

# **“Robotic Companion For Elderly”**

**By: Robot Duet**

## Team Members



**Shi Wei**



**Anandakumar  
Kavyakrithika**

# INTRODUCTION

## AIM:

To develop a robot companion that alleviates loneliness among the elderly.

## How:

Adopting the TurtleBot3 and enhancing it with voice-command control & Follow me mode.

## Features:

- Voice commands to control the robot.
- Follow-Me Mode.
- Mental health support through reminders and check-ins.

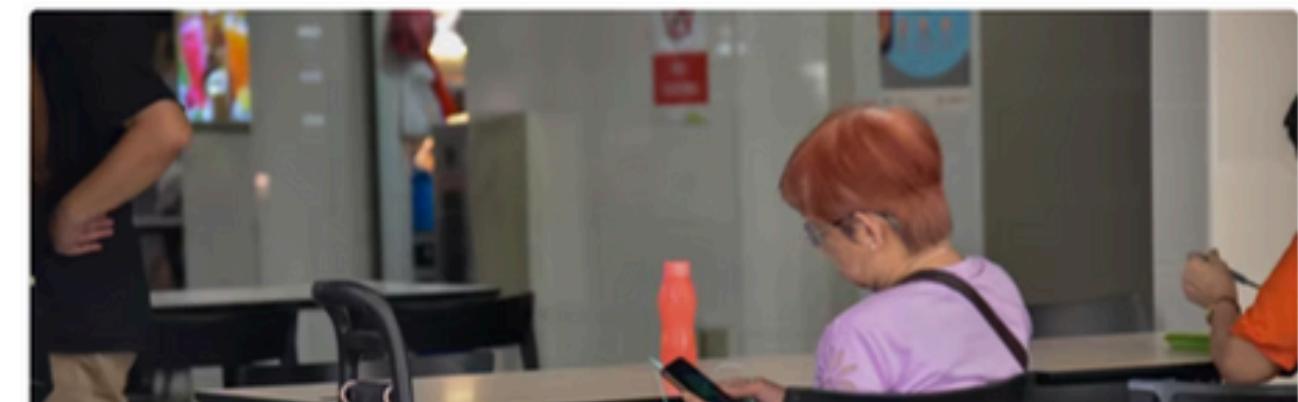
# Background & Motivation

- About **1/5th** of Singaporeans are aged 65 and above.
- In 2030, it is predicted that **83,000** elderly Singaporeans will be living alone.
- There is an **increasing number** of cases.
- The root problem is a **lack of companionship**.

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## Commentary: Loneliness is an overlooked public health challenge in ageing Singapore

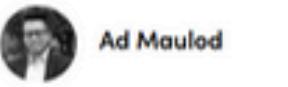
Countries like Singapore place an emphasis on self-reliance, making it difficult for individuals to acknowledge their loneliness and seek support, say researchers from Centre for Ageing Research & Education, Duke-NUS Medical School.



Angeline Chan



Rahul Malhotra



Ad Maulod

11 Jul 2023 06:00AM  
(Updated: 11 Jul 2023 08:24AM)

SINGAPORE

More seniors in Singapore calling helpline over loneliness and mental health concerns: Charity

