Facial Recognition Alarm System (FRAS)

"FRAS Can Do The Task!"
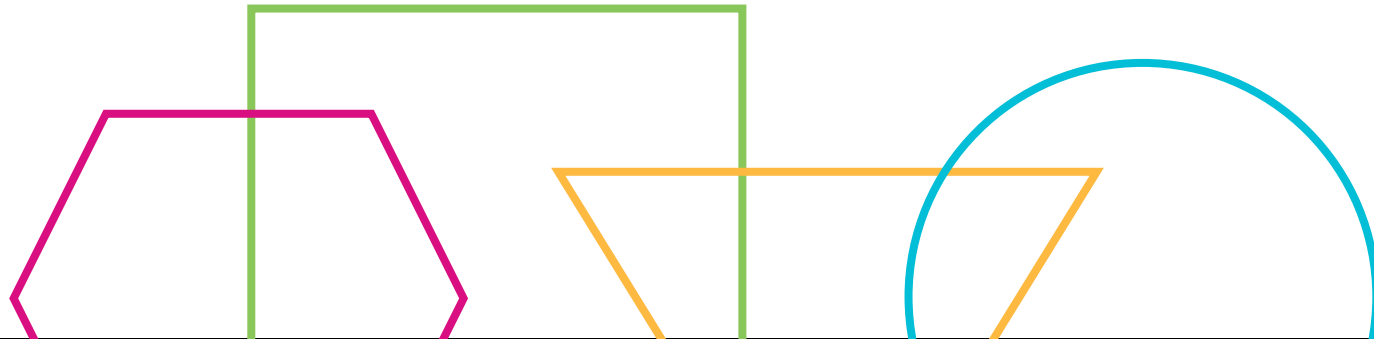
Who Are We

Ryan Mac
Abbott Lawrence Academy

Behailu Tesema
Community Charter School of Cambridge

Jacob Tesema
Community Charter School of Cambridge

Semir Seid
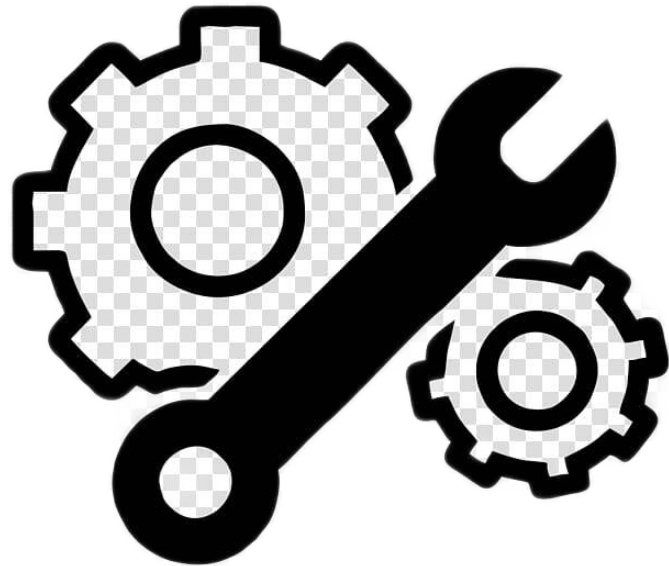*Cambridge Rindge and Latin School*

Wesley Ekes
Boston Collegiate Charter School

Wilbert Mendez
John D. O'Bryant School of Mathematics and Science

Prior Engineering Experience.

Prior experience to engineering design through **mechanical engineering** and **civil engineering/urban planning** courses (Fall 2021, Spring 2021)

- Both courses involved intensive brainstorming, problem-solving, and creating a foundation for larger projects
- Interests: biomedical engineering, computer science, etc.

