GOOD MORNING!
早上好!
안녕하세요!

DAY 6

DAY 6 (FINAL PROJECT)

- 시스템 설계 및 프로세스 정립
- 비즈니스 요구 사항 업데이트
- 역할 분담 및 일정 조율
- 개발 환경 구축(맵 디자인, SW 개발,문서 통합 관리)
- 멀티 로봇 환경 구축 및 네비게이션
- 멀티 로봇 개별 업무 수행
- 멀티 로봇 협동 업무 수행
- (Optional)Turtlebot4 각종 센서 데이터의 이해와 적용

DAY 6 (FINAL PROJECT)

- Flask 를 이용한 웹 서버 구축 (System Monitor)
  - Flask/HTML Intro
  - Deploy YOLOv8 Obj. Det results to web
  - Log in 기능 구현
  - Sysmon 웹기능 구현
- SQLite3를 이용한 데이터베이스 구축 및 연동 (System Monitor)
  - SQLite3 기본 기능 구현
  - DB 기능 구축
  - 저장된 내용 검색하는 기능 구현

DAY 7 (FINAL PROJECT)

- 시스템 설계에 기반한 객체 감지 모델 구현
- 로봇 환경에 적용 및 Unit Test
- 모듈로 제작하고 launch파일로 구현
- code 정리 및 버전관리, 문서 작성 및 영상 촬영, 팀 내 기술 브리핑

- 시스템 설계에 기반한 SysMon 설계 구현
- 로봇 환경에 적용 및 Unit Test
- 모듈로 제작하고 launch파일로 구현
- code 정리 및 버전관리, 문서 작성 및 영상 촬영, 팀 내 기술 브리핑

DAY 8 (FINAL PROJECT)

- 시스템 설계에 기반한 AMR 제어 구현
- 로봇 환경에 적용 및 Unit Test
- 모듈로 제작하고 launch 파일로 구현
- code 정리 및 버전관리, 문서 작성 및 영상 촬영, 팀 내 기술 브리핑

DAY 9 (FINAL PROJECT)

- 개별 기능 통합 구현 및 Integration 테스트
- 통합 Launch 파일로 구현
- Robust한 시스템 구축을 위한 예외 처리 및 Code Refactoring
- code 정리 및 버전관리, 문서 작성 및 영상 촬영, 팀 내 기술 브리핑

DAY 10 (FINAL PROJECT)

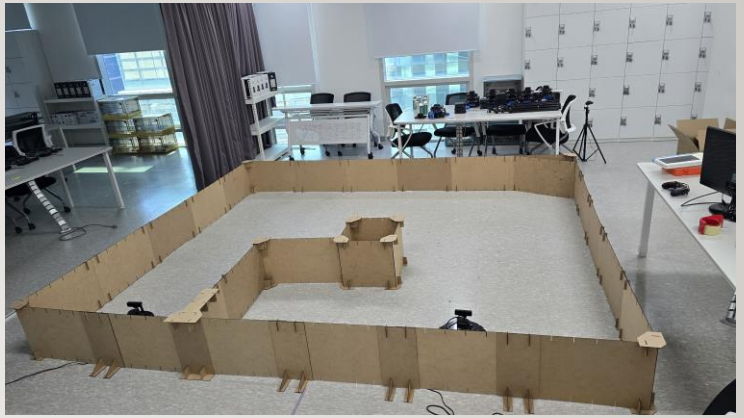
- 프로젝트 발표 및 시연
- 최종 산출문 정리(소스코드, 발표 PPT, 동작 영상)
- 팀 간 기술 컨퍼런스를 통한 기술 극복 경험담, 노하우 교류(채점 대상X)

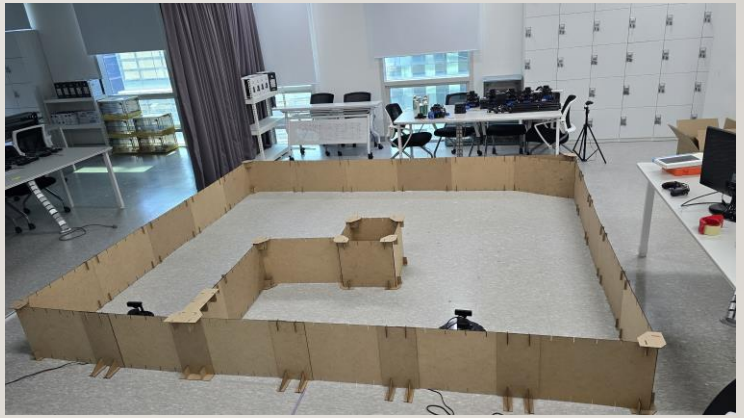
프로젝트 RULE NUMBER ONE!!!

Have Fun Fun Fun!

FINAL PROJECT

FINAL PROJECT DESCRIPTION





FINAL PROJECT TOPIC AND TEAM SELECTION

BRAINSTORM A SITUATION THAT REQUIRES THIS SOLUTION

PROJECT JUSTIFICATION (WHY)

- Situation Analysis
  - evaluates both external and internal factors to determine the necessity and feasibility of a project. It helps justify resource allocation by outlining how the project aligns with strategic goals, identifying potential challenges and opportunities, and providing a detailed understanding of the project's context for informed decision-making.

- 상황 분석
  - 프로젝트의 필요성과 타당성을 결정하기 위해 외부 및 내부 요인을 모두 평가합니다. 프로젝트가 전략적 목표에 어떻게 부합하는지 설명하고, 잠재적인 과제와 기회를 식별하고, 정보에 입각한 의사 결정을 위해 프로젝트의 컨텍스트에 대한 자세한 이해를 제공하여 리소스 할당을 정당화하는 데 도움이 됩니다.

PROJECT JUSTIFICATION (WHY)

- Business Needs/Pain Point Analysis
  - identifies and assesses the problems and unmet needs of customers. This process helps businesses tailor their solutions to enhance customer satisfaction and loyalty by directly addressing these issues.

- 비즈니스 니즈/문제점 분석
  - 문제와 충족되지 않은 요구를 식별하고 평가합니다. 이 프로세스는 기업이 이러한 문제를 직접 해결하여 고객 만족도와 충성도를 높일 수 있도록 솔루션을 맞춤화하는 데 도움이 됩니다.