# Literature Review 1(Paro)



**Reduces depression & Stress levels**



**Tactile & Aural sensors to perceive touch**



**Expensive and Ethical Concerns**



**Paro, the therapeutic seal**

## Literature Review 2(ElliQ)



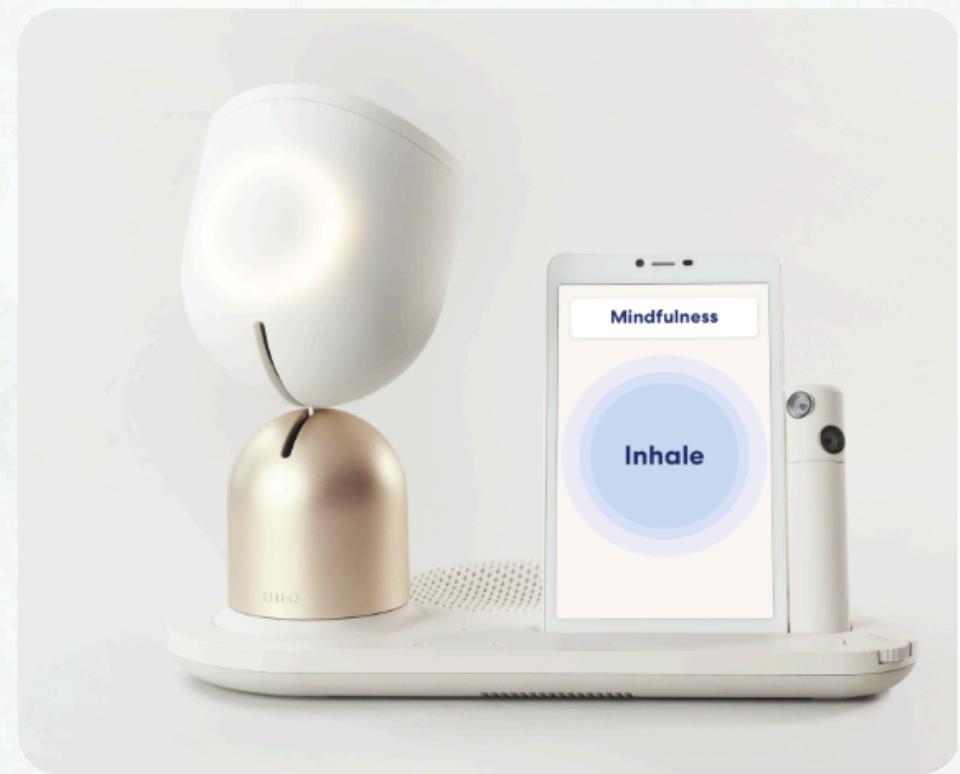
**Provide Personalized Companionship**



**Affordable & Highly Effective**



**Reduce Motivation to socialize & Over-Communication**



**ElliQ**

## Literature Review 3(Kebbi)



**Culturally tailored with engaging content**



**Improved emotional connection**



**Limited clinical research & Only available  
in care centers**



**Kebbi**

## Problem Statement

To develop an elderly companion robot that alleviates loneliness and provides companionship.

## Technical Gap

- Limited mobility and context awareness

These robots are either stationary or have very restricted movement, making them unable to accompany users across different rooms or adapt to dynamic home environments.

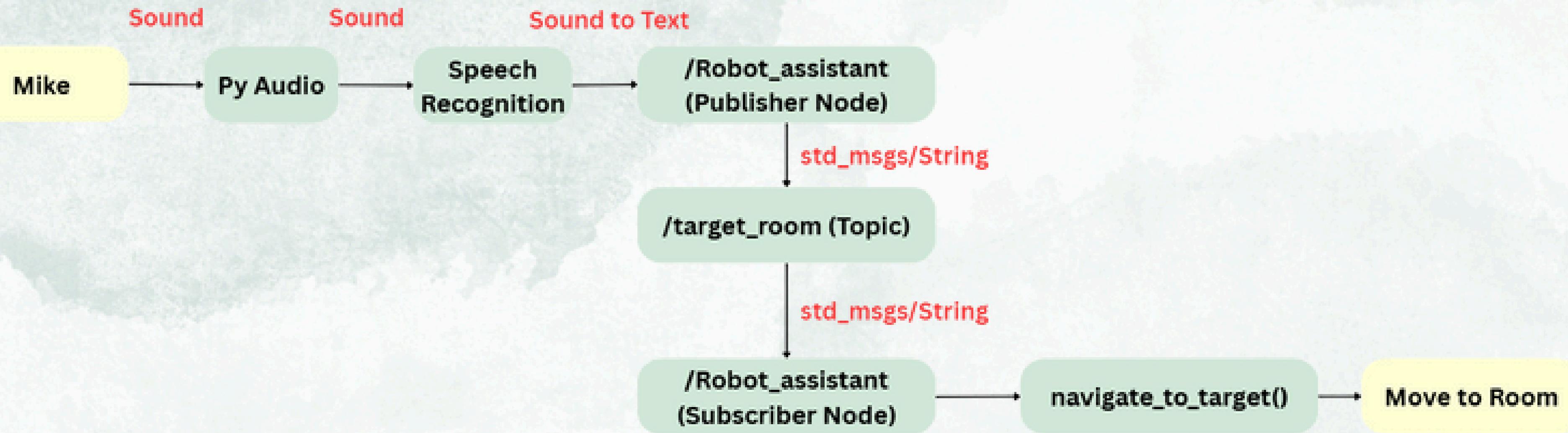
- Lack of integrated multi-modal sensing

They do not combine real-time vision and audio processing for tasks like person-following or voice-controlled navigation.