Problem Statement & Storytelling

Charlestown residents see uptick in 'porch pirates' stealing packages

Police Investigating Hollywood Shores Package Theft

by St. Mary's County Sheriff's Office   November 17, 2023

- **Package theft** is a widespread issue across the world, especially in the U.S

- Despite current initiatives to mitigate this problem (e.g Amazon Locker), a growing number of customers expressed concern over their level of convenience and general measures of security
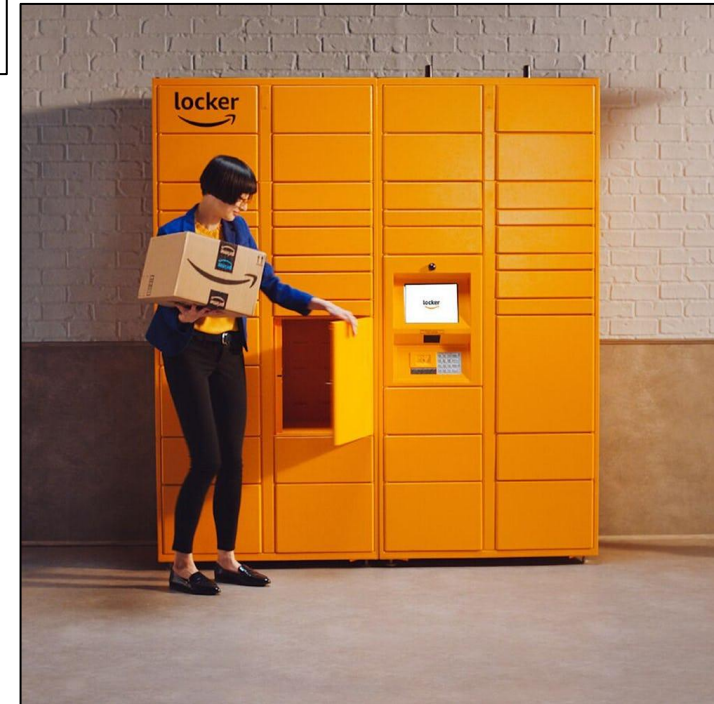
Statistics

