



# FireFli Turning Signals Into Safety

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## Overview

FireFli is a constant monitoring system enabled through a mobile platform to leverage WiFi based non-line of sight sensing and computer vision based line of sight sensing. We deploy active monitoring through walls and detect person identity and activity using both sensing modalities. FireFli consists to 3 subsystems:

- o WiFi
- o Computer Vision
- o Navigation

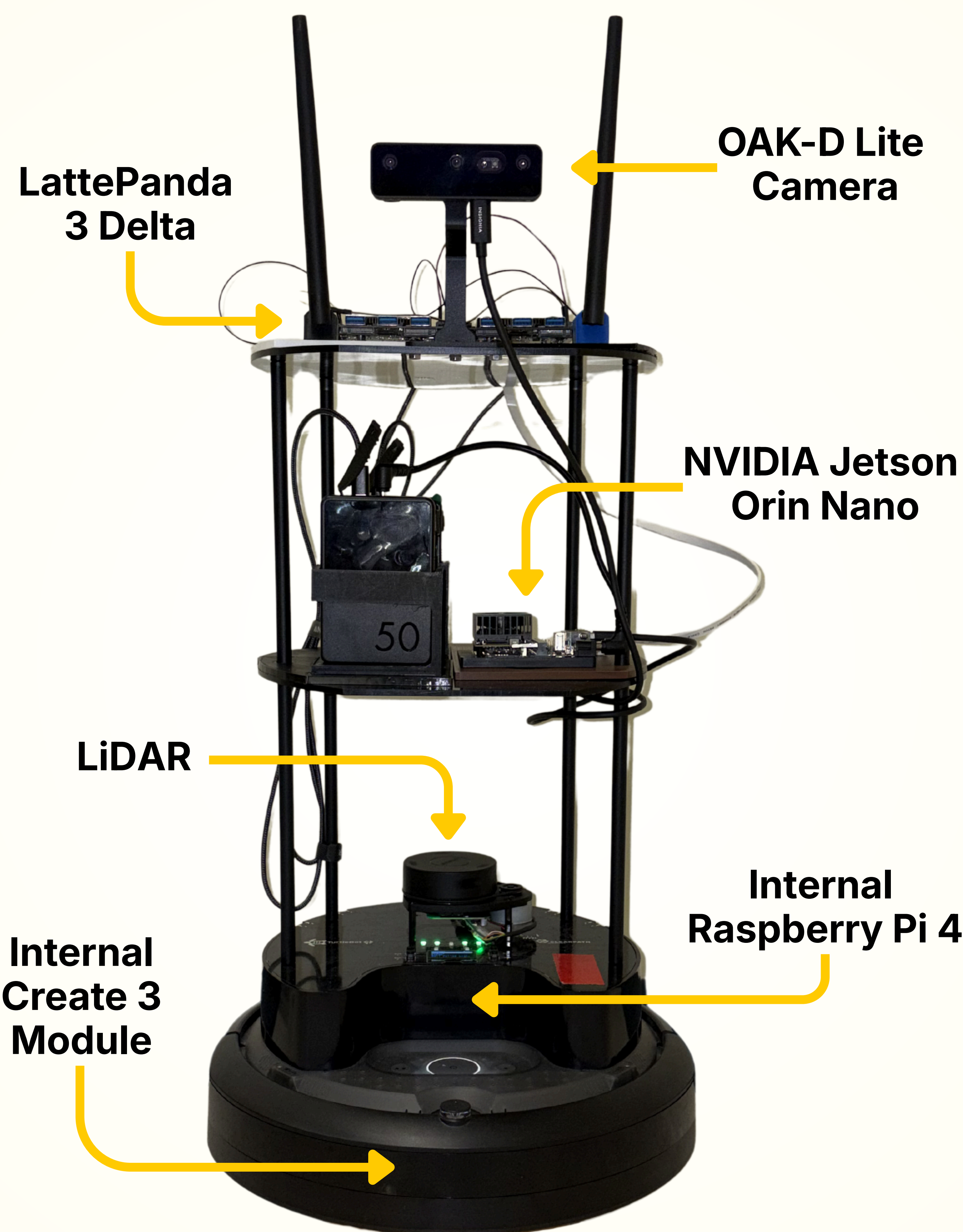
All three subsystems are integrated into a single real-time platform. An onboard audio module announces subsystem switches and detection events aloud, providing clear real-time feedback to users.

## Background

Understaffed hospitals suffer from a lack of monitoring from registered nurses. A direct consequence is a phenomenon called elopement. Elopement refers to when a patient leaves a medical facility unauthorized, unnoticed, or before the discharge date. Every year 400,000 patients elope from US hospitals, and the mortality rate is 25% after the initial 24 hours after elopement. FireFli bridges the gap between the lack of resources and essential monitoring.