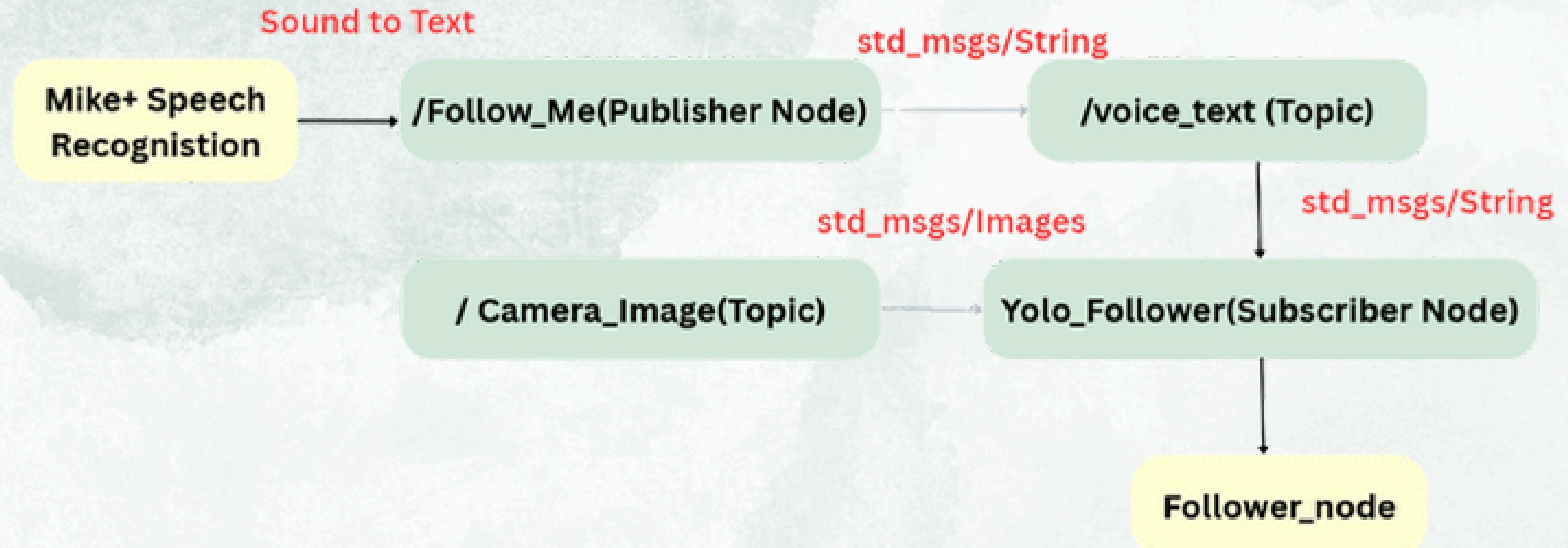
## Project Objectives & Goals

**Integrate multi-modal sensing and interaction** (vision and audio) to create a context-aware, emotionally intelligent robot.

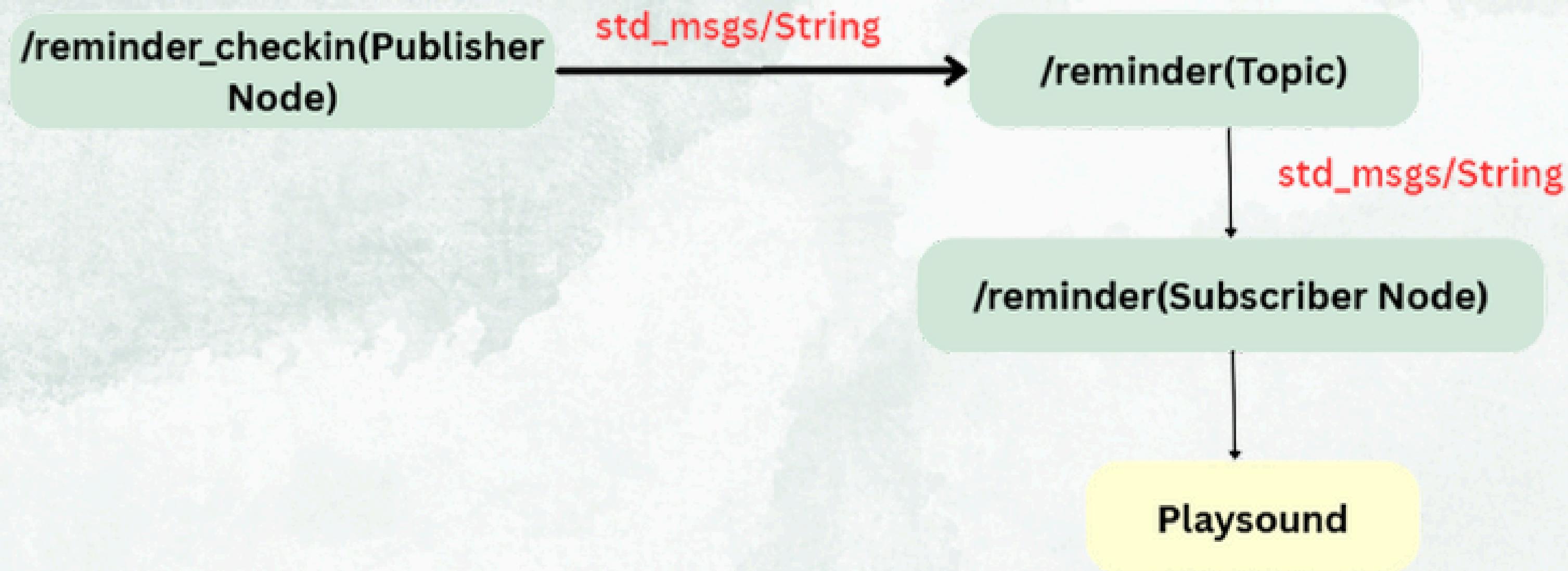
# Proposed Approach(Navigation using Voice command)