260
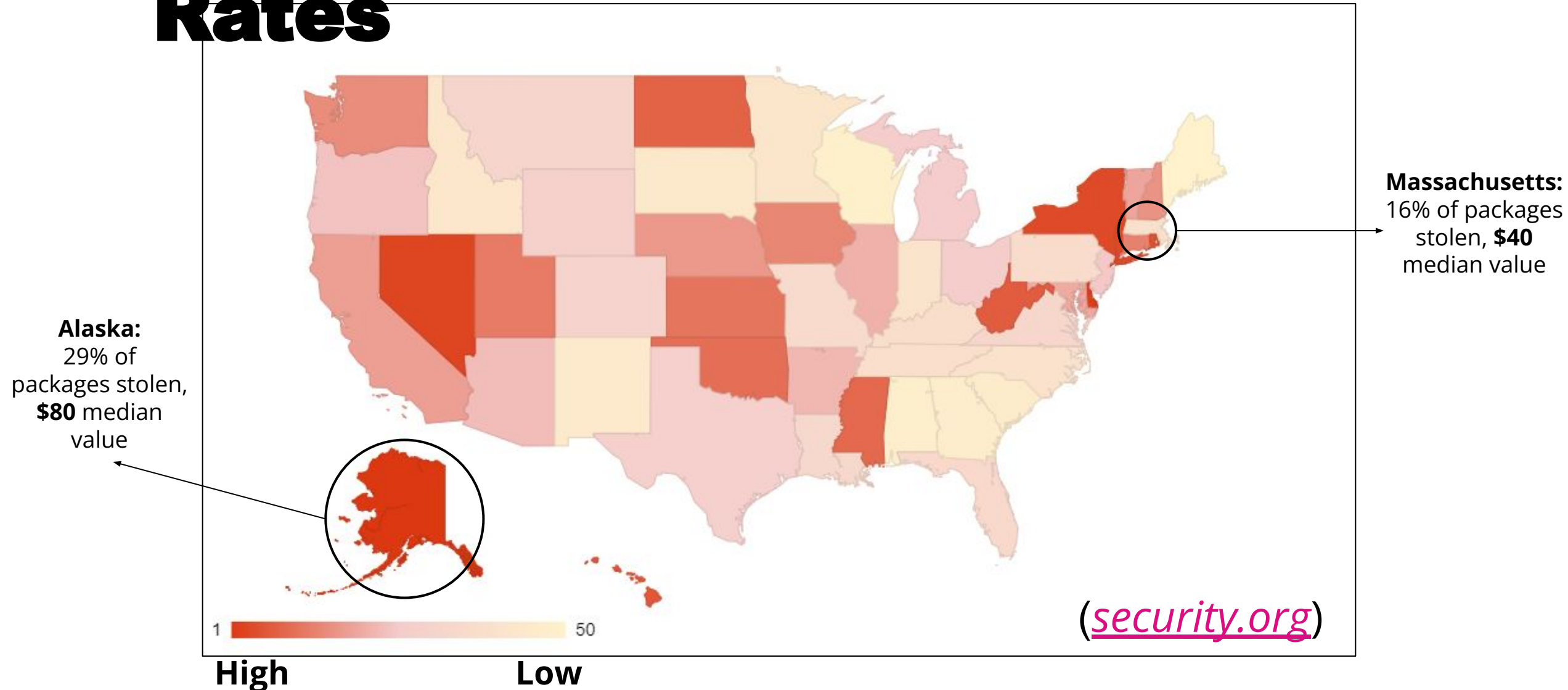
Million

Packages

Stolen In The

United States

in 2022 Alone

$19.5

Billion

Annually **Lost**

To Package

Theft In The
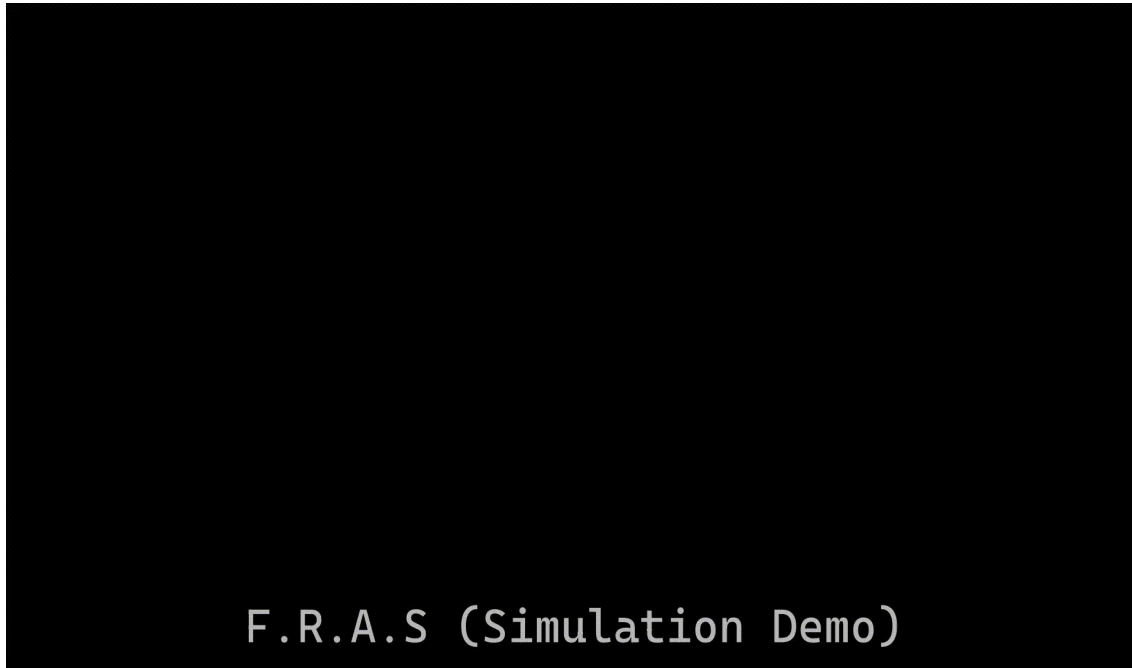
United States

(*CNBC*)

Package Theft Incident Rates

Massachusetts: 16% of packages stolen, **$40** median value

Alaska: 29% of packages stolen, **$80** median value

(*security.org*)

