A DIRECT IOTY-BASED ESP32 AP CONNECTION FOR ROBOTIC CONTROL MISSIONS

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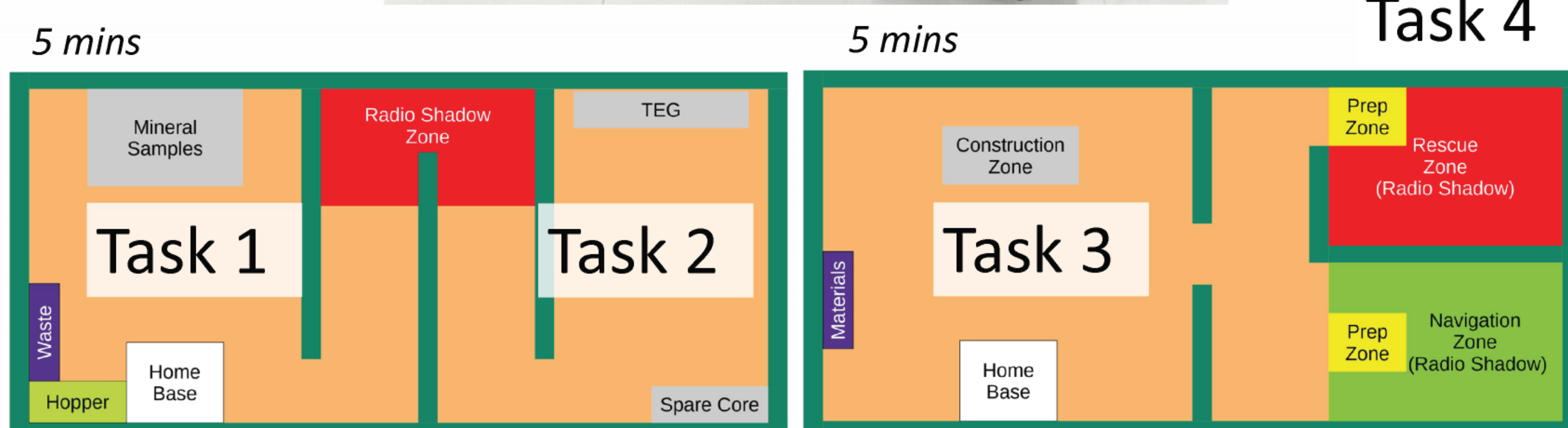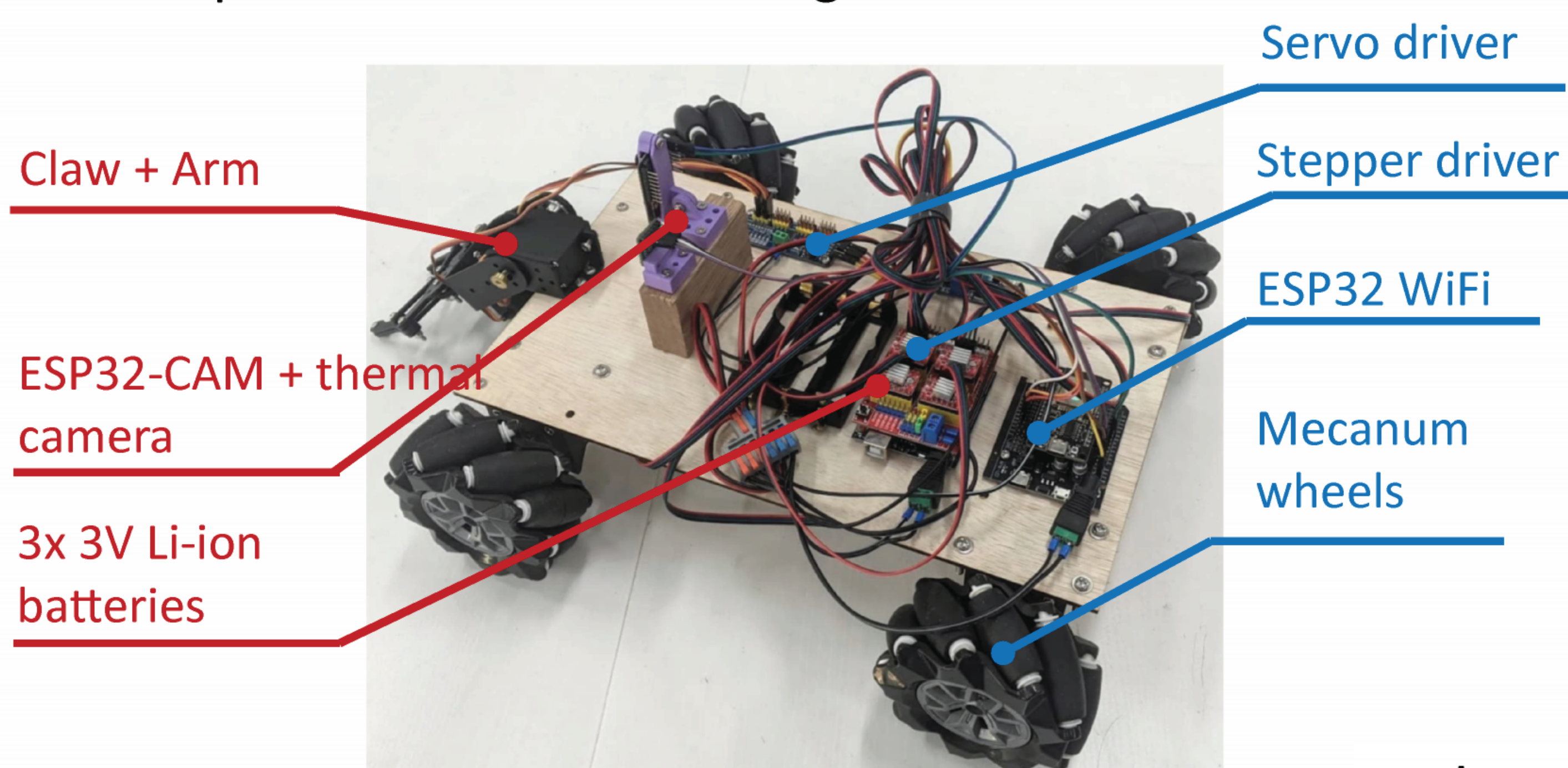
Introduction

