

Autonomous Security Vehicle Robot S.T.E.V.E.

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INTRODUCTION

Motivations

Designing a small robot for enhanced security and efficient, reliable information relay.

Importance

Alleviate pressure on security and surveillance staff by providing autonomous support via automated monitoring of controlled environments.

Project Goal

Create a security bot capable of:

- navigating and monitoring a controlled environment.
- streaming video to a user-facing app.

Project Specifications

- Initialize R-Pi [1] to receive video input
- Run Android API [2] on standard Android device
- Host video stream, accessible via shared internet
- Program bot to follow set trajectory

Design Approach

- Establishing communication via sensors (Fig. a)
- CAD model for physical assembly (Fig. b)
- Data processing (camera, audio) and online streaming
- Mobile app to view video (Fig. c)
- Navigation firmware (wheel encoding, remote control)

ANALYSIS

Challenges

- Progress bottleneck: simultaneous development of features on R-Pi, could only test one feature at a time
- Compatibility: components were not initialized with matching OS, iterative debugging and testing required
- Online streaming: integration of unknown OS, debugging layers of potential sources for error [3]
 - functionality is still limited to devices on local network

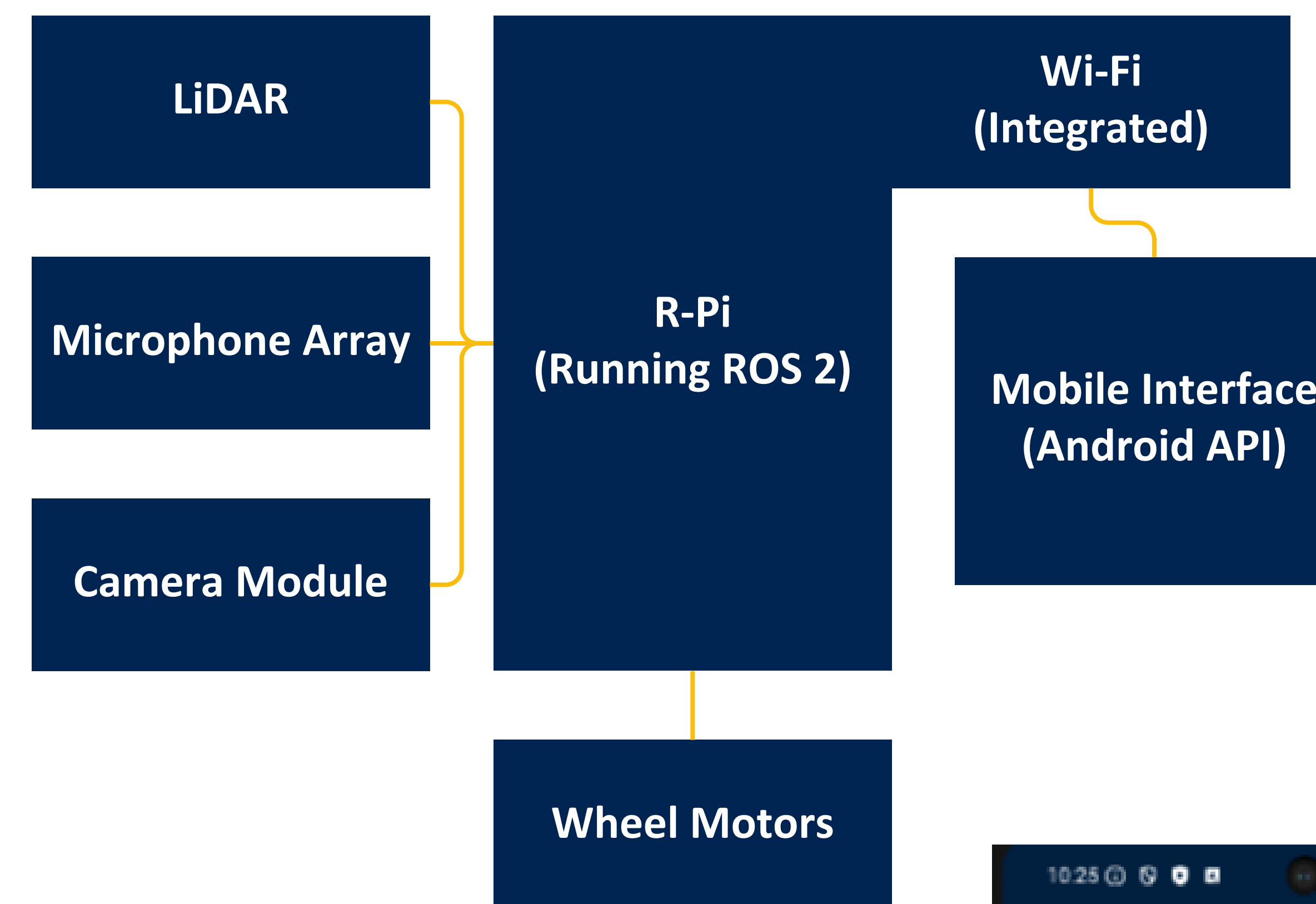
Strengths

- Versatile programming
- Robust design
- Can connect remotely to portable device (phone)