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High   Low

Package Theft Incident

States with highest package theft rates		States with lowest package theft rates	
Alaska	29%	Maine	12%
Delaware	27%	Wisconsin	13%
Nevada	27%	Alabama	14%
New York	27%	Georgia	14%
Rhode Island	25%	South Carolina	14%
Hawaii	25%	New Mexico	14%
West Virginia	25%	South Dakota	14%

(*security.org*)

FRAS
Facial Recognition Alarm System

F.R.A.S (Simulation Demo)

F.R.A.S (Simulation Demo)

Success

Failure

FRDPARRC Table & Strategies

| Functional Requirements	Design	Analysis	References	Risks	Countermeasures
• **Identification element** which relays back to the customer through an application	• **Facial recognition hardware** embedded into the box • **Built-in sensor** with detected radius after mailing service has delivered the package • **Software portal** within Amazon App: manages facial scan setup/package security status	• AI-based facial recognition • **Data will be stored locally** on customer's phone in order to prevent potential breaches/ misuse of user data	• [Lock Box Package Delivery](#) - Patent Design • Amazon Locker • Mark Rober's GlitterBomb 5.0 Trap	• System gets hacked and facial recognition is bypassed • How do Amazon workers put items into the box itself? • Ideal weight of the box • Material — carbon fiber is generally expensive	• Amazon workers equipped with an access card OR through their Amazon Employee Number & Code • Utilizing robust, but light materials

