Krishworks
Technology Innovations

Capability
Deck

# Embedded Edge Gateway Solutions

Microcontroller & IoT Nodes

Firmware →	Security →
Cloud Sync →	Protocols →
OTA →	Provisioning →

Data Acquisition Through Sensors →

Energy & Power Management →

Prototyping & circuit design, Component / Sensor Selection →

Wireless / Wired IoT Sensors

Protocols (center icons):
- WiFi
- Thread
- Sub-1 GHz
- Matter
- BLE
- Zigbee
- LoRaWAN
- Modbus

Edge Gateways & SBC

Embedded Linux - Yocto, Buildroot & Custom Linux Porting →

Bootloader(Uboot), Kernel, Device Drivers →

Secure Boot, Verified Boot, Device Mapper, Verity, Disk Encryption →

Hardware Security Modules, eFuses and OTP (One Time Programmable) NV Memory →

A/B OTA Updates - Mender, RAUC →

Toolchain →

Board Bring Up →

Connectivity icons:
- LTE
- LAN
- WiFi
- NB-IOT / Cat M1

Cloud

| Cloud Native → |
| Backend → |

User Interface & Console →

Partner logos: NXP, intel nuc, Rockchip, BROADCOM, TEXAS INSTRUMENTS, SILICON LABS, ESPRESSIF, ST life.augmented, Microchip, NORDIC SEMICONDUCTOR, aws, Google Cloud, Microsoft Azure, DigitalOcean

Building Prototypes

- Identifying components & development kits.