Space Exploration

Reliance on **unmanned** craft
Wide array of tasks, each requiring **custom features**
A **fast yet reliable** two-way communication systems is essential
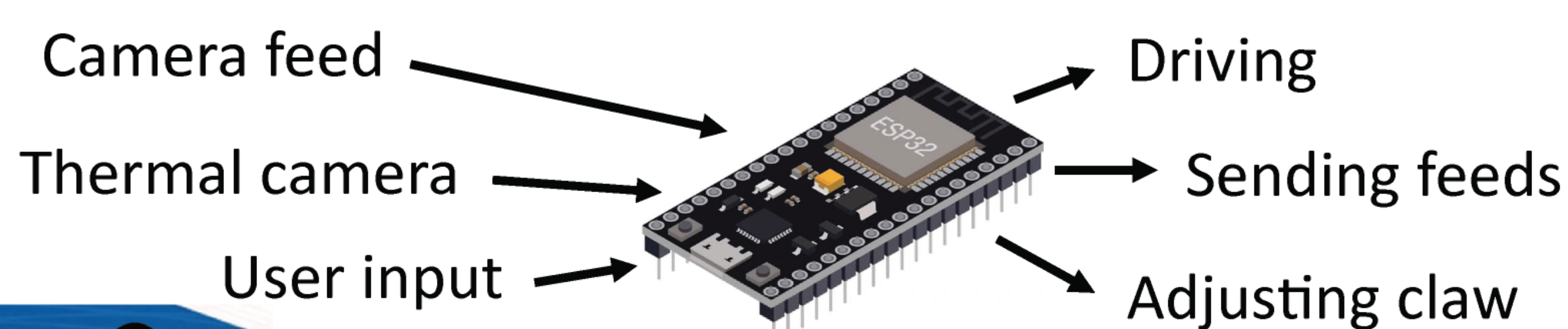
The Challenge

