WALL-E “Spirals” Out of Control

Joshua Abraham, Amer Alshoghri, Julia Paglia, Shawn Verma

Introduction

Automation is becoming increasingly present in various workplaces, allowing companies to complete the same amount of automated labour as manual, at a fraction of the cost.

Problem Statement

Design a robot that can clean up an entire eatery space as quickly as possible, while also ensuring that all trash is efficiently sorted into appropriate bins.

Stakeholders and Target Users

CUSTOMERS

- Main goal is to efficiently maintain a clean eatery space, ensuring an improved customer experience

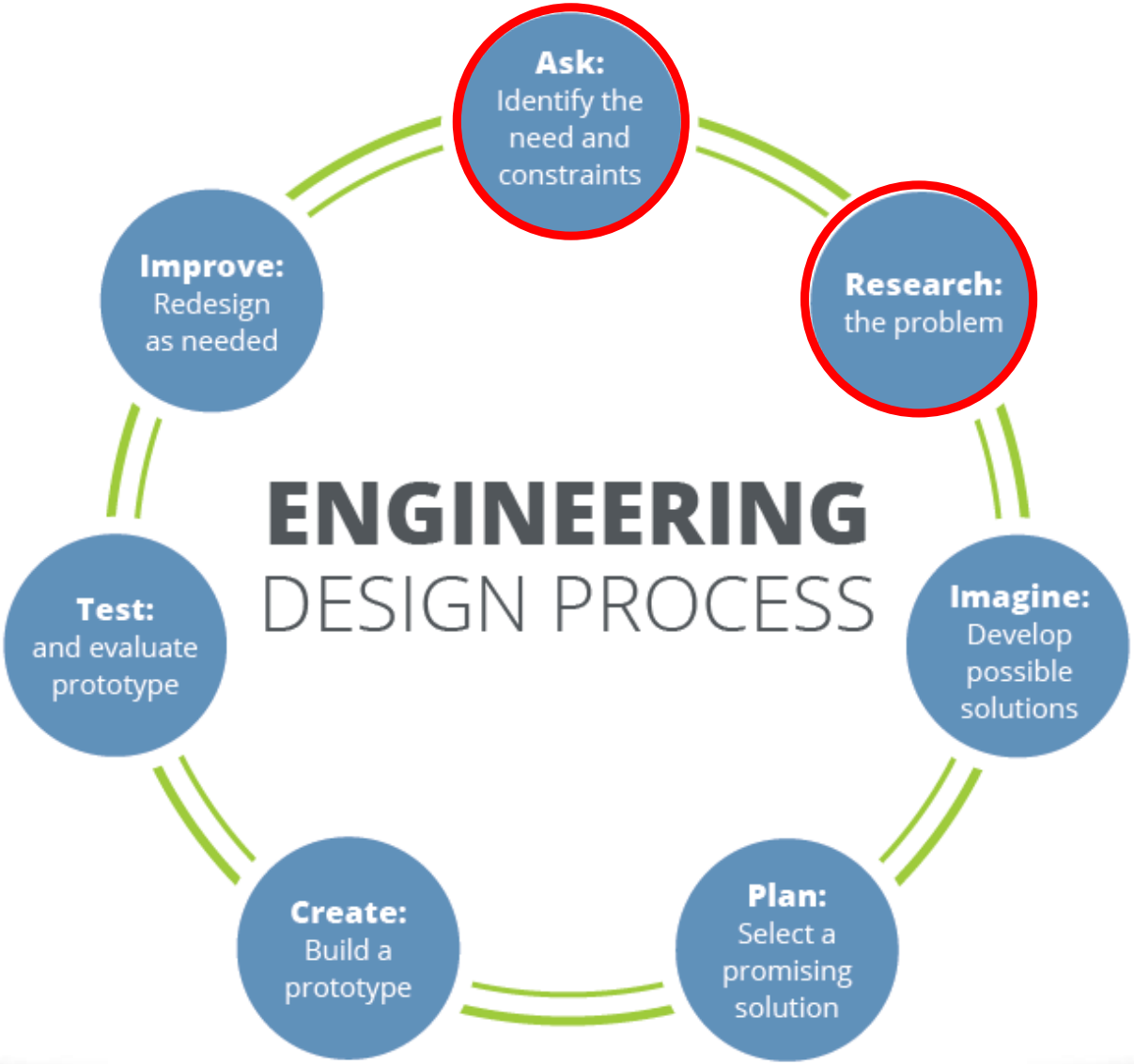
RESTAURANT STAFF

- Staff will spend less time cleaning the space
- Management will not have to pay for closing staff to clean