# Proposed Approach(Follow Me using Voice command)



## Proposed Approach(Reminder & Check In)



# DESIGN THINKING PROCESS & METHODOLOGY

## **Emphasise:**

Collecting data on the challenges faced by the elderly living alone.

## **Define:**

Lack of mobile companionship and simple interaction

## **Ideate:**

Brainstorming for different concepts to enhance Turtlebot 3.

## **Prototype:**

Navigation using SLAM in a simplified home simulation in Gazebo.

## **Test:**

Real-world Testing

# ASSUMPTIONS/LIMITATIONS

## Assumptions:

- The elderly have basic speech capabilities & tech-savvy.
- House layout available.
- Little movement around the house(only the elderly).
- Has a minimum level of noise generated.

## Limitations:

- Dependent on stable wifi connections.
- Turtlebot3 is unable to detect objects such as chairs and tables.
- Reminders have to be set manually.
- One-way conversation.

# Technical Analysis

## System Architecture

TurtleBot3(Lidar,Camera)

Jabra Speak 750 Microphone

Linux Laptop

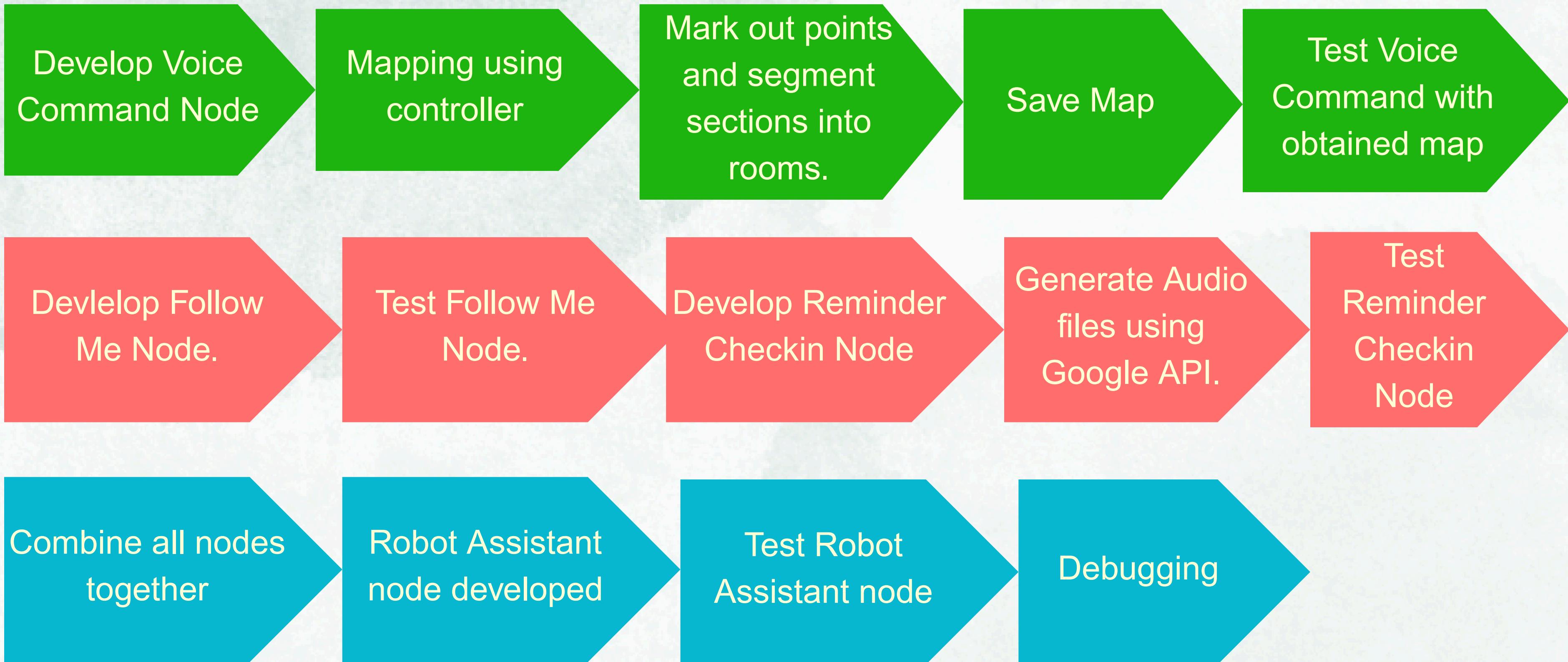
## Nodes

Robot Assistant Node(Navigation  
using voice command)

