Rover – 2: A Smart Farm Quality Mini Rover

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ARCHITECTURE PLATFORMS AND SERVICES

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Introduction – Why Rover – 2?

Fires on agricultural land account for 8–11% of the total number of fires that occur globally. These fires burn through various crops, pastures, and native vegetation on farms, causing economic and environmental losses. Fire management on farms wil

Measuring flammability of crops, pastures, fruit trees, and weeds: A novel tool to fight wildfires in agricultural landscapes - ScienceDirect

imagine a farm, but perhaps you should. Agriculture generates significant levels of air pollution and, in some parts of the world, it is now the single largest sectoral source of damages from particulate air pollution.

Understanding the complex air pollution-agriculture relationship

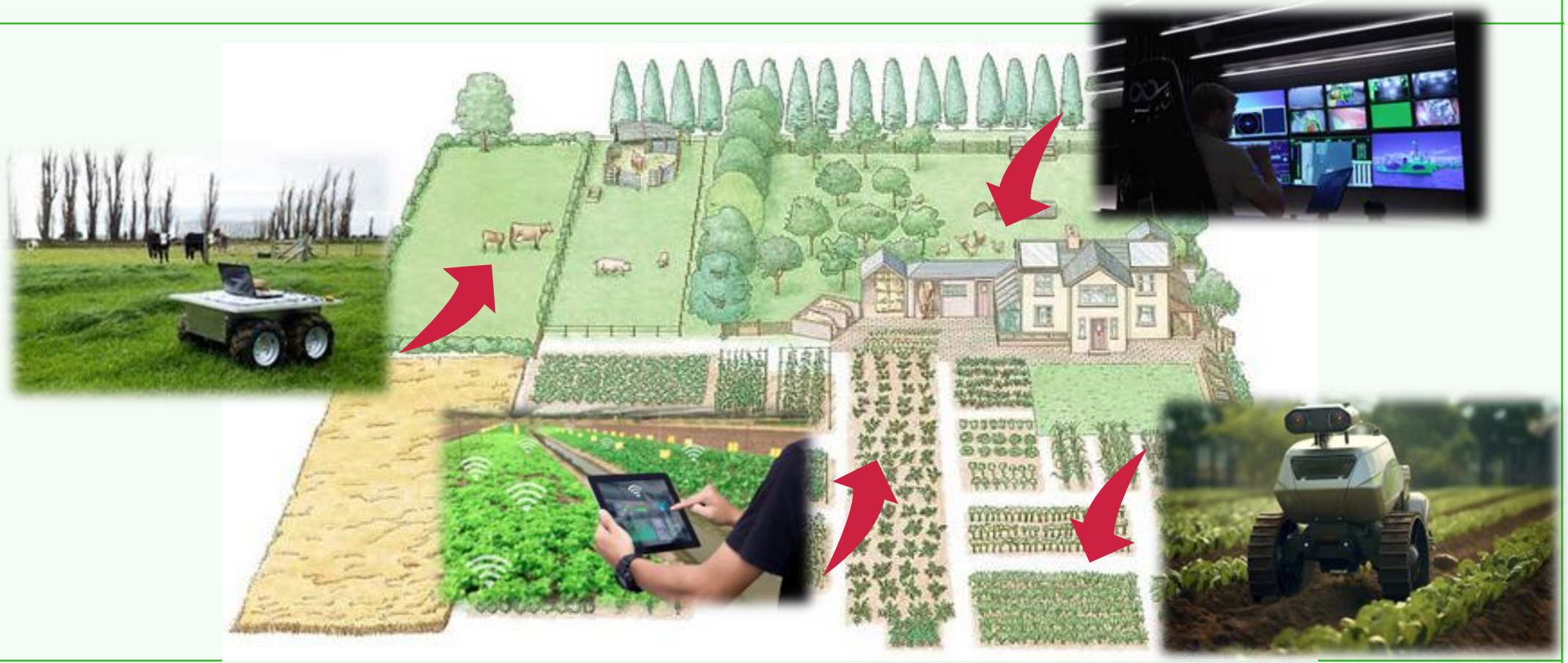
Northwest Heat Dome. Increased temperatures can also lead to issues like crop sunburn from extreme heat, whicl can reduce annual yields for farms by as much as 40%.