ENVIRONMENT / GENERAL PUBLIC

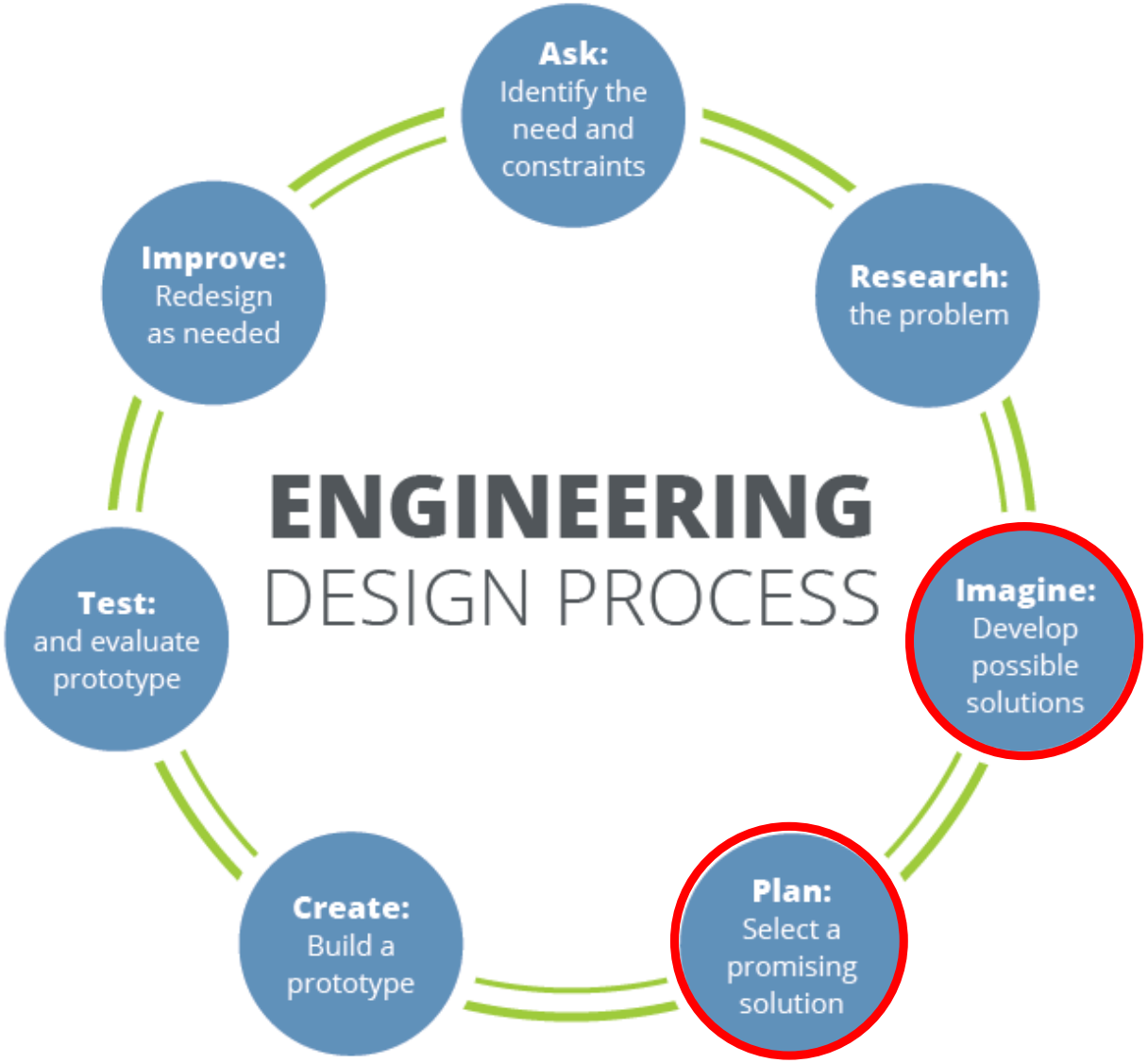
- Garbage will be sorted to ensure proper disposal, eliminating human error