Prior Art Analysis

1. **GlitterBomb** 5.0 Trap

Mark Rober
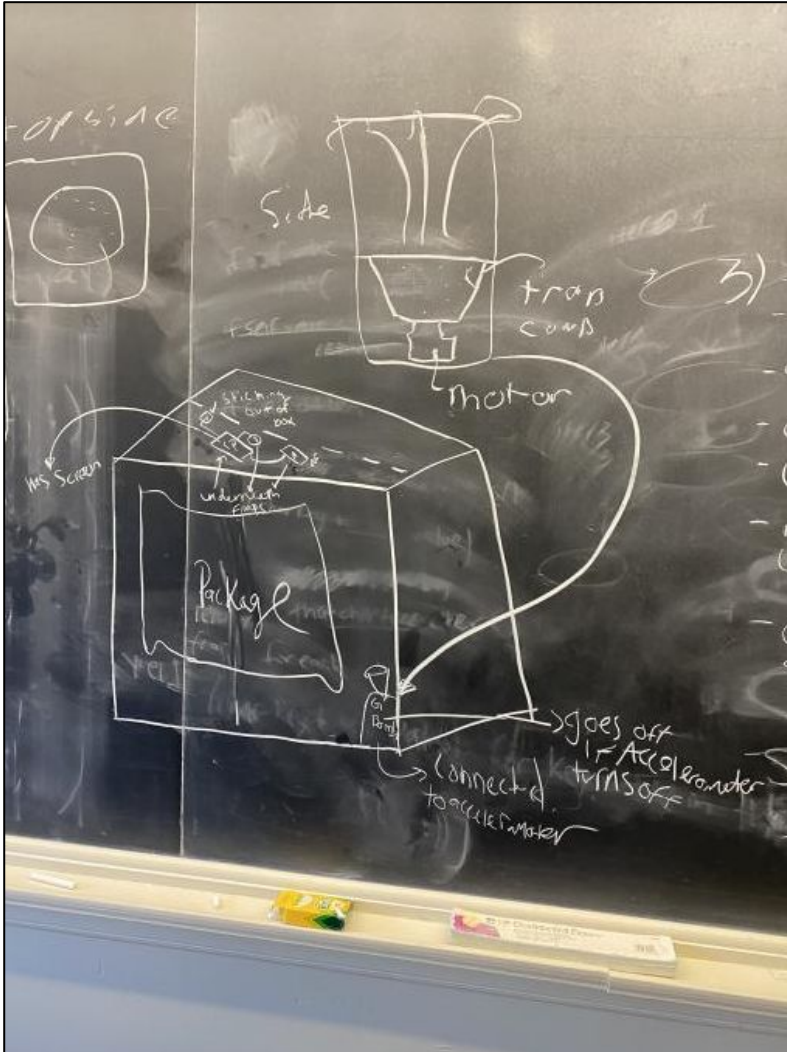(American
Youtuber,
Engineer &
Educator)
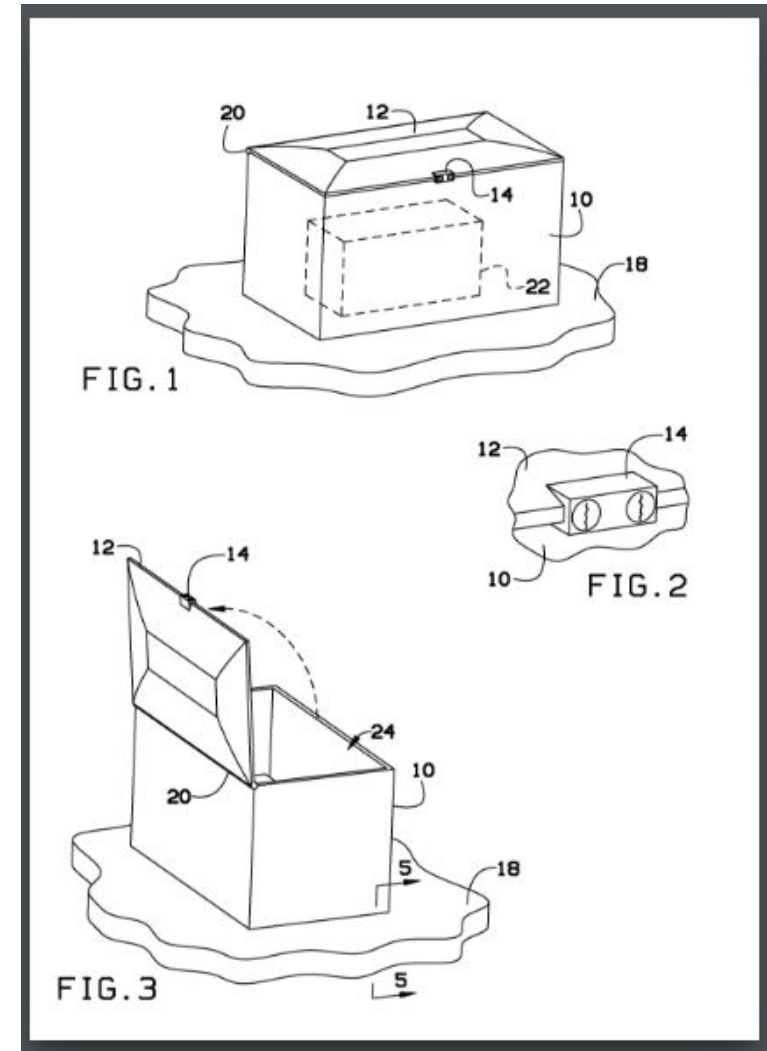
Inventor:
Charlene
Pfeiffer