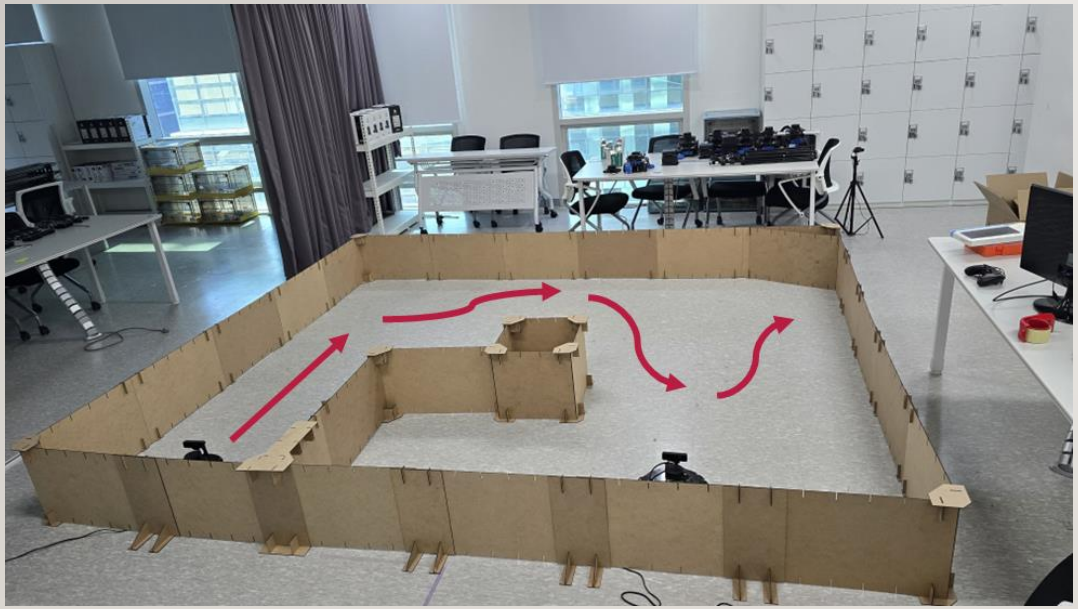
BRAINSTORMING RULES

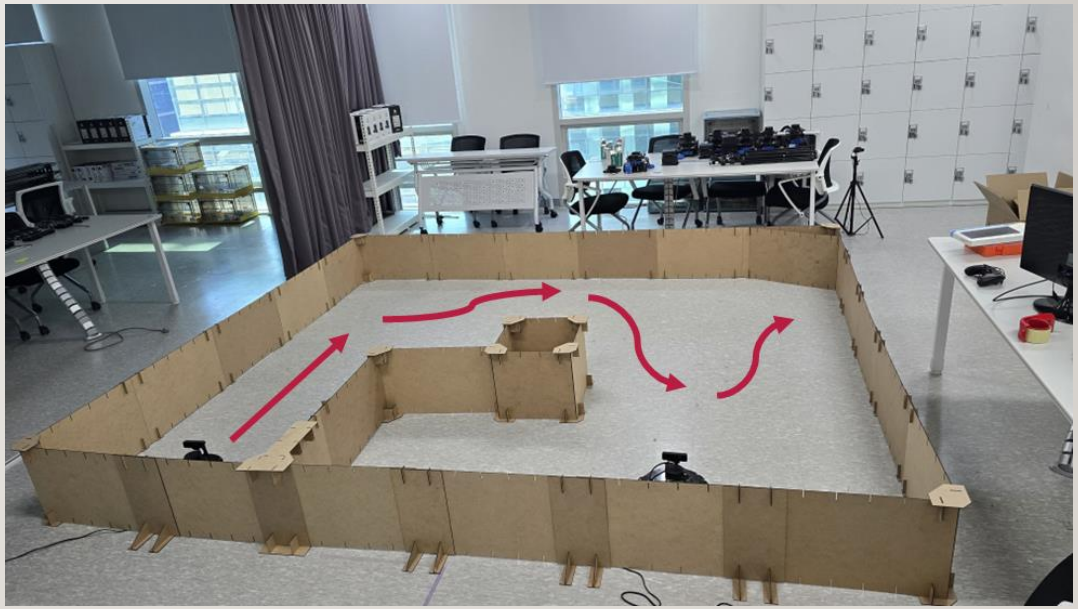
- Every input is good input
- Do not critique inputs only seek to understand
- Organize inputs into logical groupings
- Sequence or show relationships as needed
- Use Posted Notes on Flip Chart

DEVELOP YOUR BUSINESS SCENARIO (USE-CASE) PROCESS DIAGRAM

Using the posted notes and flipchart as needed

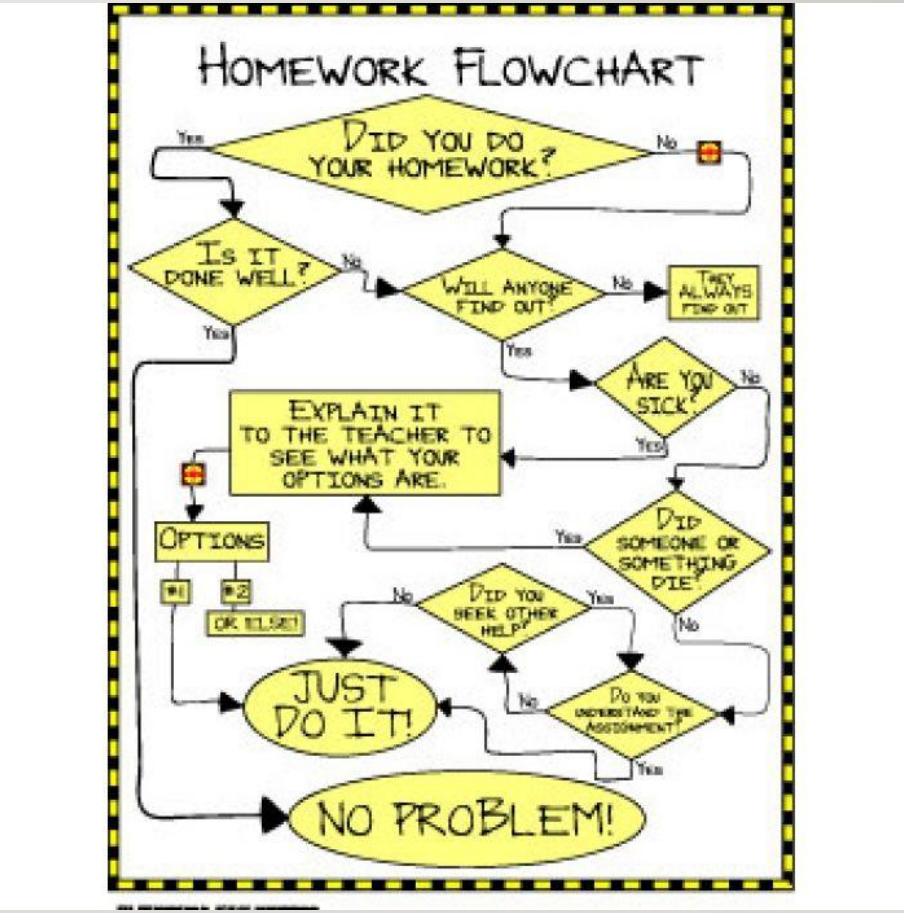
SKETCH YOUR SCENARIO ON THE ENVIRONMENT





VISUALIZATION – SCENARIO PROCESS DIAGRAMS

- As-Is Functional Process Diagram
  - Current states
- To-Be Functional Process Diagram
  - Future states
- Untitled Diagram - draw.io
- https://app.diagrams.net/