The Economic Impact of Climate Change on Northwest Farms | USDA Climate Hubs

In agriculture, the IoT devices are vulnerable to physical tampering, such as theft or attacks by predators and animals.

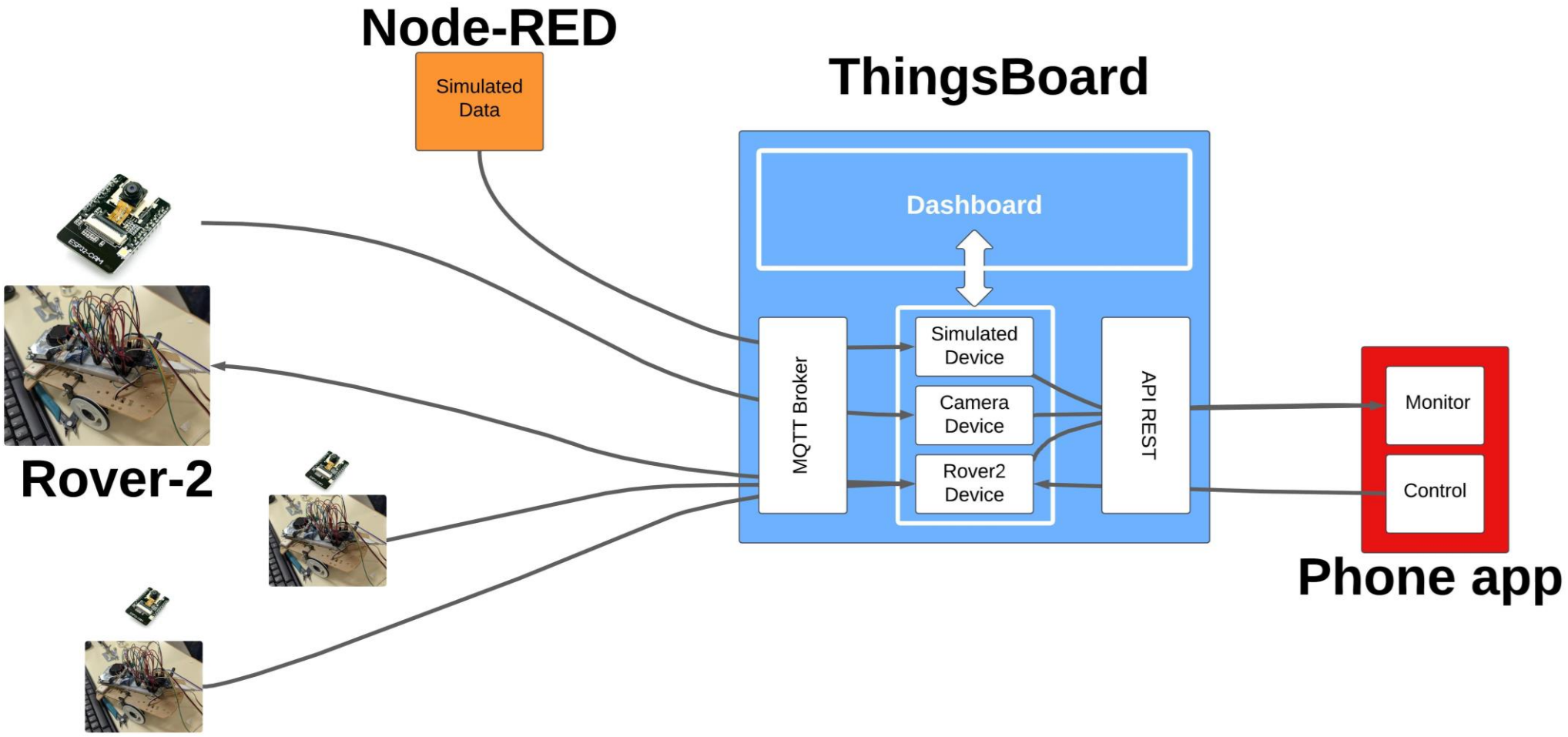
An Overview of Internet of Things (IoT) and Data Analytics in Agriculture: Benefits and Challenges | IEEE Journals & Magazine | IEEE Xplore