2. **"LockBox"** Package Delivery

Patent Design

Concept Sketches

Rough Sketch

Concept Design

Note: Not Drawn To Scale
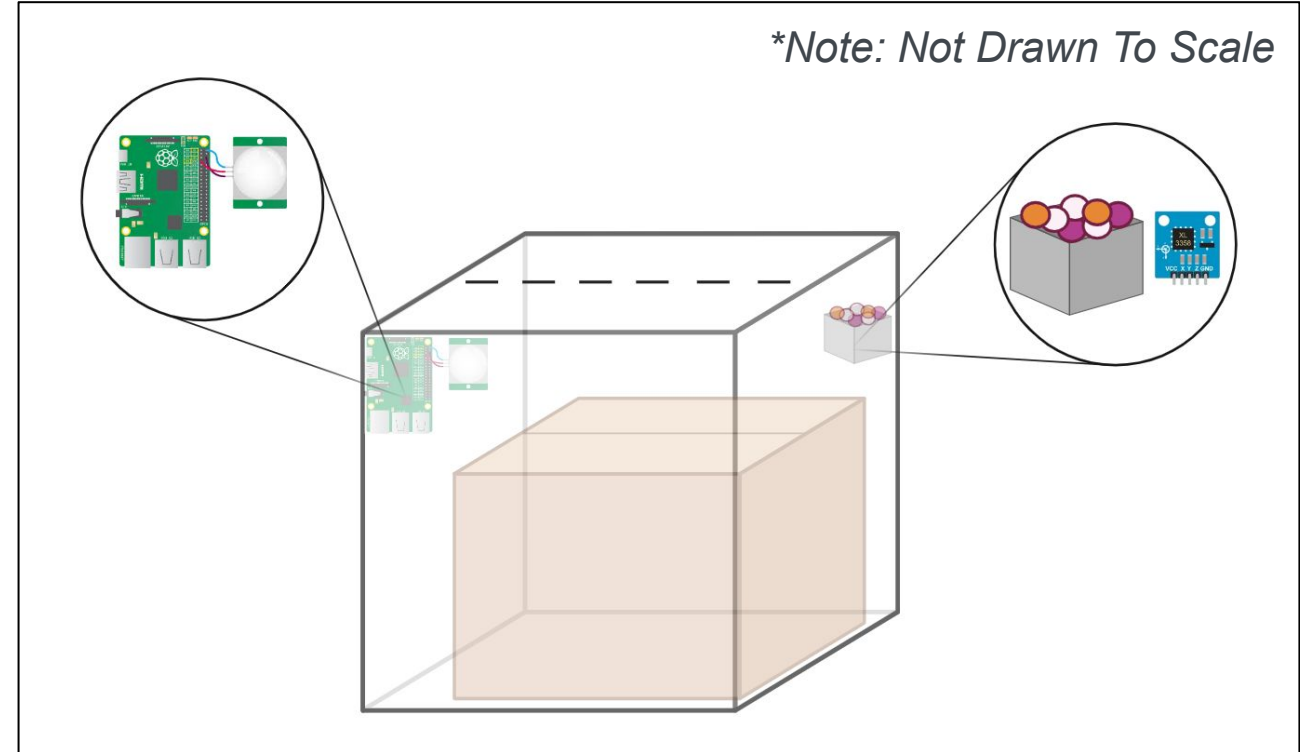
- *FRAS Box established around the perimeter of the package*
- *Raspberry Pi secured either in flaps or side of FRAS Box, connected to camera, accelerometer, and Glitter Trap*

Most Critical Module (MCM)

Raspberry Pi 4

- Has computing power similar to actual computers and laptops

- Various ranges of inputs and outputs (e.g. USB, HDMI, camera etc.)

- Cost efficient and small enough to fit within packages

- All pieces of equipment are powered by the Raspberry Pi

Bill of Materials

Item Name	Cost
Mini Speaker	$5.99
(Optional) Touchscreen Case	$33.99
RPi Camera	$19.99
Accelerometer	$8.99
Raspberry Pi 4 Model B	$54.99
Total	~$75.99

Note: Due to existing inventory access, some prices are not counted for into the total

Steps

Step 3

Polish **prototyping elements**: materials, software, etc.

Step 4

Brainstorm and propose **pricing models** (e.g. subscriptions)

Step 1

Learn how to utilize and apply an **accelerometer** and **A.I Facial Recognition** to the Raspberry Pi itself

Step 2

Learn how to **train** the A.I Facial Recognition (w/ ML) system and develop a **software portal**

