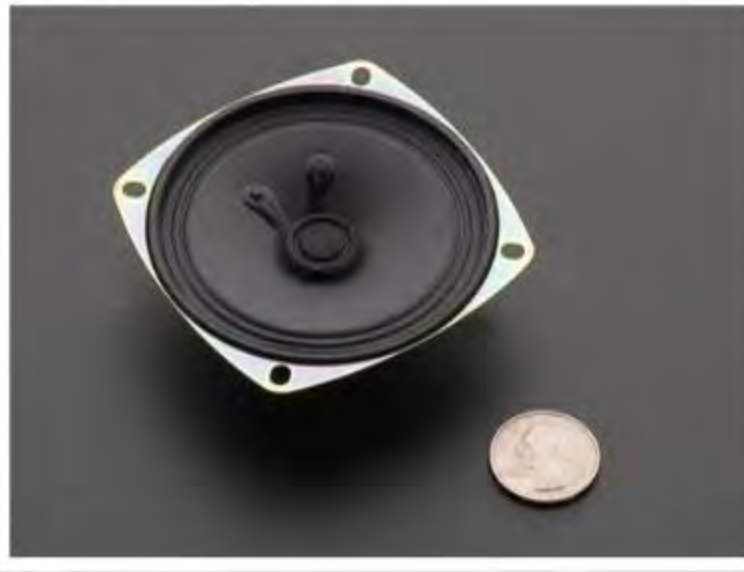
PIR Motion Sensor

Audio Sub-System Materials
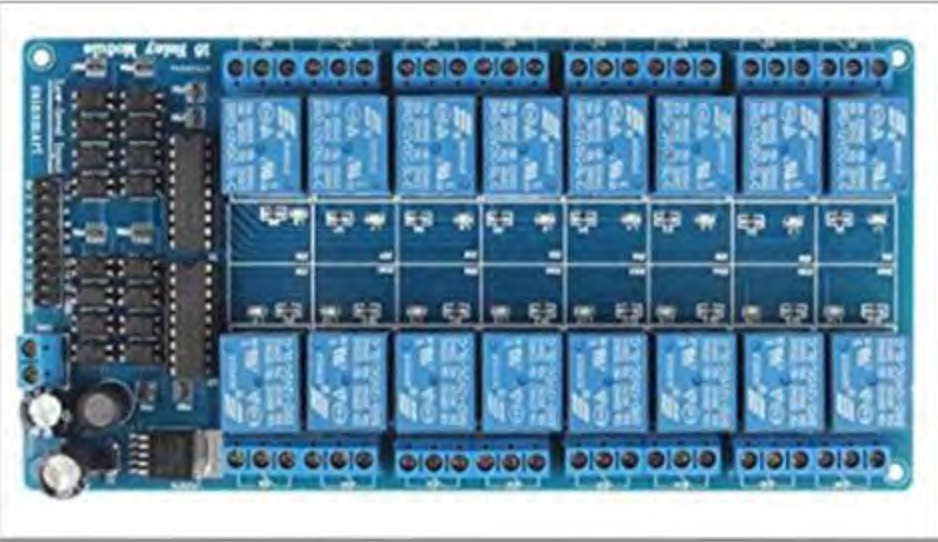

https://bit.ly/2YiGh4X

https://bit.ly/2GzFCSt

https://bit.ly/2I8CgJz
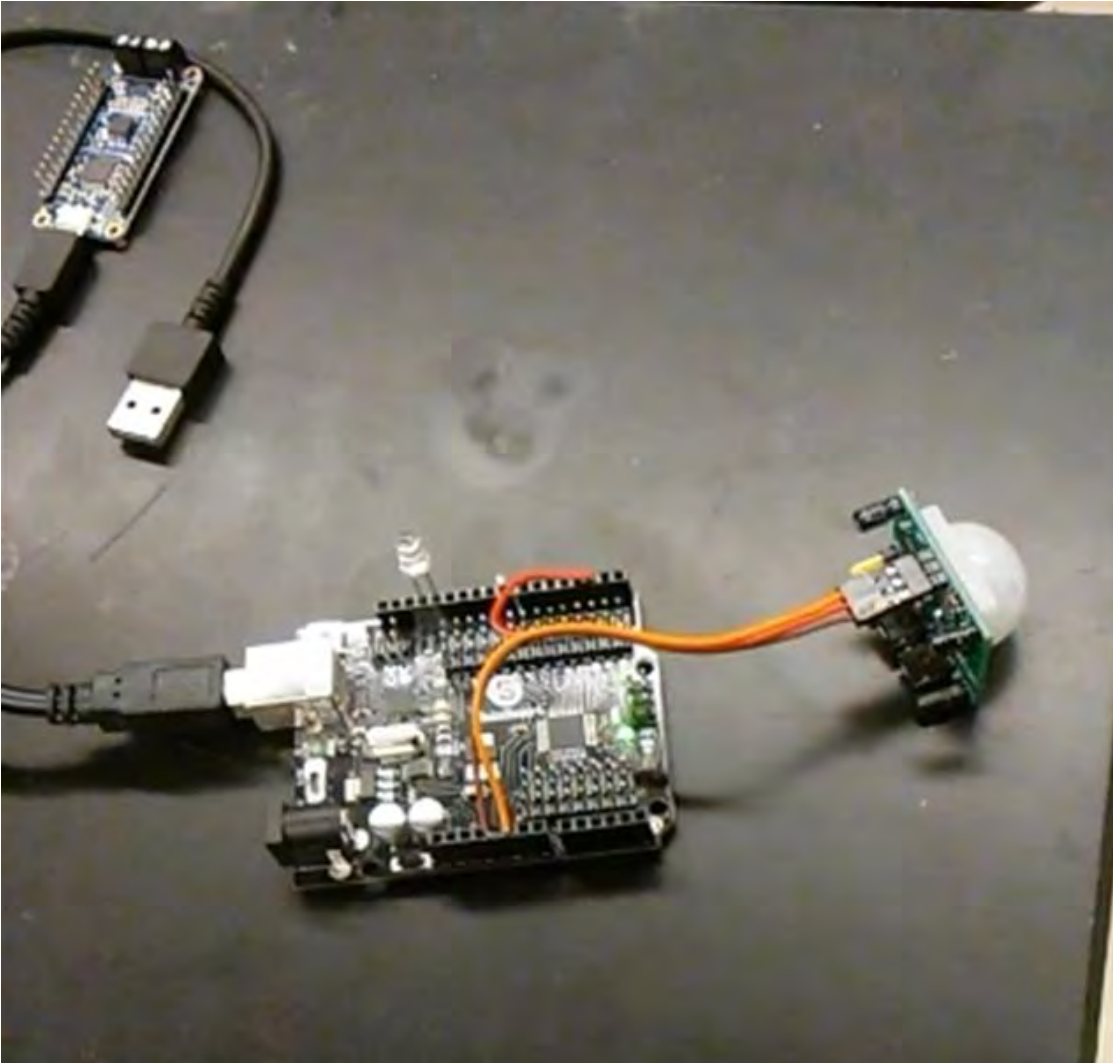
Traffic Light Sub-System Materials

https://amzn.to/2OIh6Lf

https://amzn.to/2ZIt9cE

https://amzn.to/2Y7eYLG

https://bit.ly/2SMcV9R

PURDUE
UNIVERSITY.