Follow Me Node

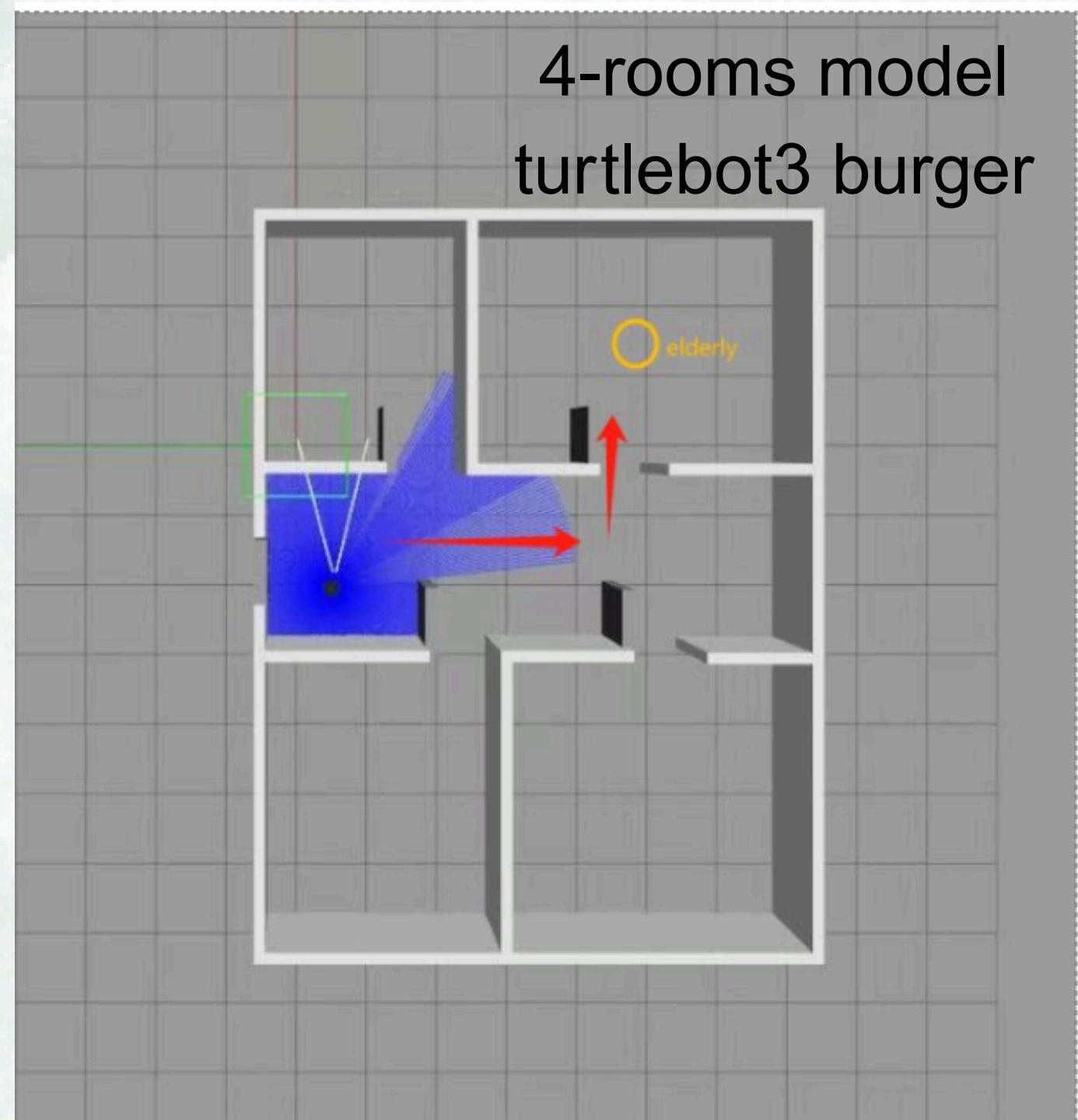
Reminder Checkin Node

# DEVELOPMENT



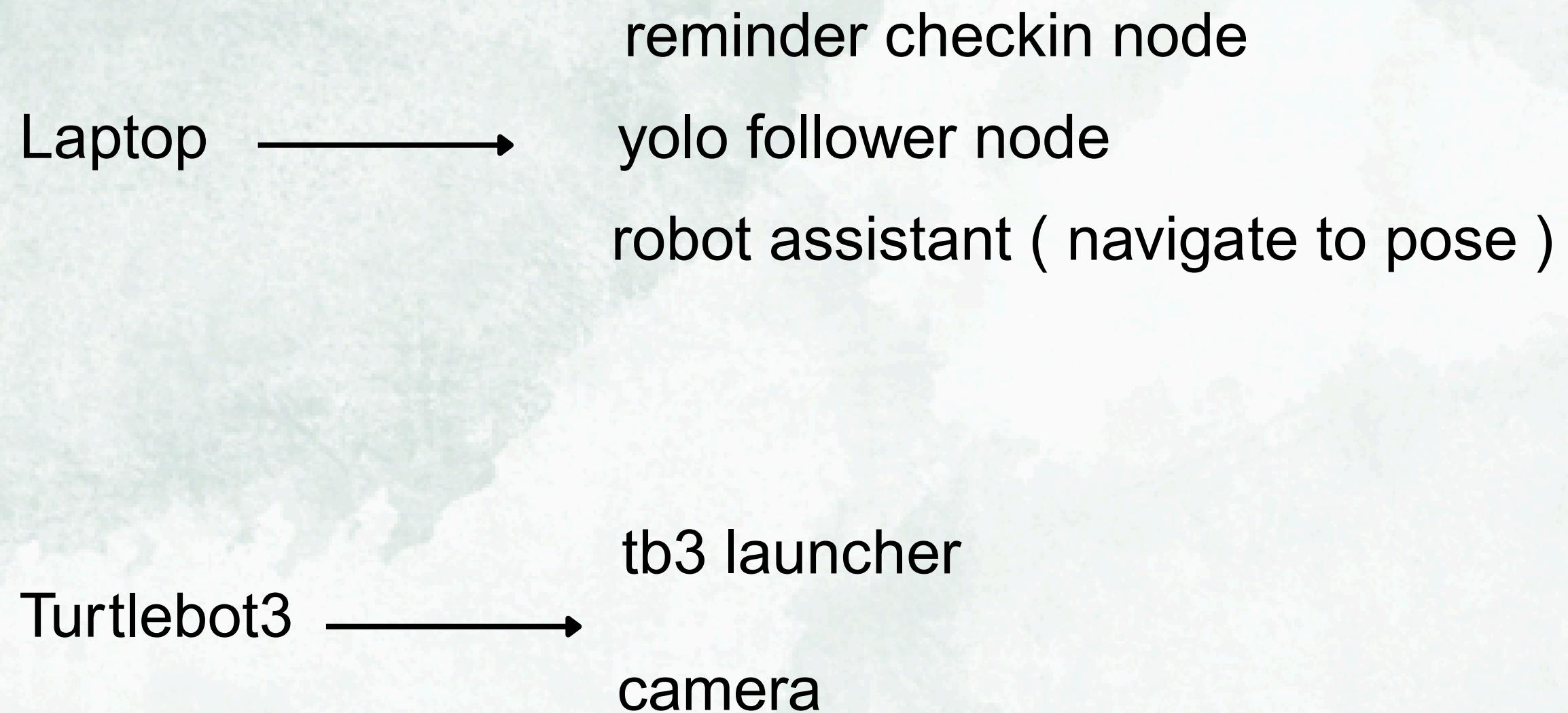
# Results(Simulations)

The simulation experiments were conducted in Gazebo using a pre-mapped indoor environment representing a typical four-room apartment layout.