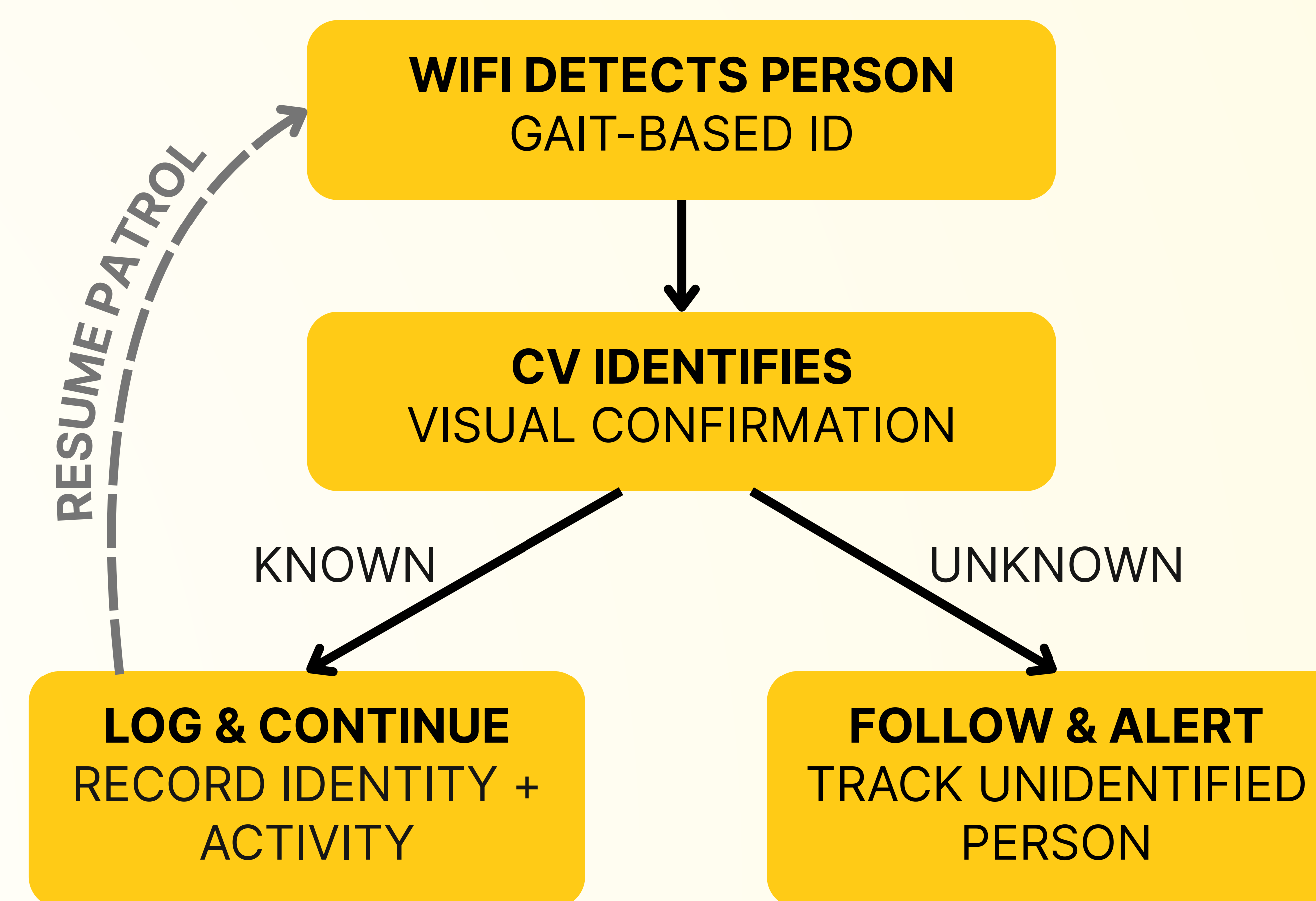
## Communication Links

A TX LattePanda transmits WiFi signals to an RX LattePanda, which processes the received data and passes it over Ethernet to the Jetson Orin, the central coordinator that controls subsystem switching and directs navigation commands to the Raspberry Pi over ROS2.



Final Design

## Implementation



## Results

**WiFi:** An LDA classifier identified individuals by gait at 79.2% accuracy without line of sight, using distinct per-person signatures extracted from CSI.

**Vision:** The pipeline ran at ~400 ms latency with 97% object detection, 92% facial recognition, and 87% activity classification accuracy.

**Navigation:** Across 20 autonomous trials to vision-identified targets, the robot stopped within 5 cm on 13/20 and within 10 cm on all 20 (mean 100.3 cm, MAE 4.13 cm).

**Full System Integration:** The subsystems operate as one coordinated platform: the Jetson Orin reliably switches from default WiFi sensing to the vision pipeline when a person or fall is detected, completing the full loop, detect through walls, confirm visually, navigate autonomously. An onboard audio module announces switches and detections aloud for real-time feedback.

## Acknowledgements:

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