BUSINESS REQUIREMENT (WHAT EXAMPLE)

- **Business Requirements with Metrics:** The company aims to deploy a robotic system integrated with a deep learning model to automate quality inspection in manufacturing. The goal is to reduce human error by achieving 98% accuracy in defect detection and increase production efficiency by minimizing inspection time to under 2 seconds per item.
- 이 회사는 딥 러닝 모델과 통합된 로봇 시스템을 배포하여 제조 시 품질 검사를 자동화하는 것을 목표로 합니다. 목표는 결함 감지에서 98%의 정확도를 달성하여 인적 오류를 줄이고 검사 시간을 품목당 2초 미만으로 최소화하여 생산 효율성을 높이는 것입니다.

TEAM EXERCISE

Brainstorm Business Requirement for the project and write business requirement statement

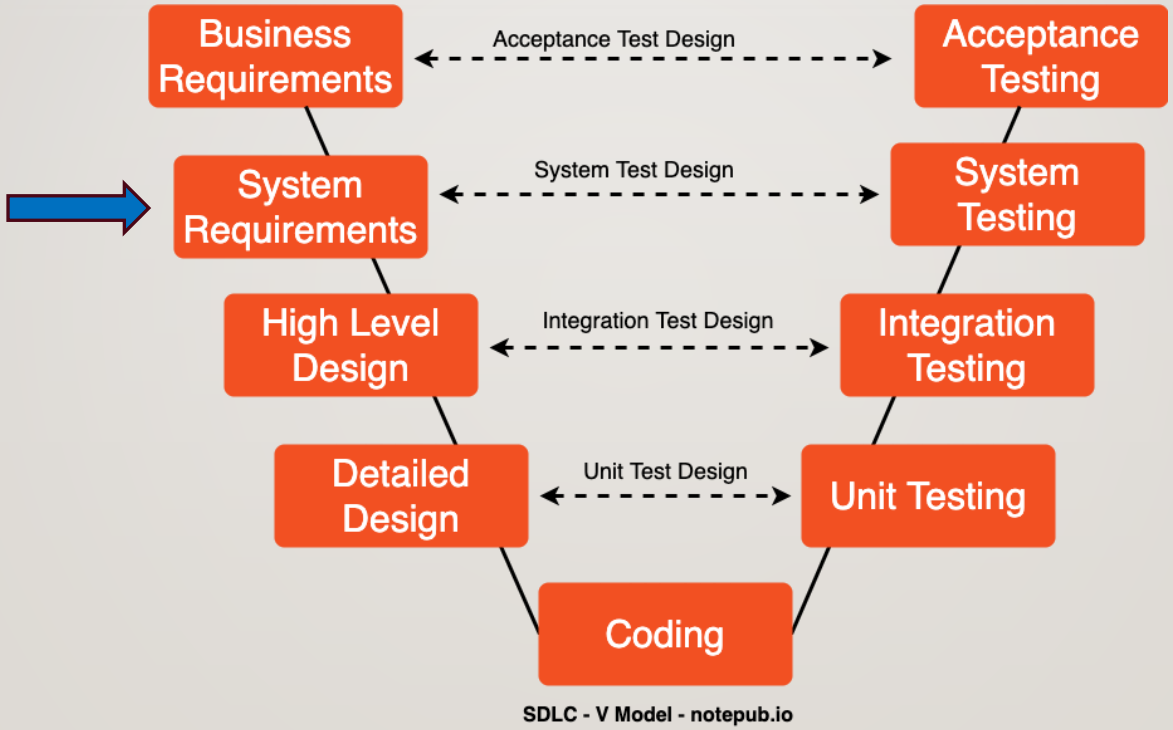
Using the posted notes and flipchart as needed

BUSINESS REQUIREMENT PRESENTATION BY EACH TEAM

Using the posted notes and flipchart as needed

SW DEVELOPMENT PROCESS

With What
And
How Much



BASE HW/OS X 2!!