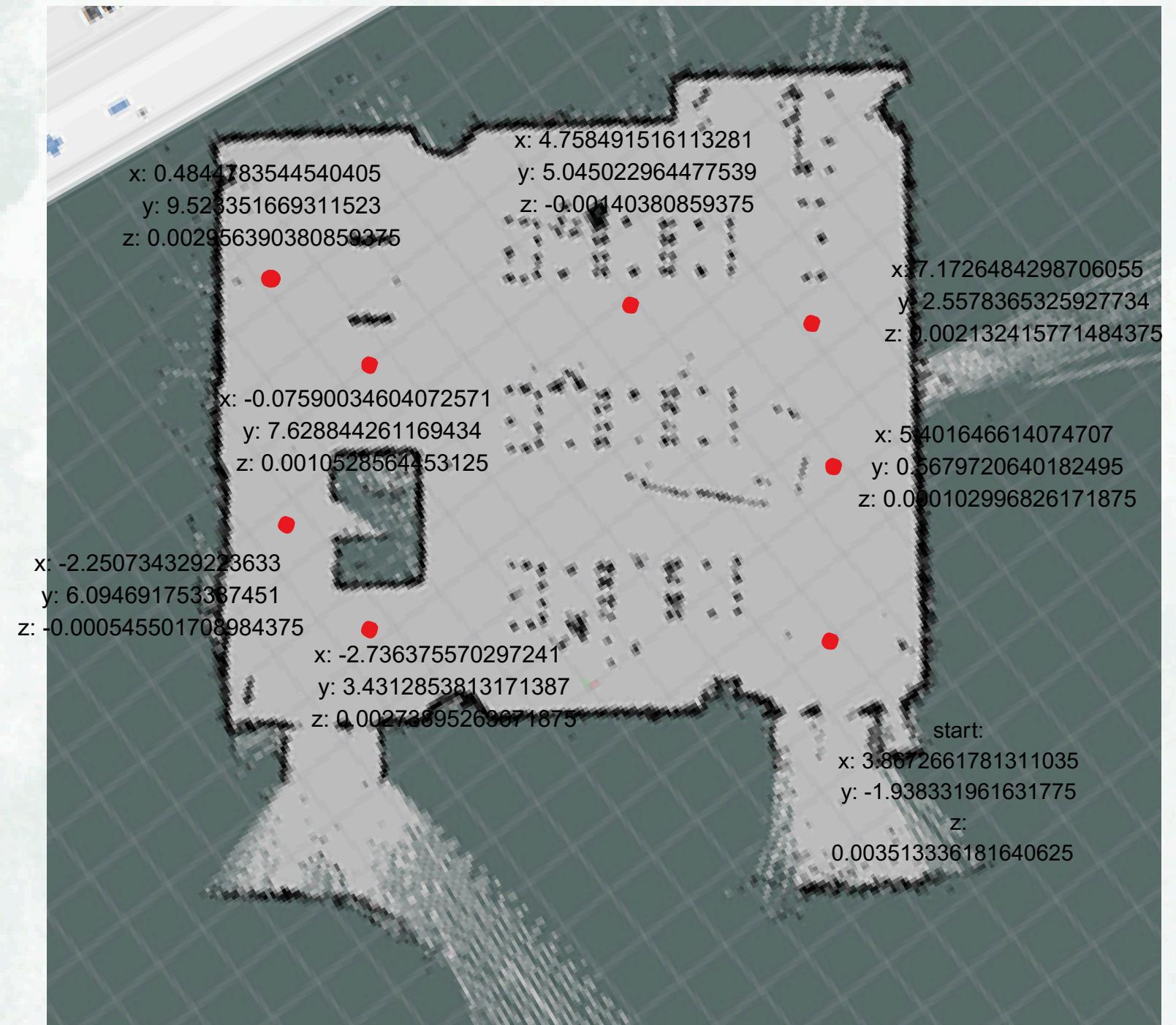


simulation map

# Setup & Experiments



# Setup & Experiments(Mapping)



# Setup & Experiments(Voice Command)



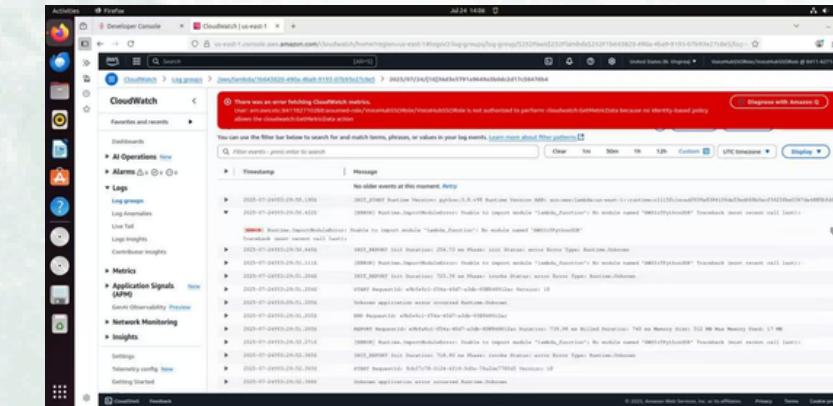
alexa echo dot



mic built-in laptop



Jabra Speak 750



lambda function issues

- Easily affected by the environment,
- The success rate of voice recognition is not high

Final choice

## Setup & Experiments

### following\_function:

yolo\_follower (voice)



yolo\_follower (voice+Choose the person in the center)