Design Process

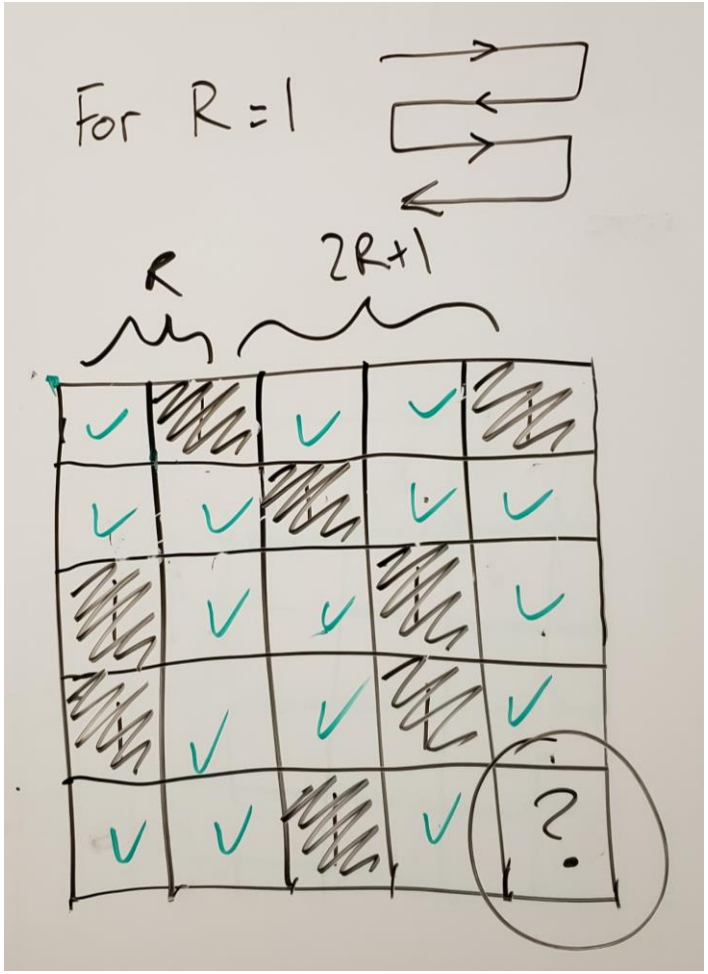


Main Objectives/Needs

1. Optimized Navigation
   - Robot must navigate to dirty locations as quickly as possible
2. Efficient Garbage Sorting
   - Robot must sort collected garbage into appropriate bins
3. Customer Experience
   - Robot must maintain clean eatery for customers to enjoy