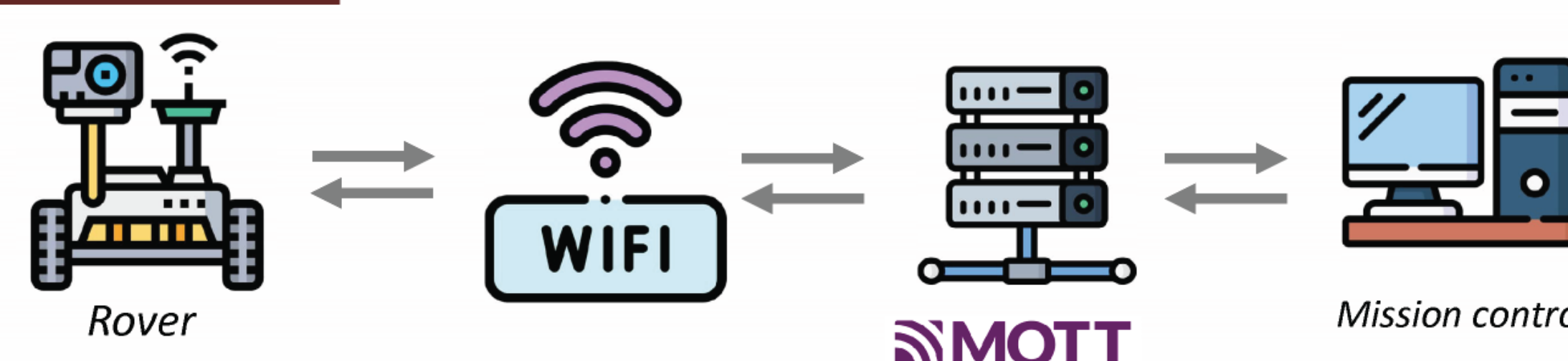Design and build a remote-controlled robot to complete a series of challenges

- Claw + Arm
- ESP32-CAM + thermal camera
- 3x 3V Li-ion batteries
- Servo driver
- Stepper driver
- ESP32 WiFi
- Mecanum wheels

5 mins

- Mineral Samples
- Radio Shadow Zone
- TEG
- Task 1
- Task 2
- Waste
- Hopper
- Home Base
- Spare Core

5 mins

- Construction Zone
- Prep Zone
- Rescue Zone (Radio Shadow)
- Task 3
- Materials
- Home Base
- Prep Zone
- Navigation Zone (Radio Shadow)

Task 4

Collaboration within team alliances

Task 5

The Problem

- Camera feed
- Thermal camera
- User input
→
- Driving
- Sending feeds
- Adjusting claw

Critical: Low-latency communication

Our Solution

Provided solution

Rover → WIFI → MQTT → Mission control

Provided an *easy-to-use* IoTy interface, but network became *quickly overwhelmed*