MITES

MIT

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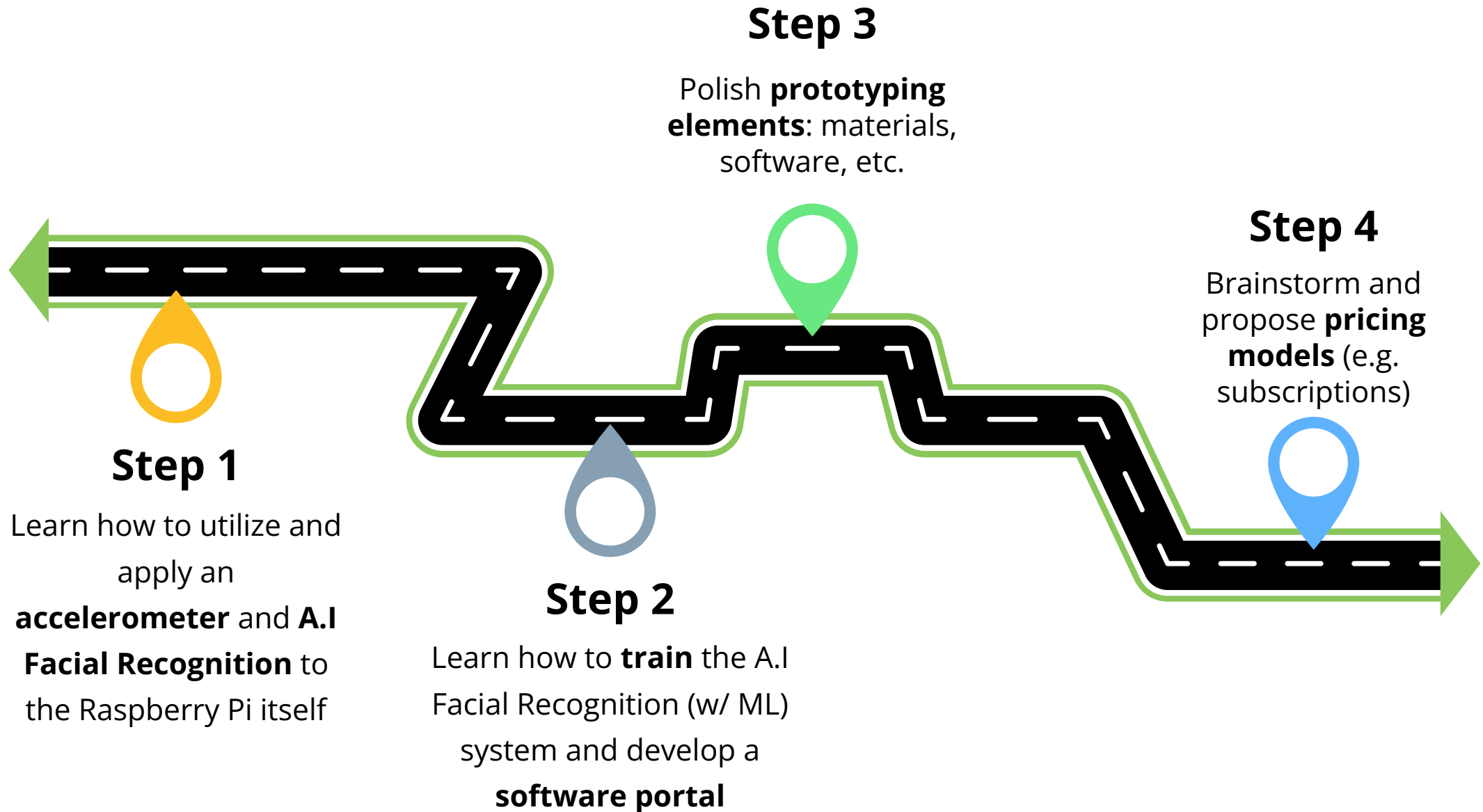
Reflections - Team Dynamics
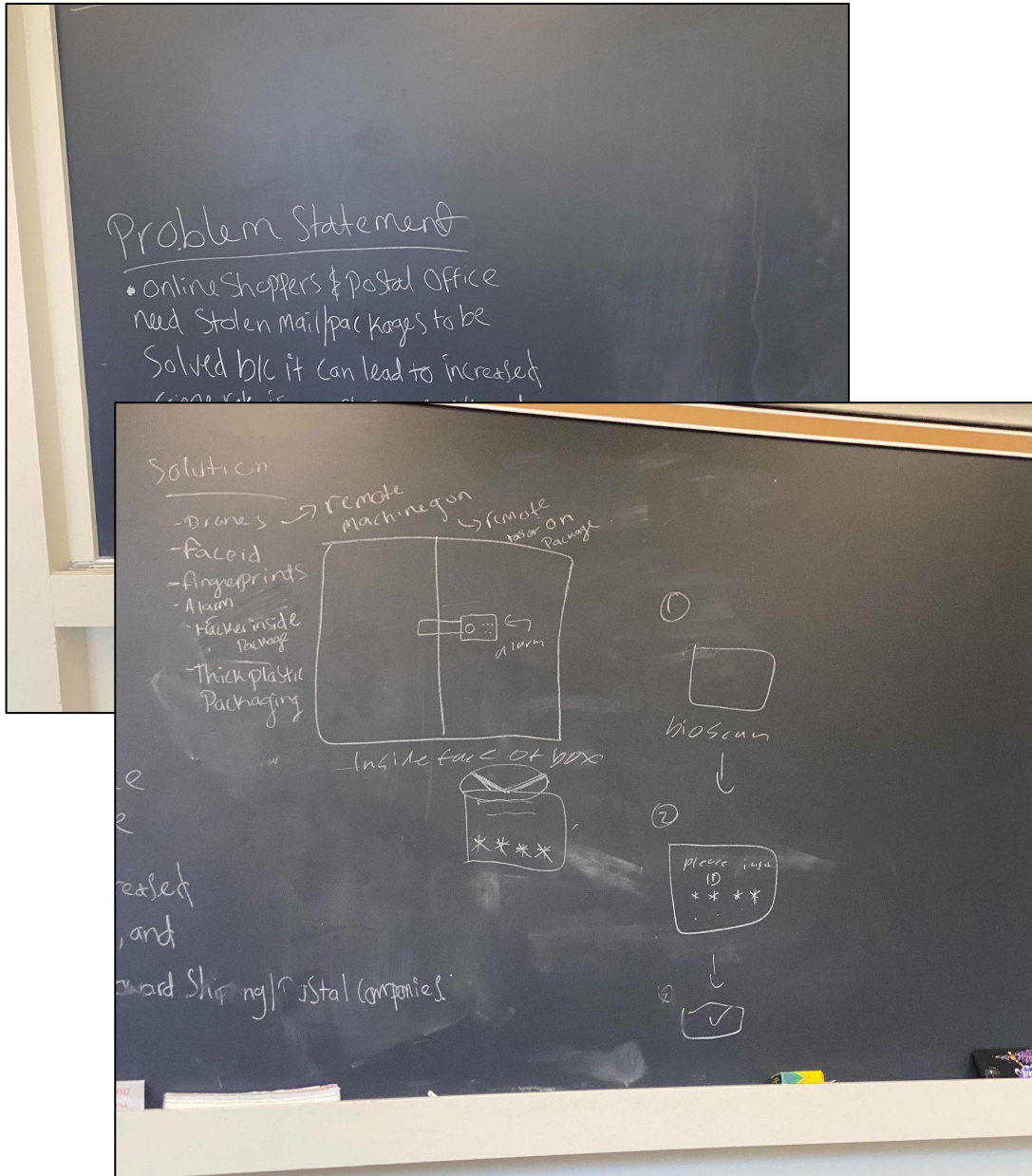
- Everyone had interests in various STEM fields and contributed to the project with diverse skills and ideas
- Learned how to efficiently distribute tasks and merge several concepts into one for the purpose of a large-scale project
  - Roles such as data collectors and members who would work on the slides & project design, but overall, we collectively worked together to create FRAS
  - Became more versatile while learning from one another

Fall Semester Reflections

Challenges	Accomplishments
Creating a unique, easy to design build	Facial Recognition design model
Finding a simple and effective working solution (w/ limitations)	Keeping the product at a low production cost in comparison to commercialized solutions

Cited Materials:

- CNBC Porch Pirates Article: cnbc.com/2022/12/18/porch-pirates

- Security.org 2022 Package Theft Report: security.org/package-theft/annual-report/2022/

- LockBox Delivery Open Patent: patents.google.com/US20140008246A1

- Mark Rober Glitter Bomb Package Designs: youtube.com/watch?v=xoxhDk

Thank You!

F.R.A.S (Simulation Demo)

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Questions?