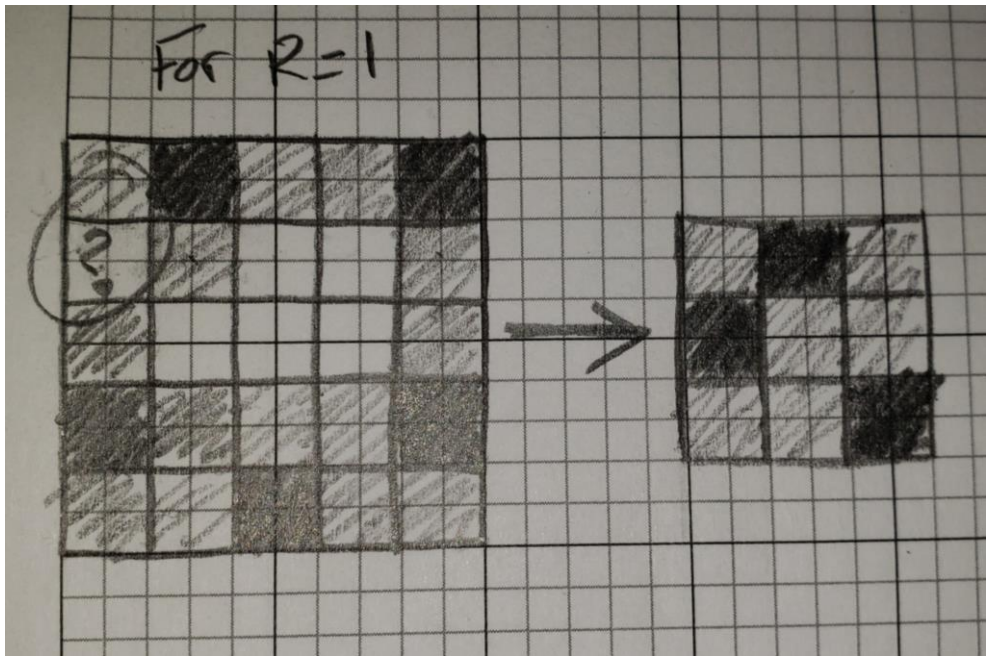

Ask:
Identify the need and constraints
Research:
the problem
Imagine:
Develop possible solutions
Plan:
Select a promising solution
Create:
Build a prototype
Test:
and evaluate prototype
Improve:
Redesign as needed
ENGINEERING
DESIGN PROCESS

Possible Solutions



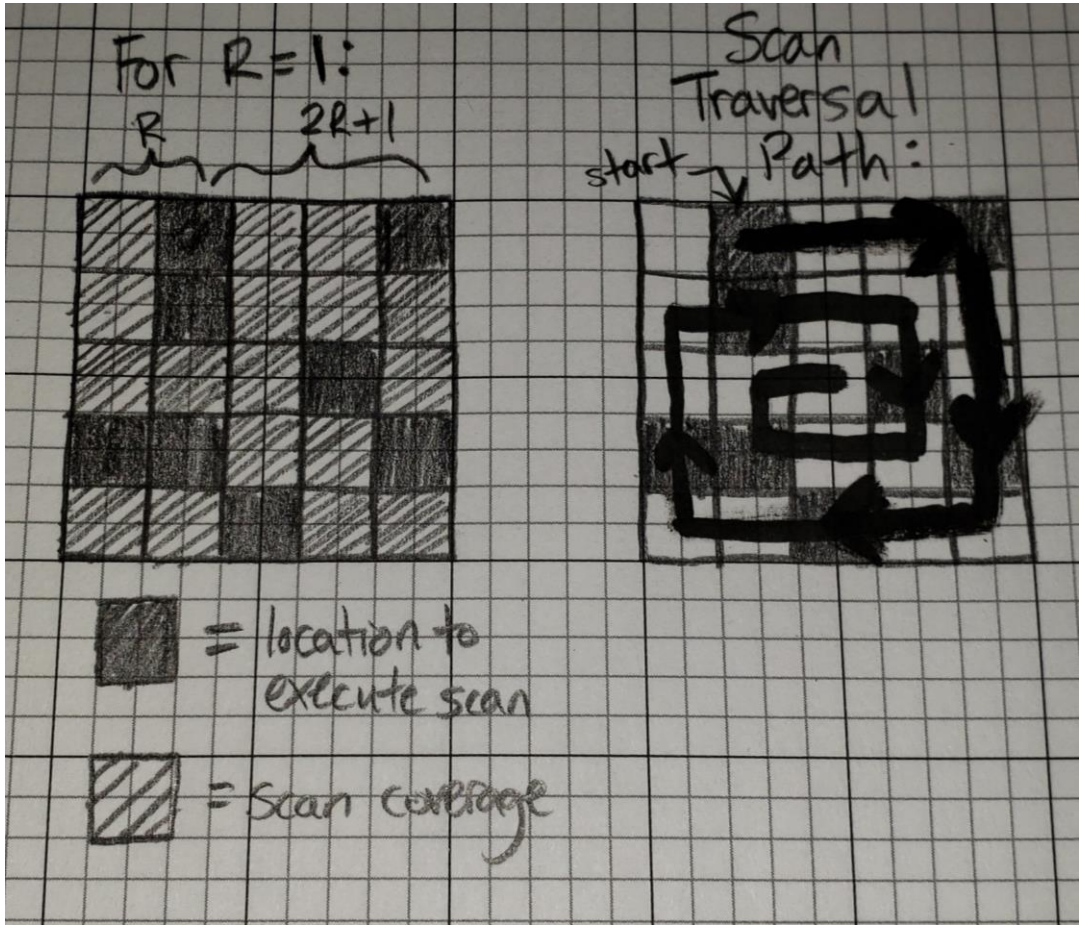
1. "Snake" Traversal for Scanning
   - Excessive re-scanning needed
   - Does not always scan all tiles