- PC
  - Ubuntu 22.04
  - USB Camera

- AMR
  - TurttleBot4
  - Ubuntu 22.04

- Network
  - Wifi

OBJ. DET. X 2

TARGET

DUMMY

TEAM EXERCISE

Brainstorm Updated System Requirement for the project and document

Using the posted notes and flipchart as needed

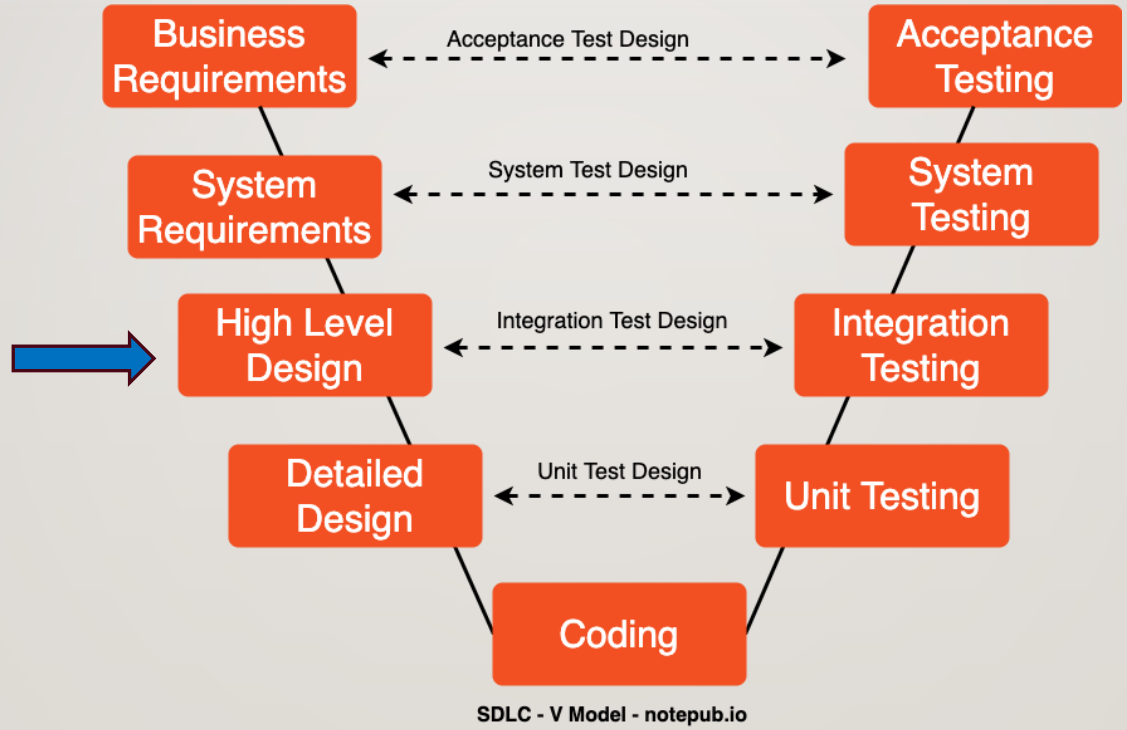
Include where, when, what will be used

SYSTEM REQUIREMENT PRESENTATION BY EACH TEAM

Using the posted notes and flipchart as needed

SW DEVELOPMENT PROCESS

HOW:
Where,What,
When,How Much



VISUALIZATION – SYSTEM FUNCTIONAL PROCESS FLOW (ARCHITECTURE) DIAGRAMS

- To-Be Functional Process Flow Diagram

  Detection Alert

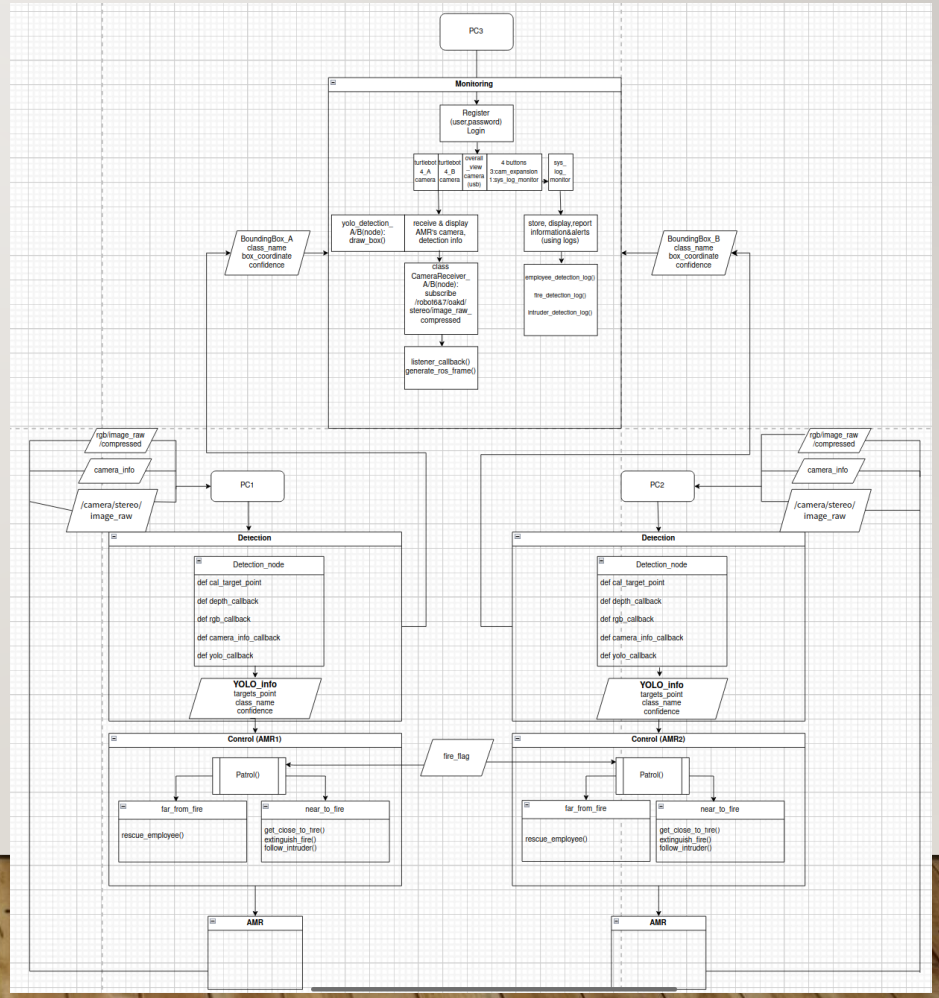
  AMR Controller

- Functions
- Interfaces

  Dataflow

- Testing

  Error and Exception Handling



EXERCISE: FUNCTIONAL GROUPING

Using the system functional process flow (Architecture) diagram created before, group the functions logically and by HW and SW that will be used to implement them

PROJECT SPRINTS

- Detection Alert
  - Camera Capture
  - Object Detection
  - Send messages to other subsystems
- AMR Controller
  - Receive messages and act accordingly
  - Move using (SLAM) with Obstruction avoidance
  - Target Acquisition (Obj. Det.) and Tracking
  - Follow target using camera and motor control
- System Monitor
  - Receive and Display Detection Camera and info
  - Receive and Display AMR Camera and info
  - Store, display, and report Information and Alerts

SYSTEM DESIGN PRESENTATION BY EACH TEAM

MULTI-ROBOT SETUP - PC

- Multi Robot Setup
- https://indecisive-freedom-6e8.notion.site/Multi-Robot-Setup-1e98e215779c807d9918cd2a0bd8fa01

SYSTEM MONITOR

PROJECT SPRINTS

- Detection Alert
  - Camera Capture
  - Object Detection
  - Send messages to other subsystems
- AMR Controller
  - Receive messages and act accordingly
  - Move using (SLAM) with Obstruction avoidance
  - Target Acquisition (Obj. Det.) and Tracking
  - Follow target using camera and motor control
- System Monitor
  - Receive and Display Detection Camera and info
  - Receive and Display AMR Camera and info
  - Store, display, and report Information and Alerts

CODING HINTS

- Flask Basic Review
- SQLite Basic Review
- Webpage
  - Login page
  - Two video window
  - Alert Report
    - Status Captured and Following
- Database – SQLite
  - Login Data
  - Status Data