Our solution

ESP32 WiFi Access Point
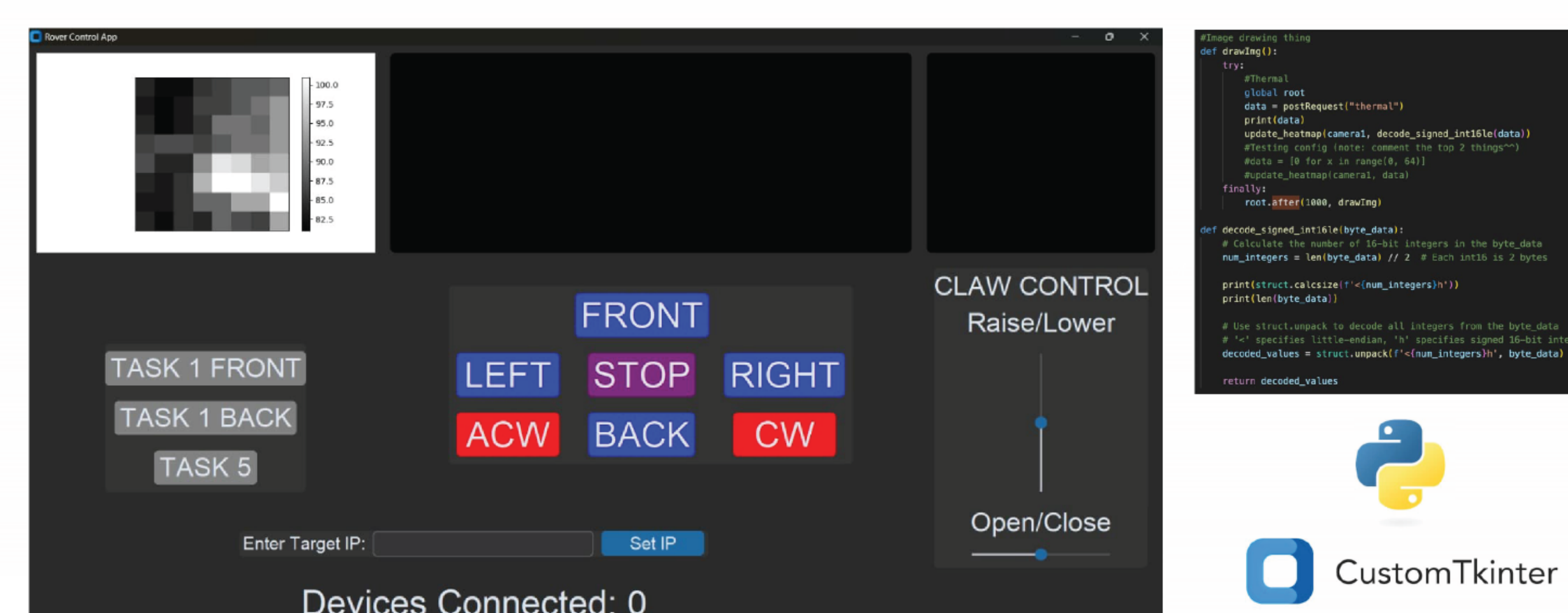

Response
http requests

Client
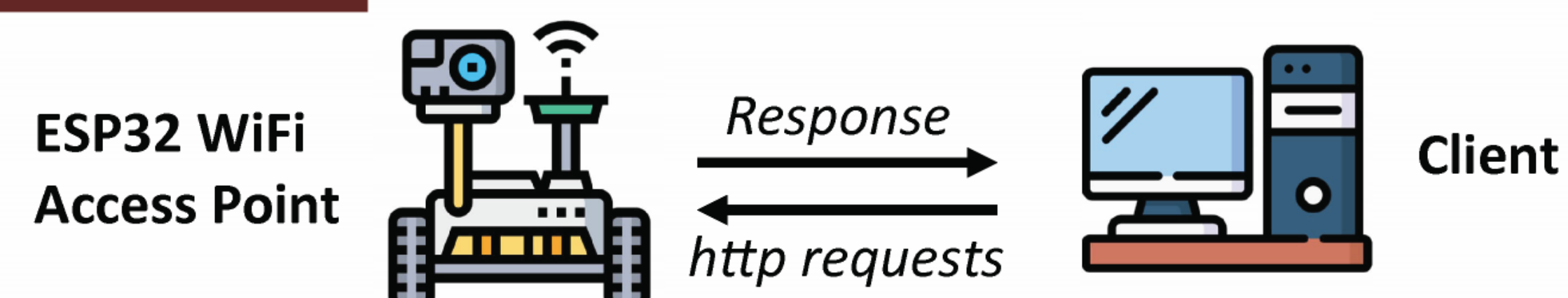
✓ Best suited for **DIRECT, short-range communications** *(our main objective) + Ease of debugging*

Custom GUI for intuitive controls and custom presets
+
Python Script to handle networking requests

CustomTkinter

- Fast **thermal camera decoding** & **visualisation** using Struct and Matplotlib
- Easy-to-use **buttons and sliders**
- **Fully customisable** to mission needs

Applications

- **Short-range** control of **rovers** (e.g., robot swarm controlled by master)
- Enhanced **EVA support** in spacecraft vicinity
- **Local network** for deployable **sensors**