Possible Solutions

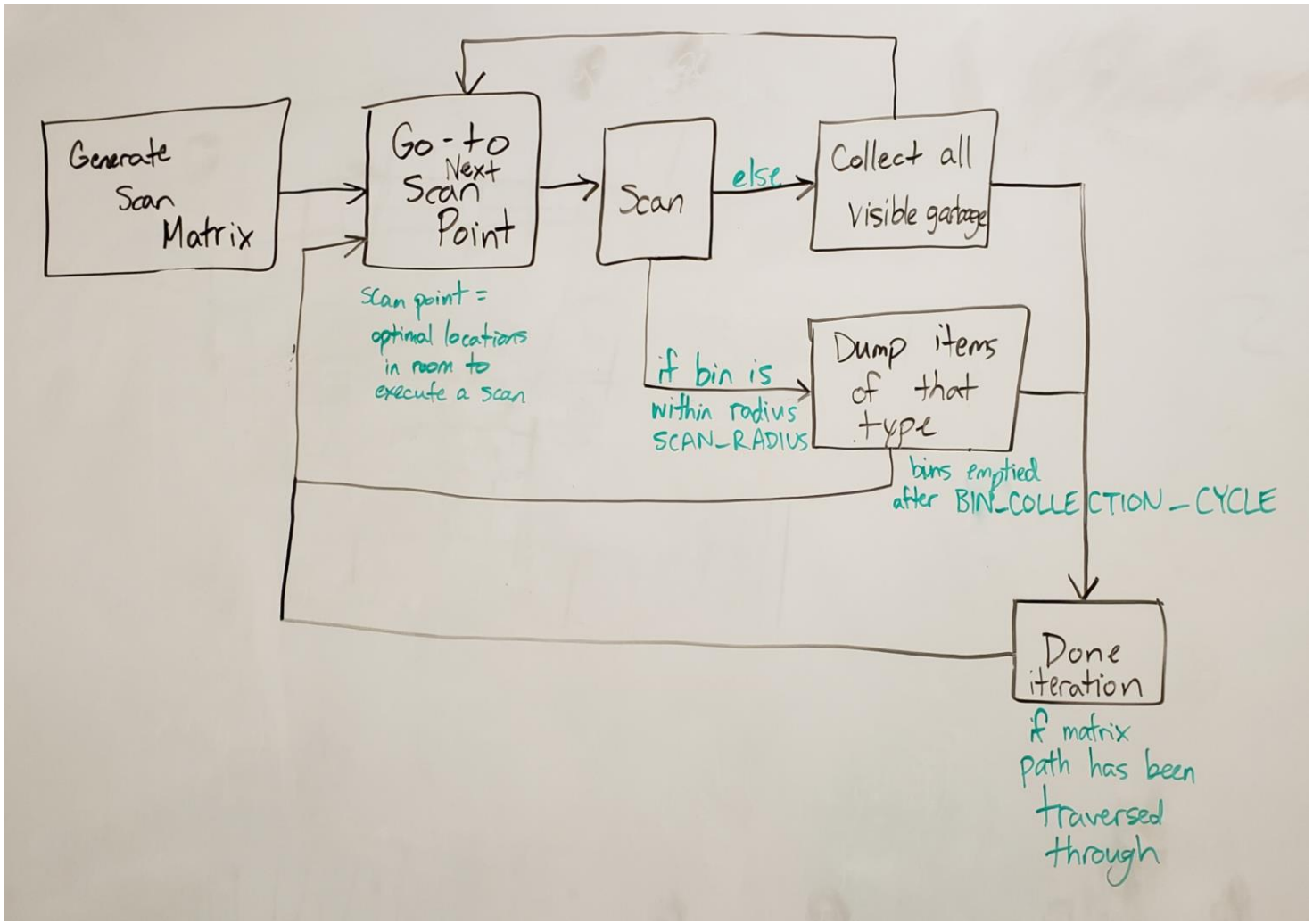


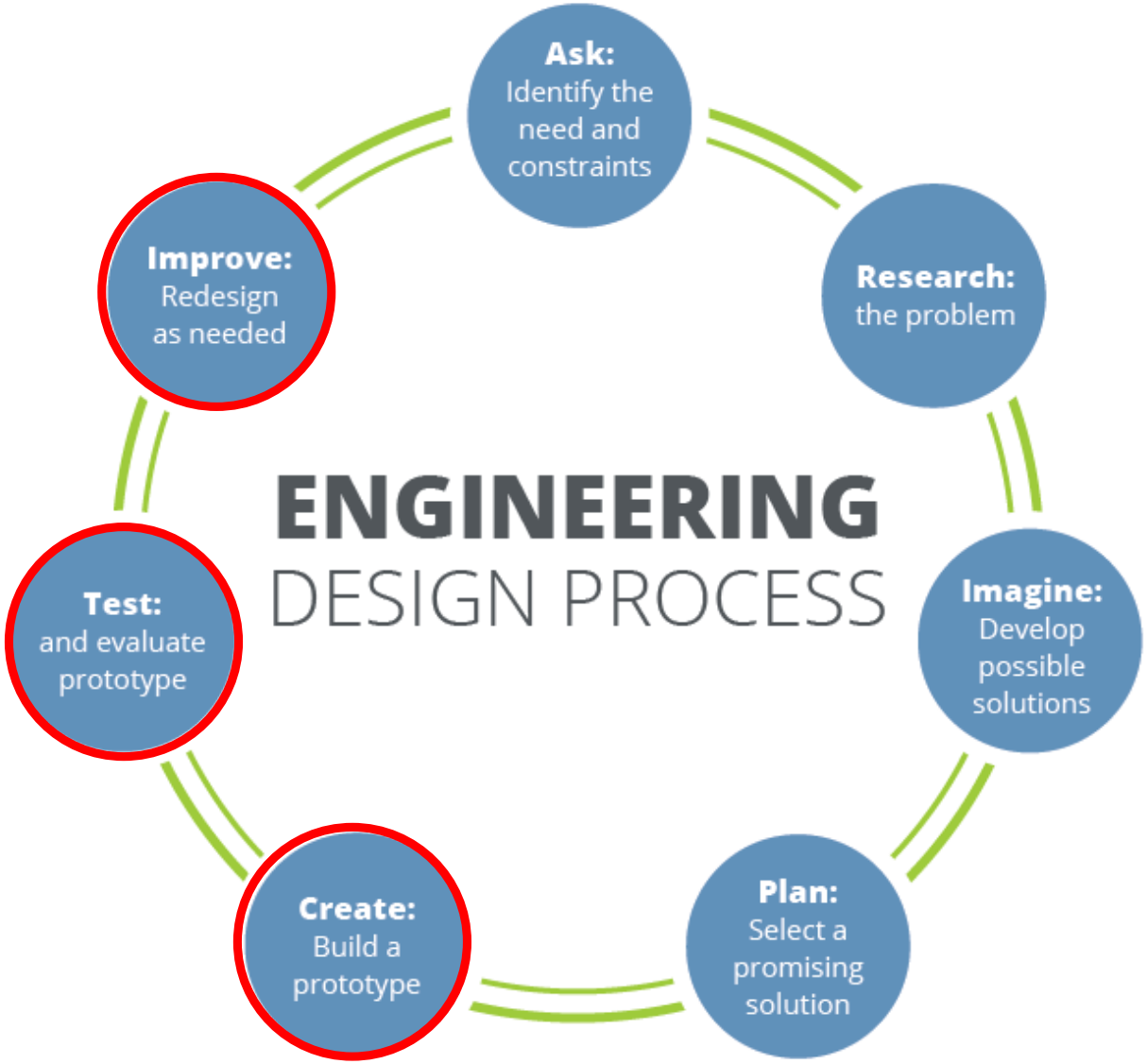
2. Recursive Traversal
   - Breaks down size of room
   - Does not always scan all tiles in single