Introduction – Action plan



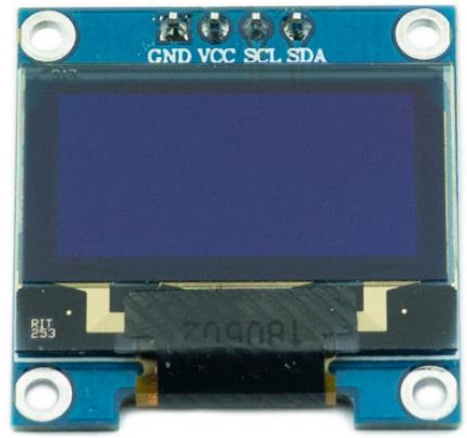
Design decisions

Network architecture



Simulated magnitudes in NodeRED

- Rain rate – mm/h
- Solar radiation – W/m²
- CO and CO2 - ppm
- NO - ppm
- Methane - ppm

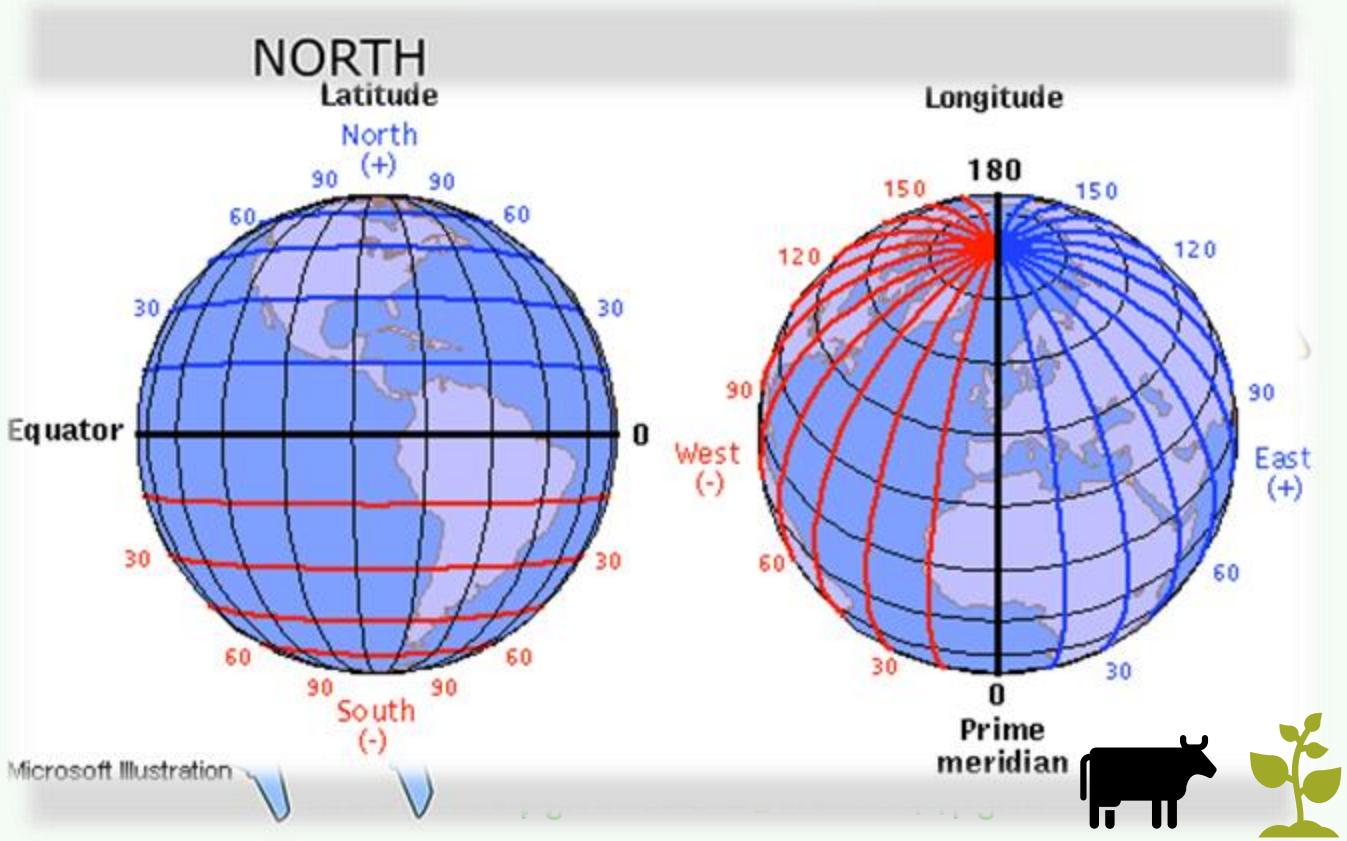


Rover-2 architecture

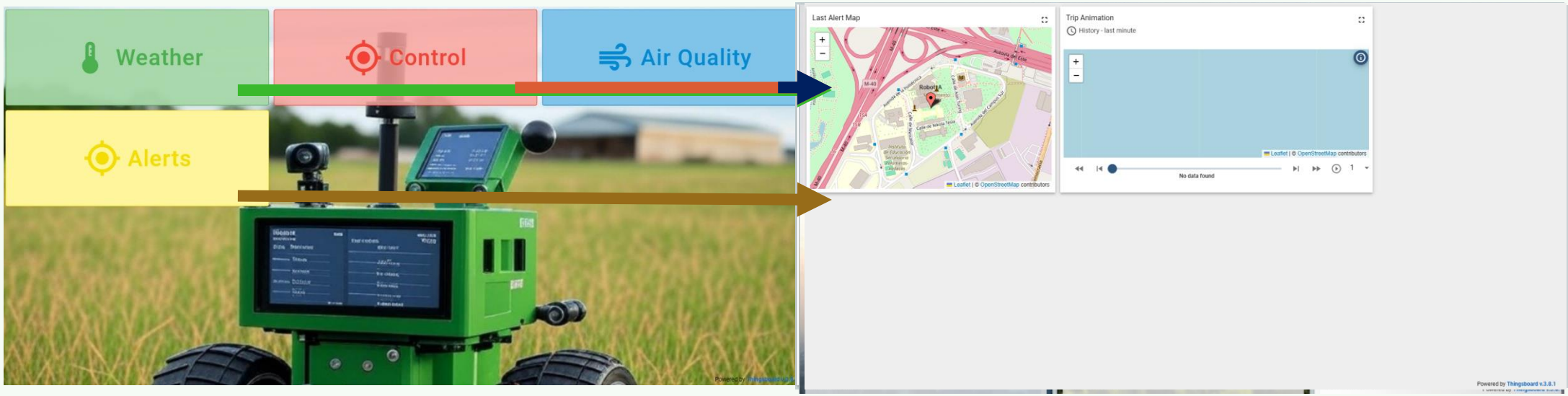
- Two ESP32: main one and vision one
- Powered by FreeRTOS
- Location and orientation: GPS and compass
- 5-megapixel digital camera
- PM2.5 and PM10 sensor - ppm
- Temperature - ºC, humidity - % and pressure - hPa sensor
- Actuators: LED, buzzer, OLED screen and servo motors

Rover-2 node intelligence

- Auto-pilot algorithm: route follower
- Alarms: most valuable knowledge extraction