INTRODUCTION TO FLASK

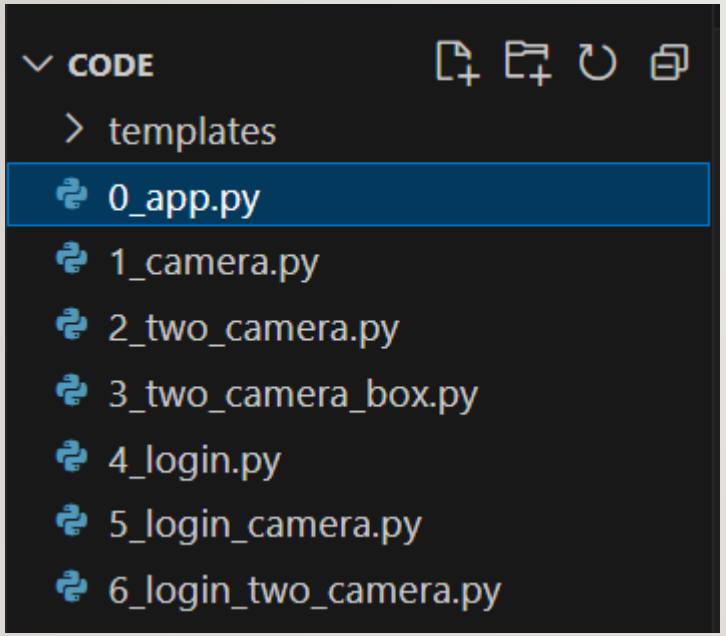
- What is Flask?

  A lightweight web framework for Python.
- Why Flask? Simple, flexible, good for beginners and small projects.

- pip install Flask

- <project>/
- ├ app.py # Main Flask application file
- └ templates/ # Folder for HTML templates
  - └——— index.html

FLASK HINTS



- HTML Reference:

  HTML elements reference - HTML: HyperText Markup Language | MDN

  https://developer.mozilla.org/en-US/docs/Web/HTML/Element

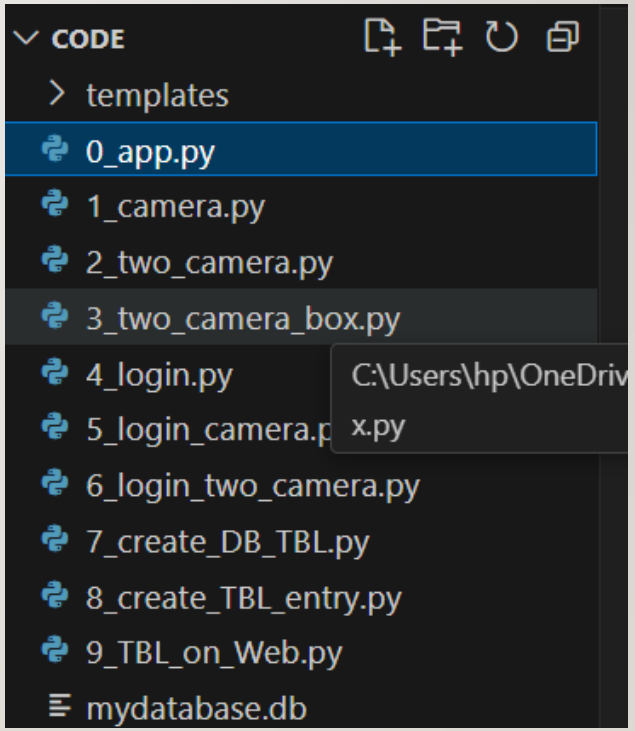
- CSS

  CSS: Cascading Style Sheets | MDN

  https://developer.mozilla.org/en-US/docs/Web/CSS

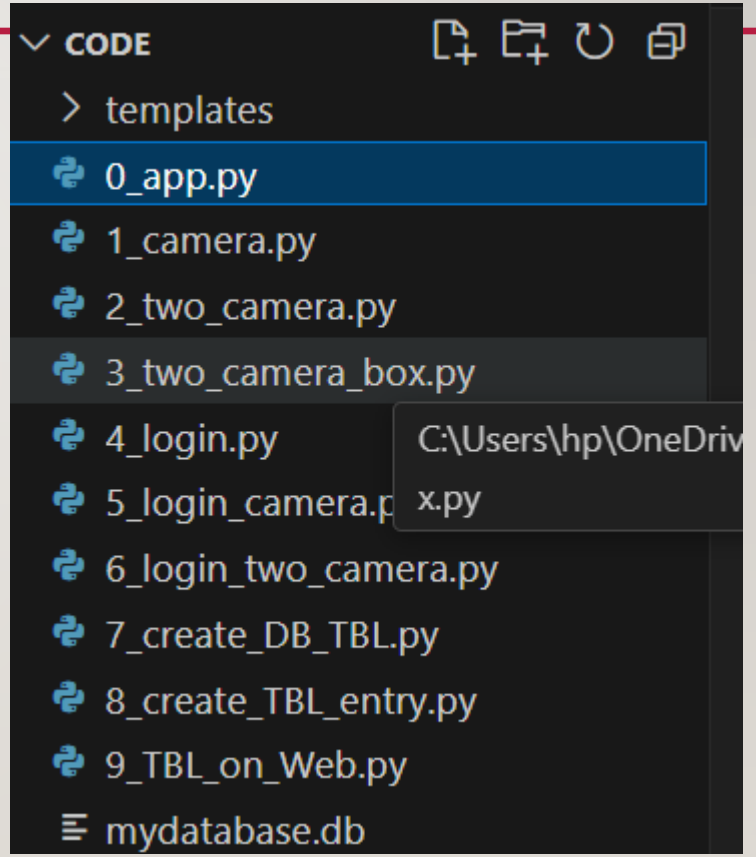
CODING HINTS

- Flask Basic Review
  - sudo apt install sqlite3
- SQLite Basic Review
  - SQLite is a lightweight, self-contained, serverless SQL database engine.