Chosen Solution – Spiral Traversal



Design Overview




ENGINEERING
DESIGN PROCESS
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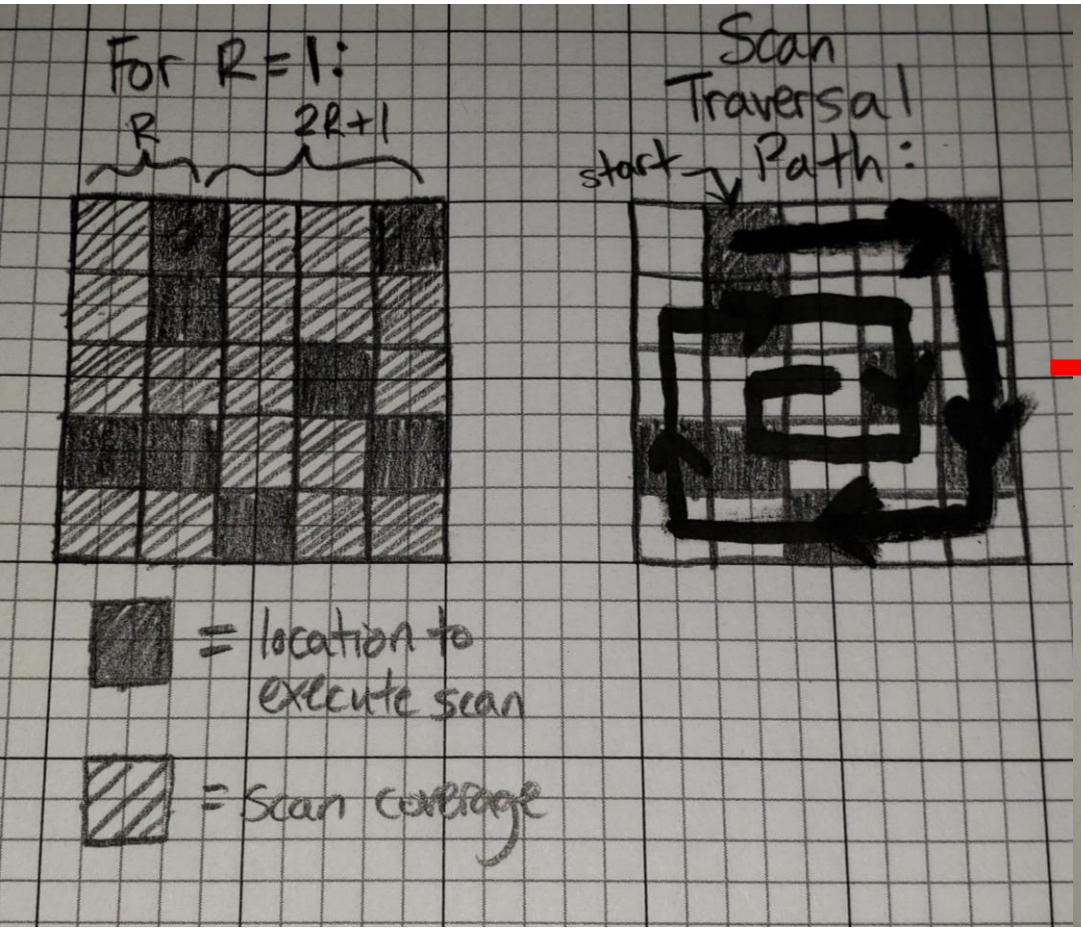
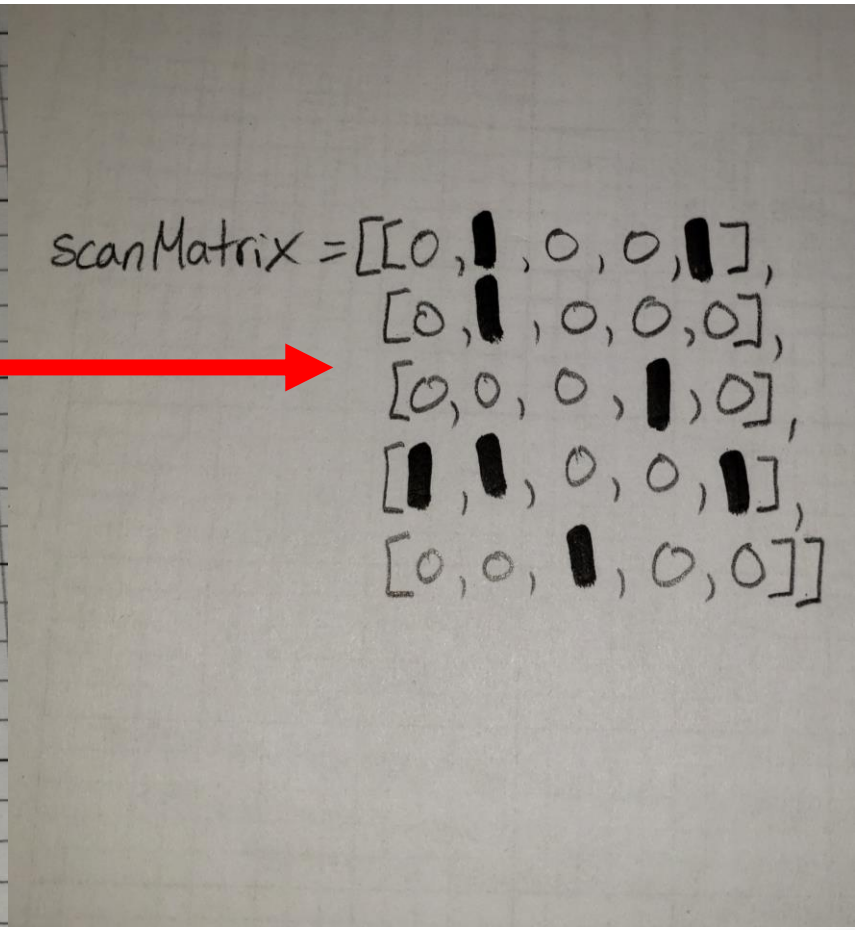
Test: and evaluate prototype
Improve: Redesign as needed