### Reminder checkin:

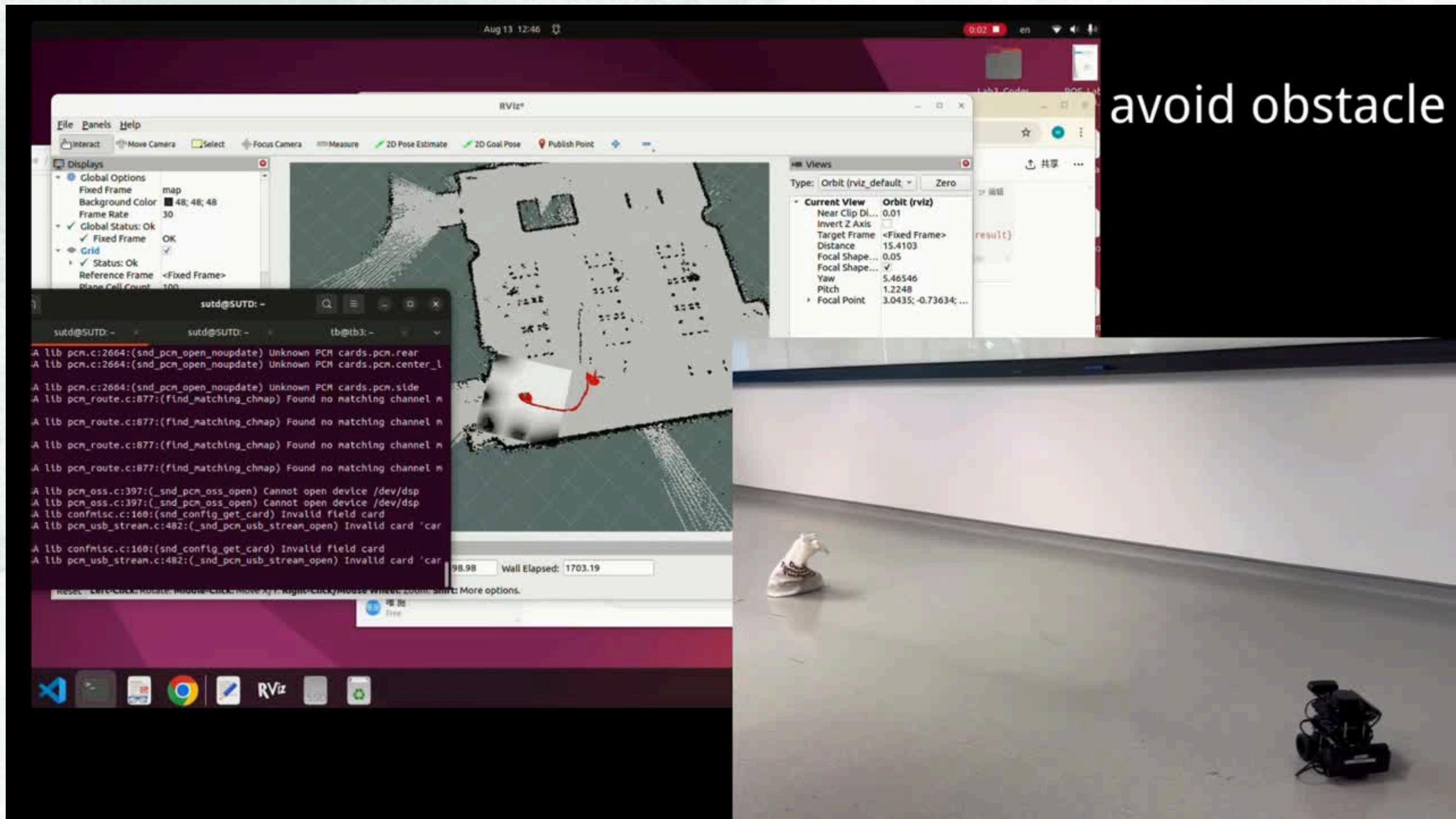
Espeaking(library)

not human-like



Google AI voice record audio files

# Video



# **DISCUSSION & ANALYSIS**

## **Voice Command Recognition Tests:**

### **Jabra Speak 750**

- Quiet environment: Command recognition accuracy reached 90% for short commands such as “Follow me” and “Go to the kitchen.”
- Moderate background noise: Accuracy decreased to 80%, primarily due to partial word detection errors.
- High background noise: Accuracy dropped to 40%, with most failures occurring when commands overlapped with loud external noise (e.g., TV playing).
- Short commands (fewer than 3 words) are better than long ones.

### **Navigation Performance**

- Succeed (failures caused by dynamic obstacles or obstacles cannot be detected by radar)

# DISCUSSION & ANALYSIS

## Follow Me Performance:

- Continuous following without interruption when just one person in view.
- Failure cases mainly occurred:
  - When the target abruptly changed direction, causing the robot to lose the line-of-sight lock.
  - When more than one person is detected.

## Reminder Performance:

- Difficulty in Debugging, as reminders can only be triggered at specific timings.
- Reminders are only triggered once at a specific time.
- Only limited reminders were implemented.



# Demo



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*Thank  
You*