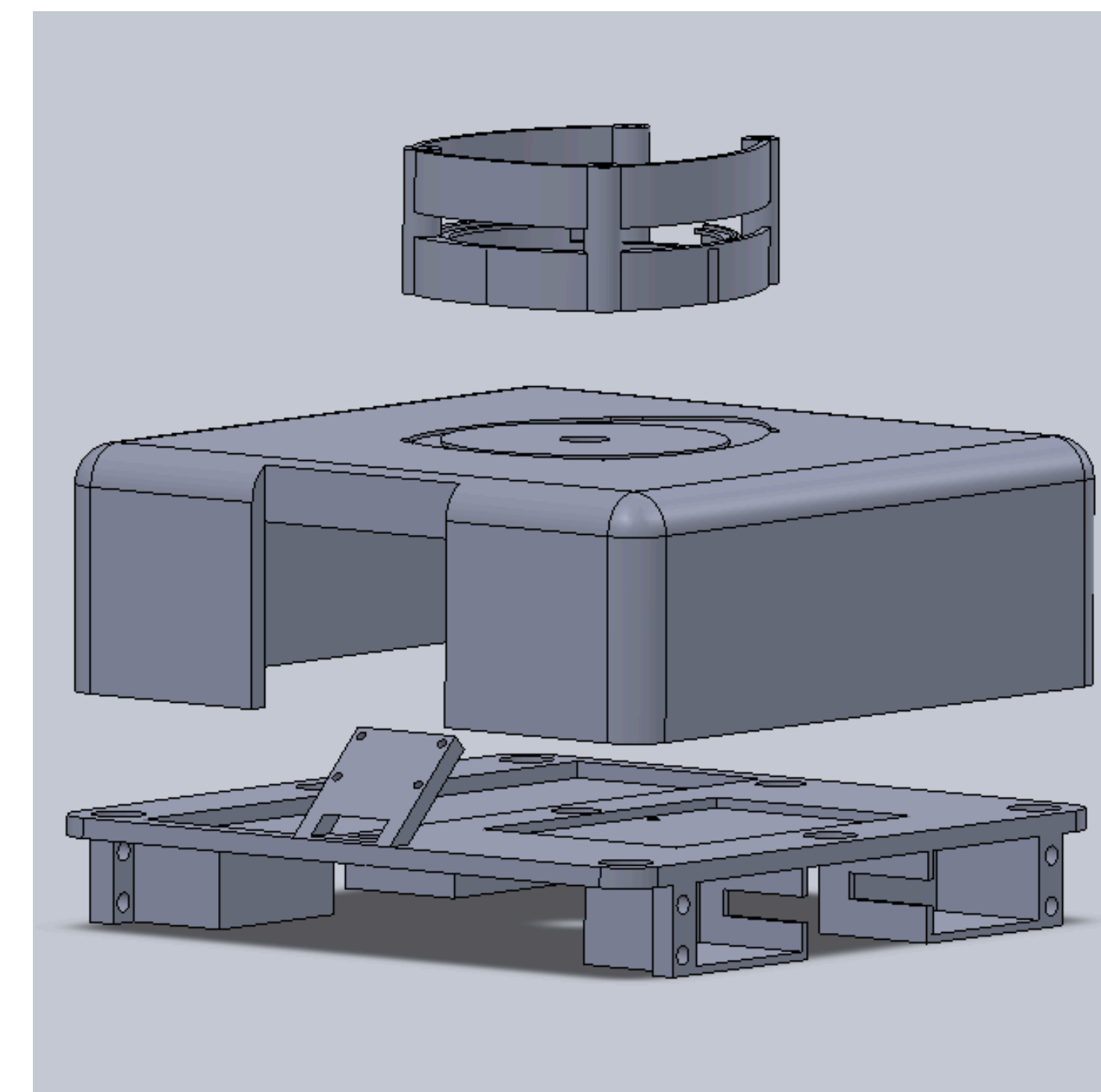
Weaknesses

- Power-intensive
- Can overheat
- Hosting is incompatible with most firewalls

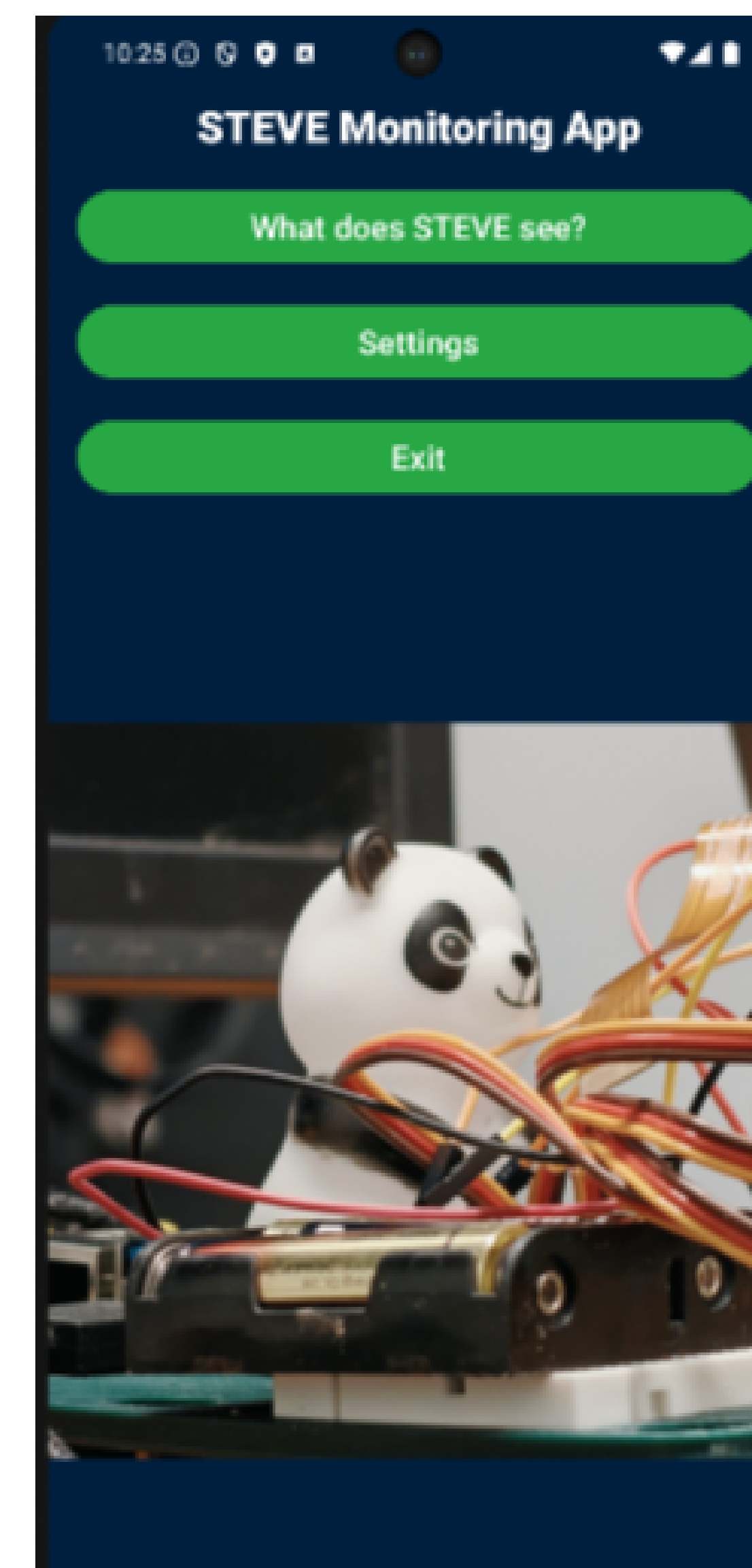
TABLES / FIGURES / DIAGRAMS



(a) Component Block Diagram



(b) CAD Chassis in three parts



(c) User Interface

CONCLUSIONS & RECOMMENDATIONS

Applications

Suitable for use in low-security, controlled environments, such as small museums and general-use classroom halls.

Next Steps

Continuation from Current Progress:

- Autonomous navigation of planned routes
- Audio anomaly detection
- Autonomous evaluation of audio anomaly direction
- Push notifications from Android API
- Dedicated streaming server with higher security

Future Development

Stretch Goals:

- audio anomaly detection
- push notifications from user interface
- remote (manual) control of robot movement

To Prepare Product for Commercial Market:

- Larger chassis to support onboard power supply
- In-app path planning and manual control/navigation
- In-app framerate and quality control
- Custom chip and PCB for dedicated functionality

REFERENCES

[1] "Raspberry Pi Documentation - Raspberry Pi hardware," Raspberry Pi Foundation. [Online]. Available: <https://www.raspberrypi.com/documentation/computers/raspberry-pi.html>. [Accessed: 02-Mar-2025].

[2] "Projects Overview," Android Developers. [Online]. Available: <https://developer.android.com/studio/projects>. [Accessed: 12-Jan-2025].

[3] ChatGPT, "Debugging assistance with R-Pi camera setup," OpenAI, personal communication, Mar. 13, 2025.

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