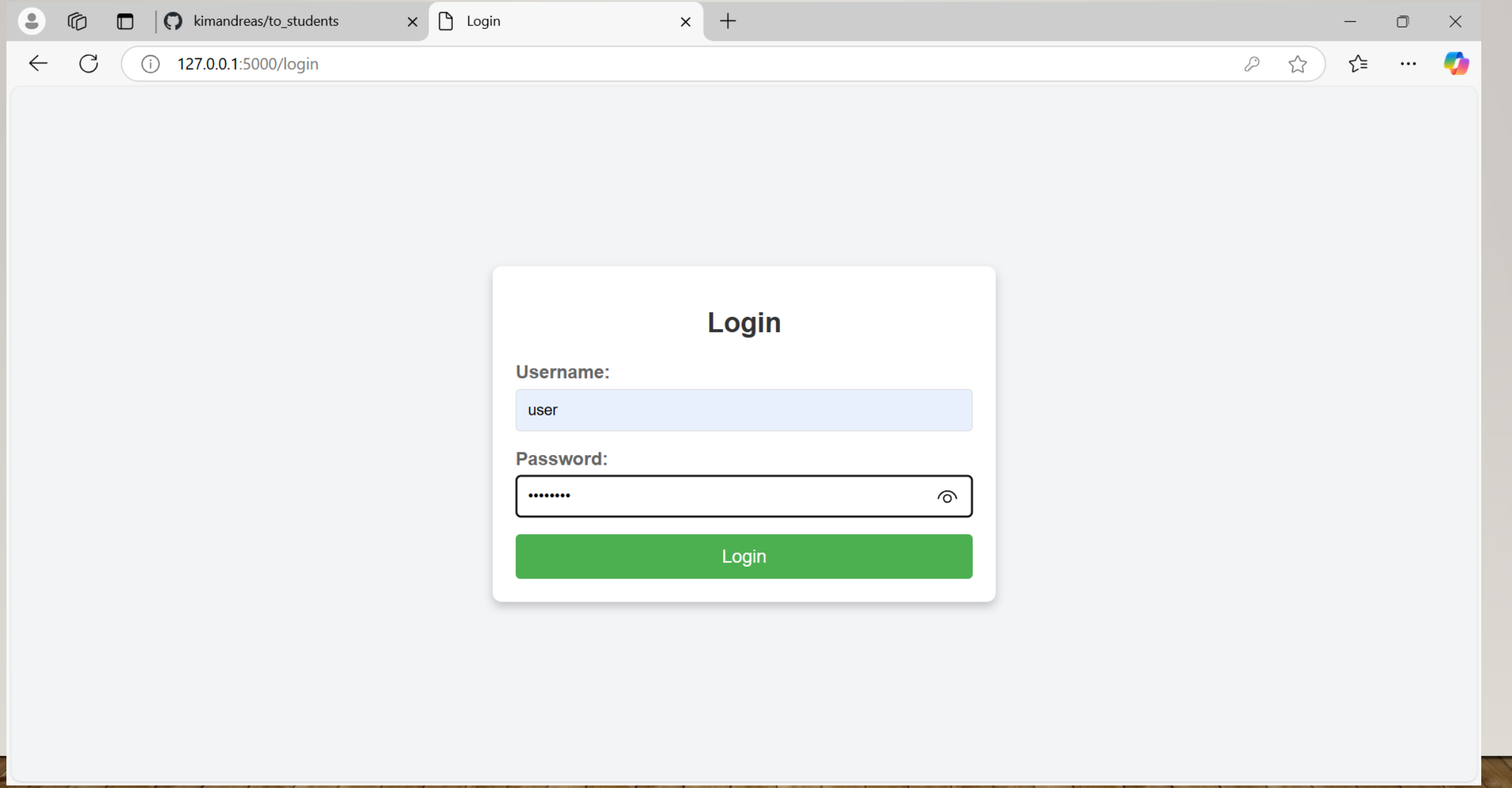
CODING HINTS

- Flask Basic Review
- SQLite Basic Review
- Webpage
  - Login page
  - Two video window
  - Alert Report
    - Status Captured and Following
- Database – SQLite
  - Detection Alert Data



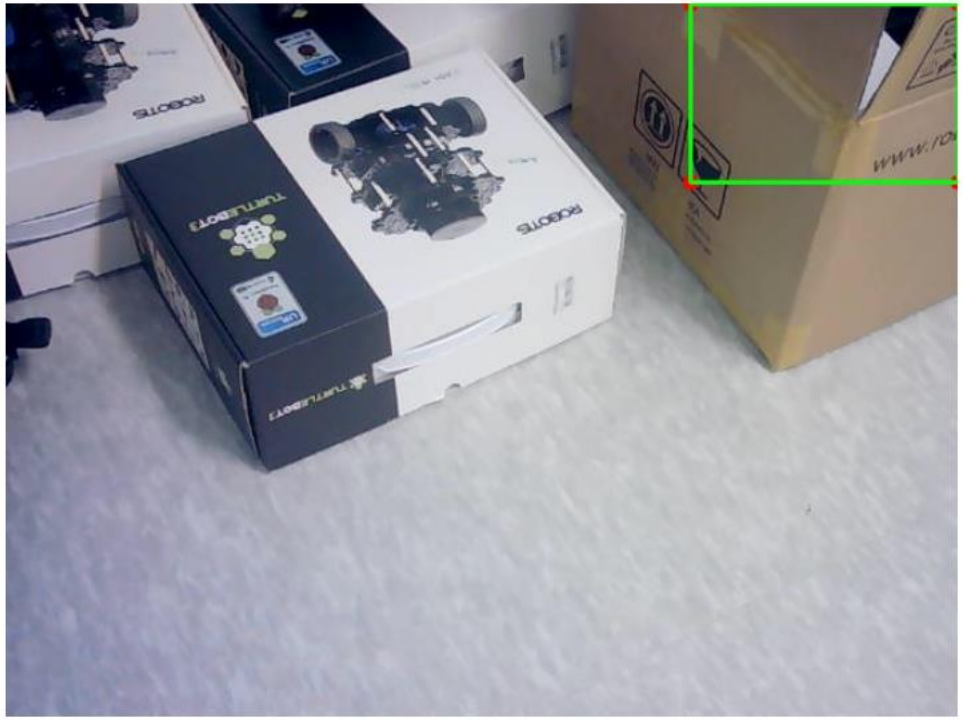
CODING HINTS

- Database – SQLite viewer
  - sudo apt install sqlitebrowser
  - VSCode sqlite viewer extension


kimandreas/to_students
Login
127.0.0.1:5000/login
Login
Username:
user
Password:
Login

Welcome, user!

You are now logged in.