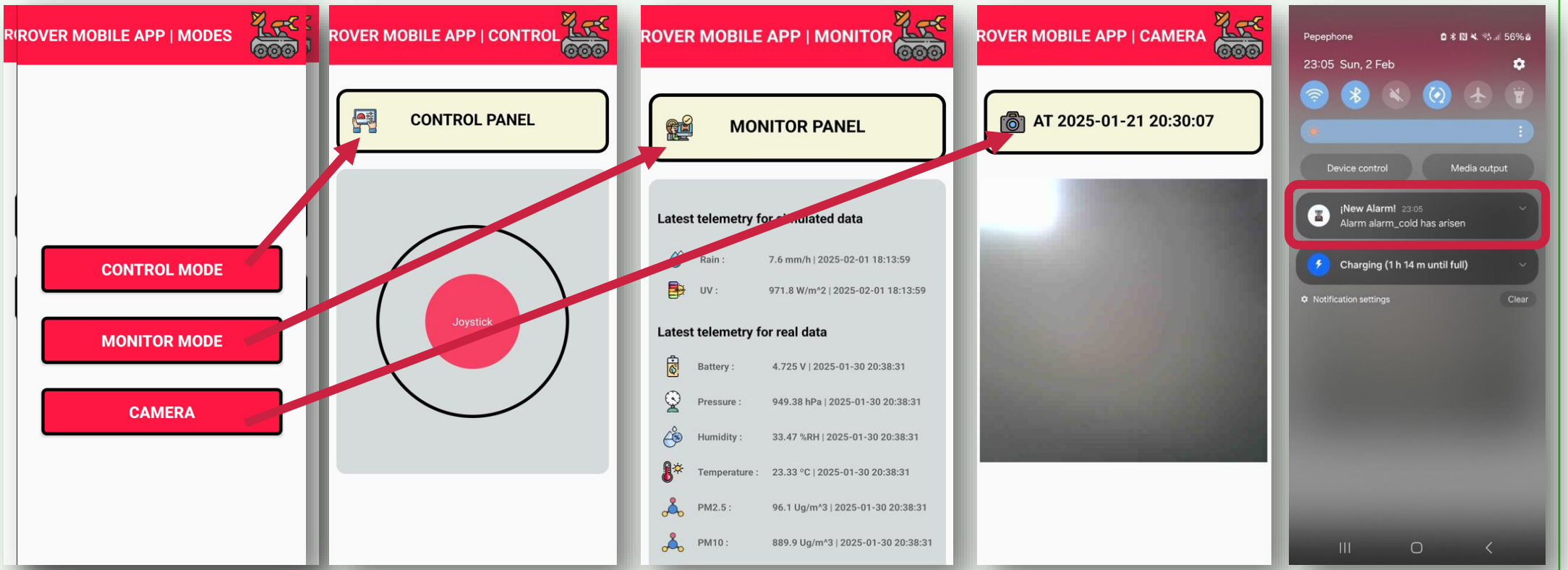
Thingsboard dashboard

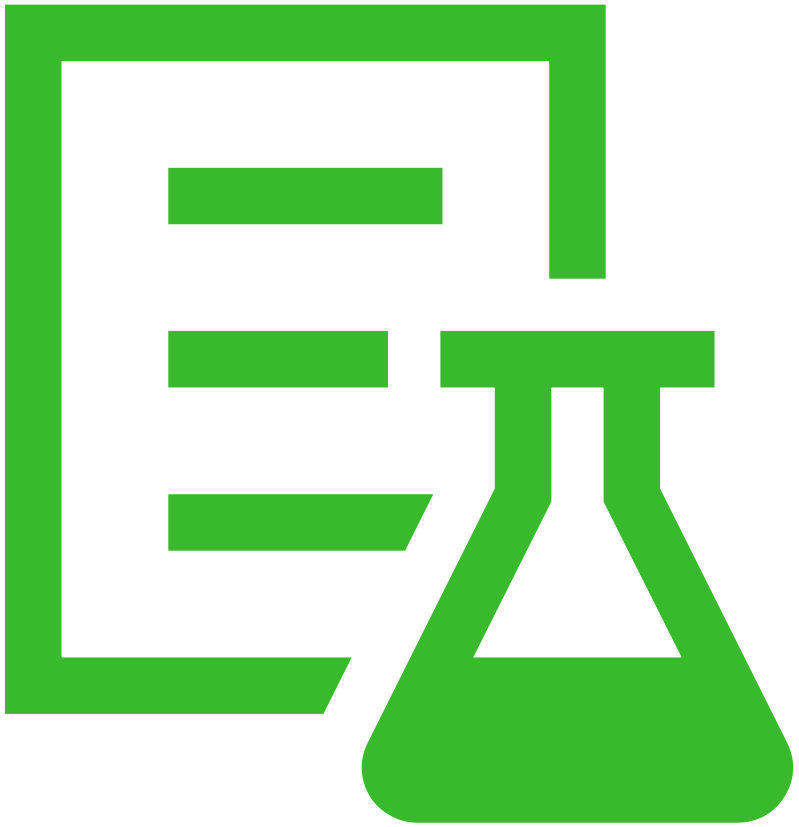


Main hub

Air quality dashboard

Android app


ROVER MOBILE APP | MODES
CONTROL MODE
MONITOR MODE
CAMERA
ROVER MOBILE APP | CONTROL
CONTROL PANEL
Joystick
ROVER MOBILE APP | MONITOR
MONITOR PANEL
Latest telemetry for
Rain : 7.6 mm/h | 2025-02-01 18:13:59
UV : 971.8 W/m^2 | 2025-02-01 18:13:59
Latest telemetry for real data
Battery : 4.725 V | 2025-01-30 20:38:31
Pressure : 949.38 hPa | 2025-01-30 20:38:31
Humidity : 33.47 %RH | 2025-01-30 20:38:31
Temperature : 23.33 °C | 2025-01-30 20:38:31
PM2.5 : 96.1 Ug/m^3 | 2025-01-30 20:38:31
PM10 : 889.9 Ug/m^3 | 2025-01-30 20:38:31
ROVER MOBILE APP | CAMERA
AT 2025-01-21 20:30:07
Pepephone
23:05 Sun, 2 Feb
Device control
Media output
¡New Alarm! 23:05
Alarm alarm_cold has arisen
Charging (1 h 14 m until full)
Notification settings
Clear