Implementation

1. Optimize Floor Coverage for Scanning

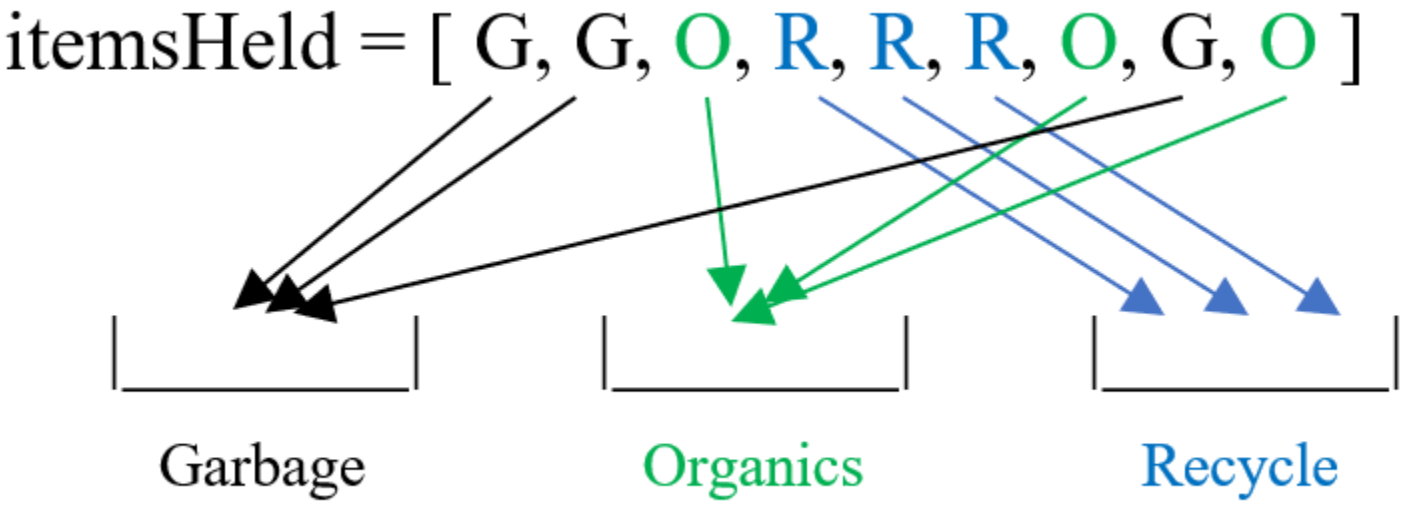




Example followed from: https://leetcode.com/problems/spiral-matrix/solution/

Implementation

2. Efficient Garbage Sorting



Limitations of Solution

- Inefficient item collection order
  - Priority was given to covering more unique surface area per scan
- Difficult to test
  - Only provided one instance with API key
- Time constraint

DEMO

Team York University