Violations Detected

ID	Name	Date & Time
0	Truck	2024-11-06 10:30:22

Track and Following

ID	Name	Date & Time
1	Dummy	2024-11-06 10:30:22

TEAM EXERCISE 2

Brainstorm Updated System Requirement for the project and document

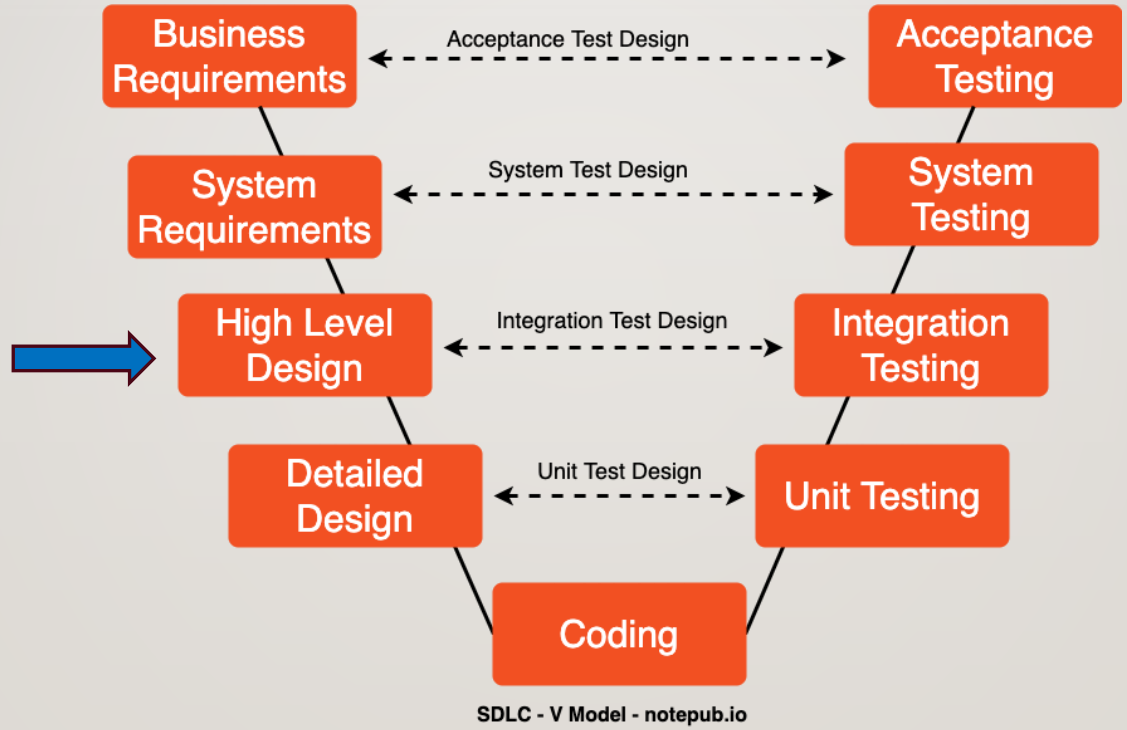
Using the posted notes and flipchart as needed

SYSTEM REQUIREMENT PRESENTATION BY EACH TEAM

Using the posted notes and flipchart as needed

SW DEVELOPMENT PROCESS

HOW:
Where,What,
When,How Much



KEY SUBSYSTEM (MODULES) TO DEVELOP

- Detection ???
- AMR Controller ???
- System Monitor ???

VISUALIZATION – SYSTEM FUNCTIONAL PROCESS FLOW DIAGRAMS

- To-Be Functional Process Flow Diagram

  Detection Alert

  System Monitor

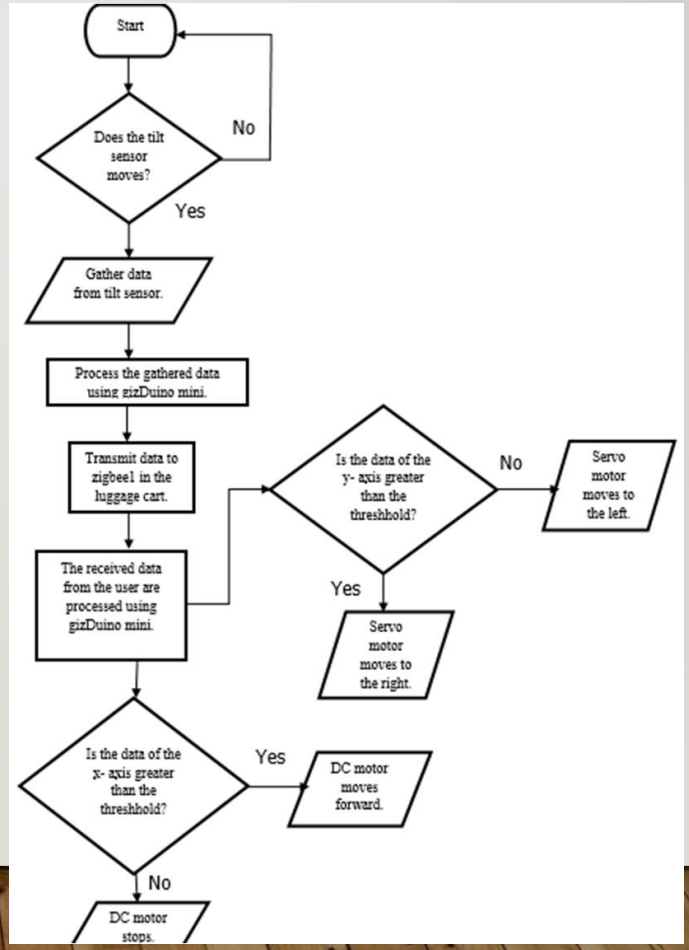
  AMR Controller

- Functions
- Interfaces

  Dataflow

- Testing

  Error and Exception Handling



TEAM EXERCISE 3

Create System Design using Process Flow Diagram.

Use the posted notes and flipchart as needed

SYSTEM DESIGN PRESENTATION BY EACH TEAM

EXAMPLE SYSTEM DESIGN DOCUMENT

System Design Document (SDD)

Project Title: Autonomous Mobile Robot (AMR) Security System
Version: 1.1
Date: [Insert Date]

1. Overview

The Autonomous Mobile Robot (AMR) Security System is designed to provide autonomous patrolling, threat detection, and alerting within a secure area using a single AI-enabled robot. The system consists of one AMR equipped with necessary hardware and software components to operate independently, processing data on-board without the need for a central server.

2. System Architecture

Since the system consists of a single AMR, data processing, navigation, threat detection, and alerting are all performed locally on the AMR itself. The AMR communicates directly with a user interface on a PC via a local network (Wi-Fi) for monitoring, alerts, and manual override if required.

시스템 설계 문서 (SDD)

프로젝트 제목: 자율 이동 로봇(AMR) 보안 시스템
버전: 1.1
날짜: [날짜 삽입]