Project testing and validation

Validation tests

CODE DEBUGGING

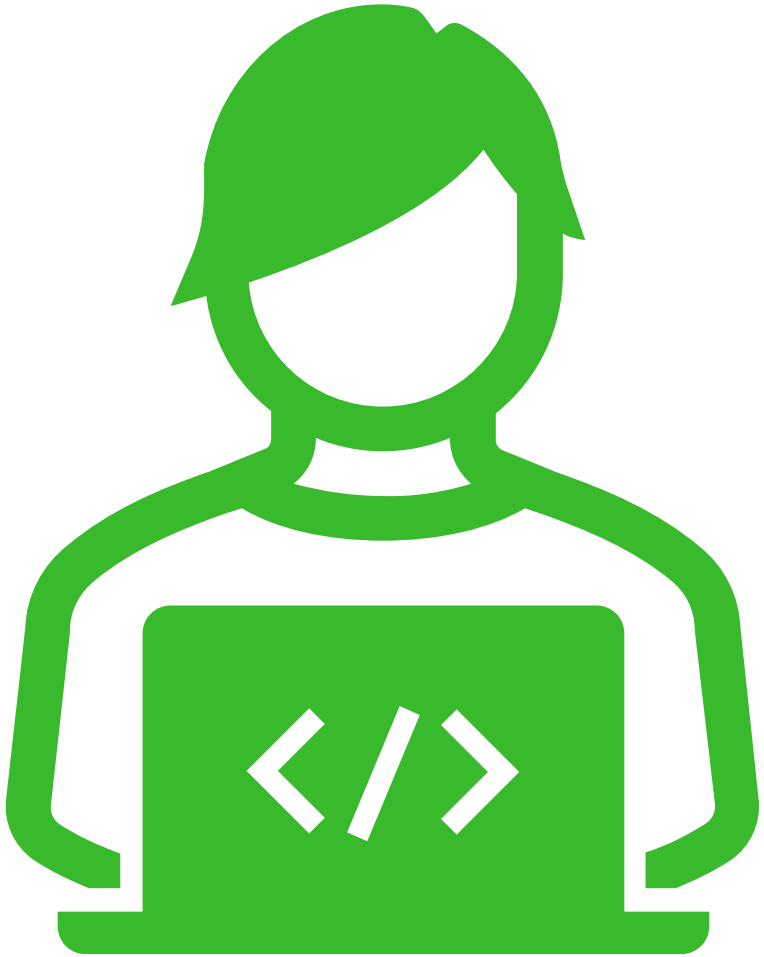
MOTION MANOEUVRES

THINGSBOARD REAL-TIME GRAPHS (PUBLISH)

THINGSBOARD COMMANDS AND ALERTS (SUBSCRIBE)

REST API CONNECTION WITH ANDROID APP

SYSTEM ROBUSTNESS AND FAILURE HANDLING



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Future work

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1. Produce more Rover-2
2. Use geared down motors
3. Implement more specific sensors
4. Implement an obstacle avoiding system
5. Protect the hardware with a 3D printed casing and design a PCB to solder the electronics
6. Migrate to 4G/5G
7. Research on cloud algorithms to improve production with the collected information

To do list

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Thank you for your attention!

We hope you have enjoyed our project

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