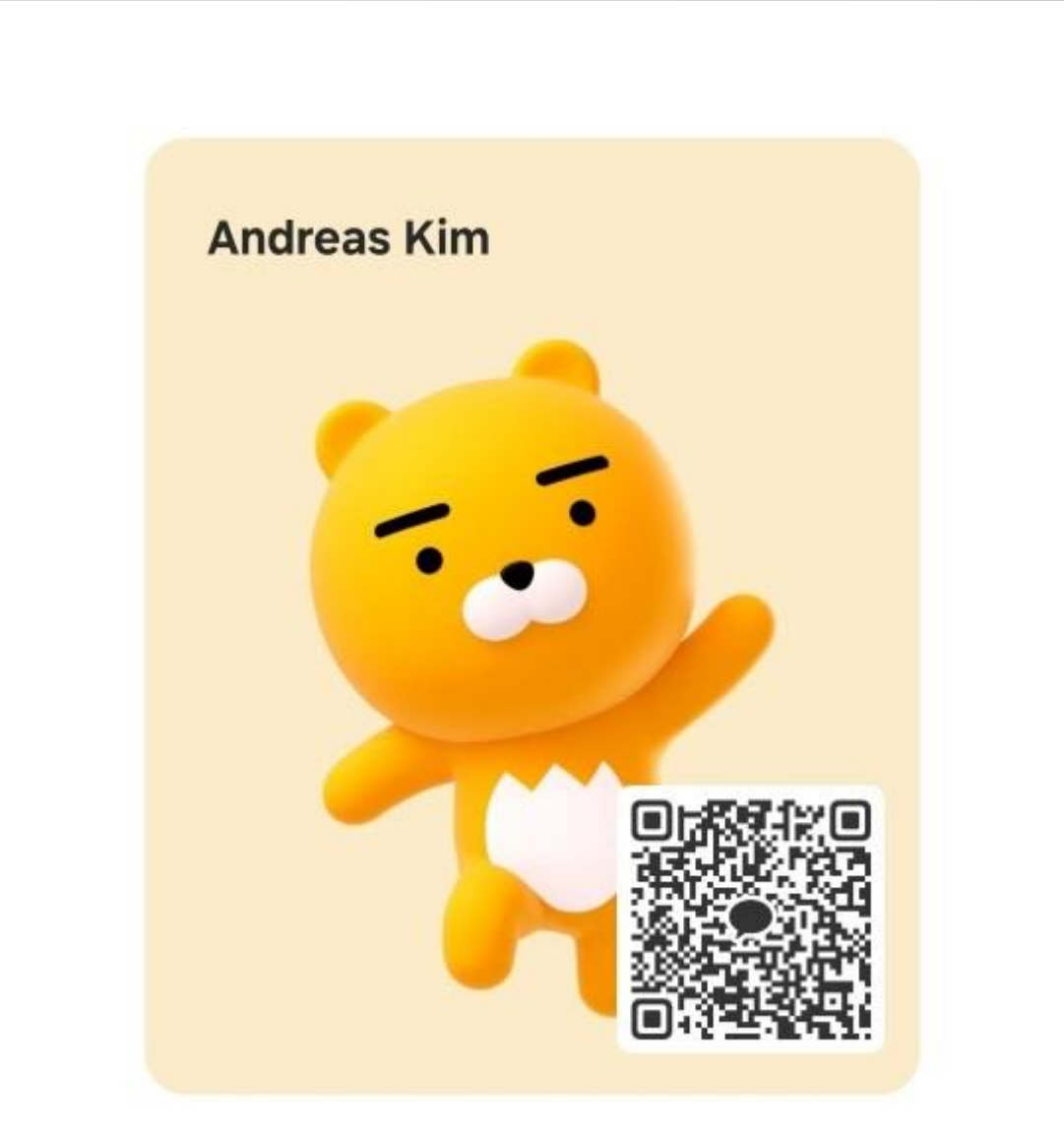
1. 개요

자율 이동 로봇(AMR) 보안 시스템은 단일 AI 기반 로봇을 사용하여 보안 구역 내에서 자율 순찰, 위협 탐지 및 경고를 제공하도록 설계되었습니다. 시스템은 단일 AMR 이 독립적으로 작동할 수 있도록 필요한 하드웨어 및 소프트웨어 구성 요소로 구성되며, 중앙 서버 없이 데이터를 현장에서 처리합니다.

2. 시스템 아키텍처

이 시스템은 단일 AMR 으로 구성되므로 데이터 처리, 네비게이션, 위협 탐지 및 경고가 모두 AMR 에서 로컬로 수행됩니다. AMR 은 모니터링, 알림 및 수동 제어를 위해 PC 의 사용자 인터페이스와 로컬 네트워크(Wi-Fi)를 통해 직접 통신합니다.

Send System Design Doc.
Here:



PROJECT TIMELINE/CRITICAL PATH ITEM MANAGEMENT

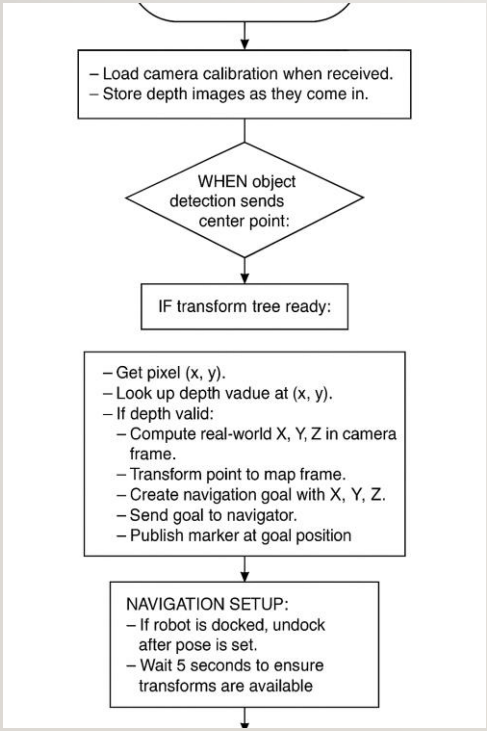
EX. IMPLEMENTATION TIMELINE

Function Backlog	Owner	5월 20일	5월 21일	5월 22일	5월 23일	5월 24일	5월 25일
Unloading Module	John						
Input1	John						
Input2	John						
Output 1	John						
Unit Test	John						
Receiving Module	Jan						
Input1	Feb						
Input2	Mar						
Output 1	Apr						
Unit Test	John						
Integration Test	John/Jan						

이 타임라인을 생성할 때 먼저 시스템 및 시스템 설계의 기능 프로세스 다이어그램(To-Be)을 완료해야 합니다.

그런 다음 각 기능(하위 함수/모듈 및 입력/출력)에 대해 누가, 무엇을, 언제, 어떻 게를 정의합니다. 표에 설명 타임라인 형식의 무엇을, 누가, 언제를 입력합니다.

DETAIL DESIGN EXAMPLE




```
START ROBOT NODE

- Load camera calibration when received.
- Store depth images as they come in.

WHEN object detection sends center point:
    IF transform tree ready:
        - Get pixel (x,y).
        - Look up depth value at (x,y).
        - If depth valid:
            - Compute real-world X,Y,Z in camera frame.
            - Transform point to map frame.
            - Create navigation goal with X,Y,Z.
            - Send goal to navigator.
            - Publish marker at goal position.

NAVIGATION SETUP:
    - If robot is docked, undock after pose is set.
    - Wait 5 seconds to ensure transforms are available.
```

프로젝트 RULE NUMBER ONE!!!

Are we still having FUN!