- Assembling them on general purpose PCBs.
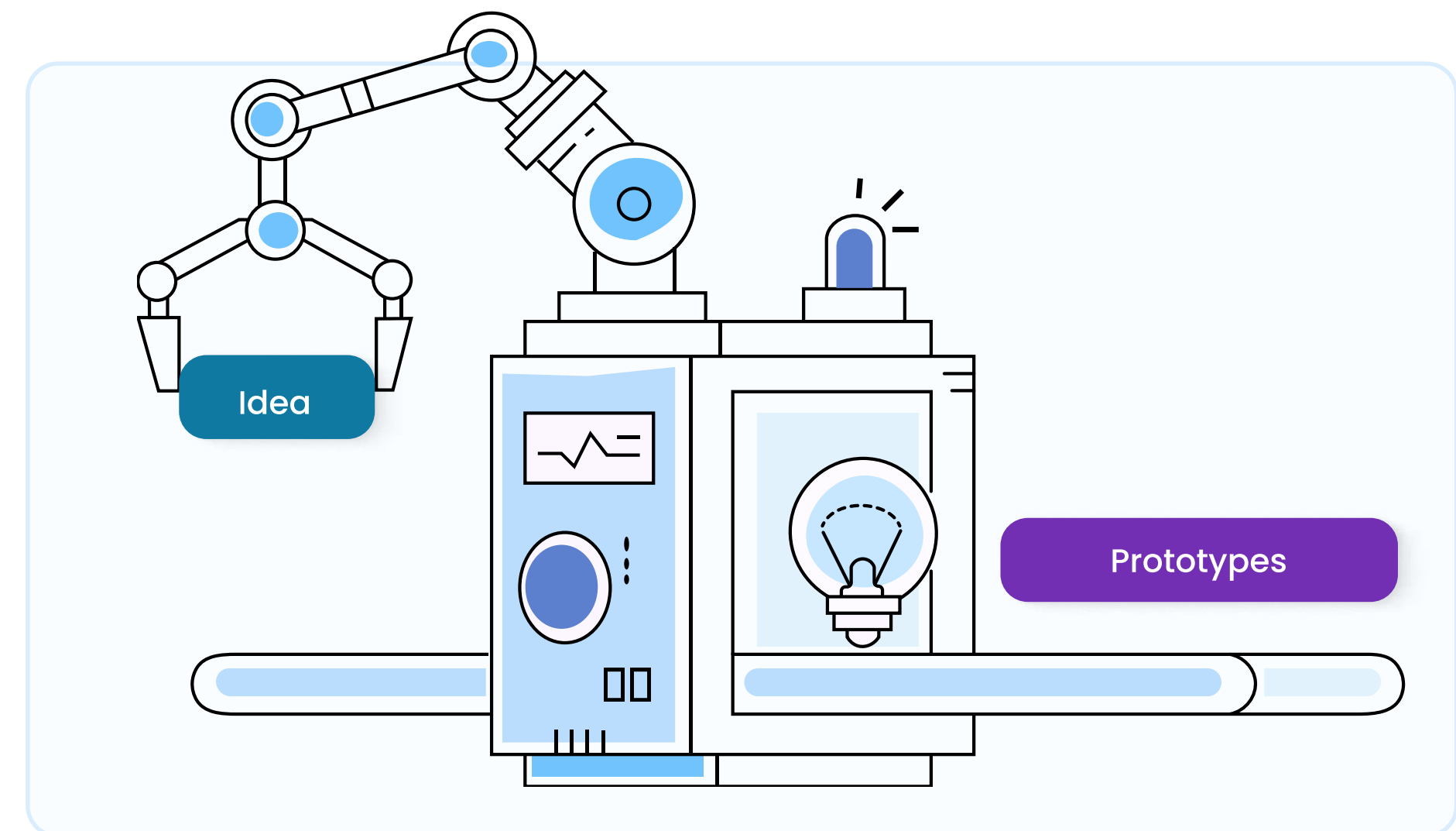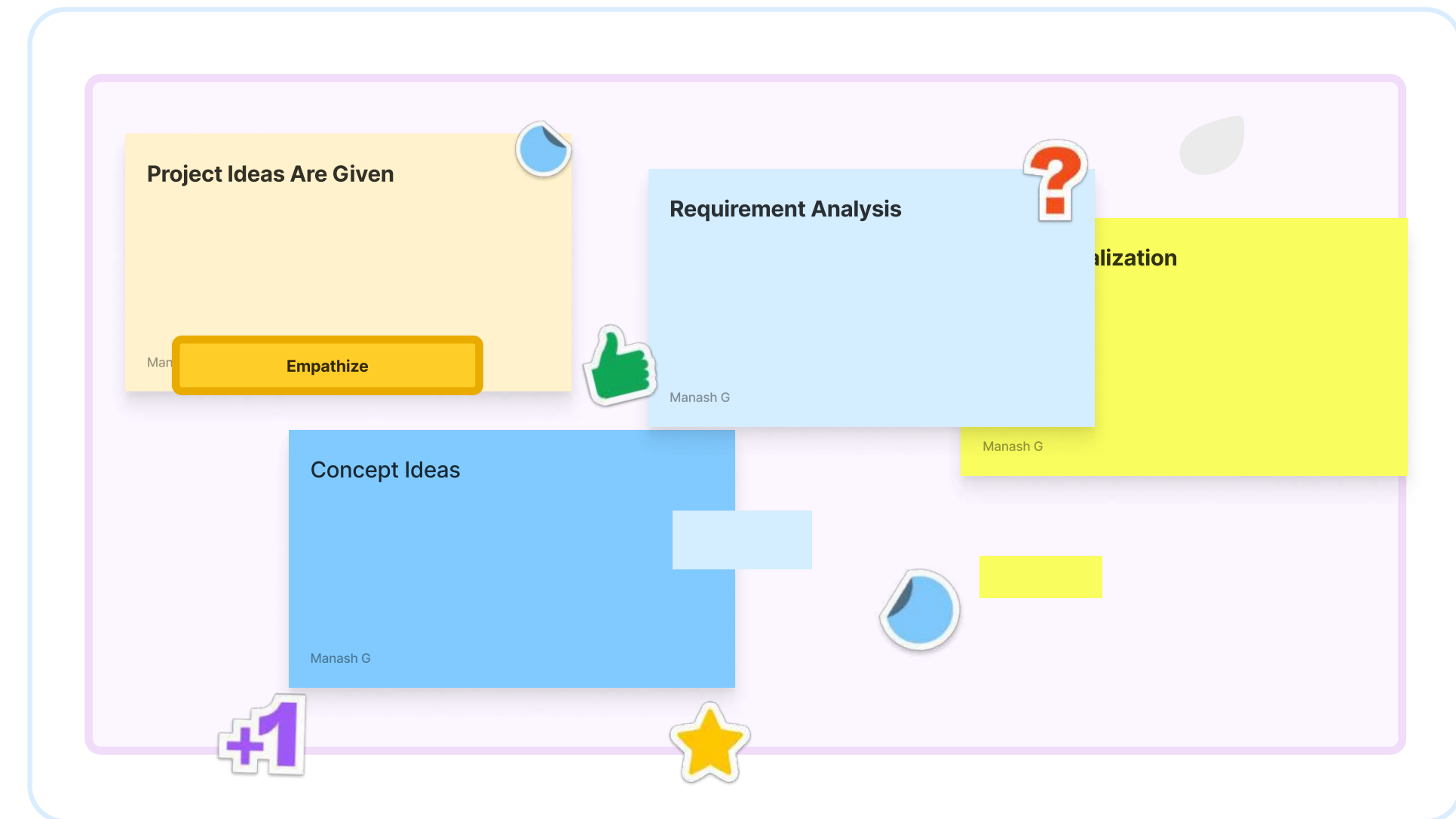
Bare Metal Firmware Development

- PIC
- MSP 430
- ARM

- TIVA C
- Silicon Labs EFM8

- SD Card, FAT File System

- USB - Control, Interrupt, Bulk Transfer

- Bluetooth Classic EDR 2.1 and BLE
- TCP/ IP

- MQTT
- PWM
- LCD
- LoRa - RFM95W

- 7 Segment LED
- I2C, SPI, 1-wire

Firmware Development on Free RTOS

- ESP32, STM32   • Mesh Network - WiFi/BLE

- WiFi/BLE co-existence   • LTE   • ESP NOW

- ESP Rain Cloud   • ESP Touch

- Node: Access Point/Station mode

- 4G-SIMCOM 7600X, Quectel - HTTP, FTP - AT Command , PPPOE Mode

- LCD, OLED   • Bluetooth, NIMBLE   • OTA   • SPIFFS

- FAT File System, VFS   • RMT   • HTTP Server

- Captive Portal   • Provisioning   • LoRa, LoRaWAN

- 7 RFID LED   • I2C, Temperature Sensor   • NFC

- ADC - Potentiometers, Voltage dividers, battery level monitoring
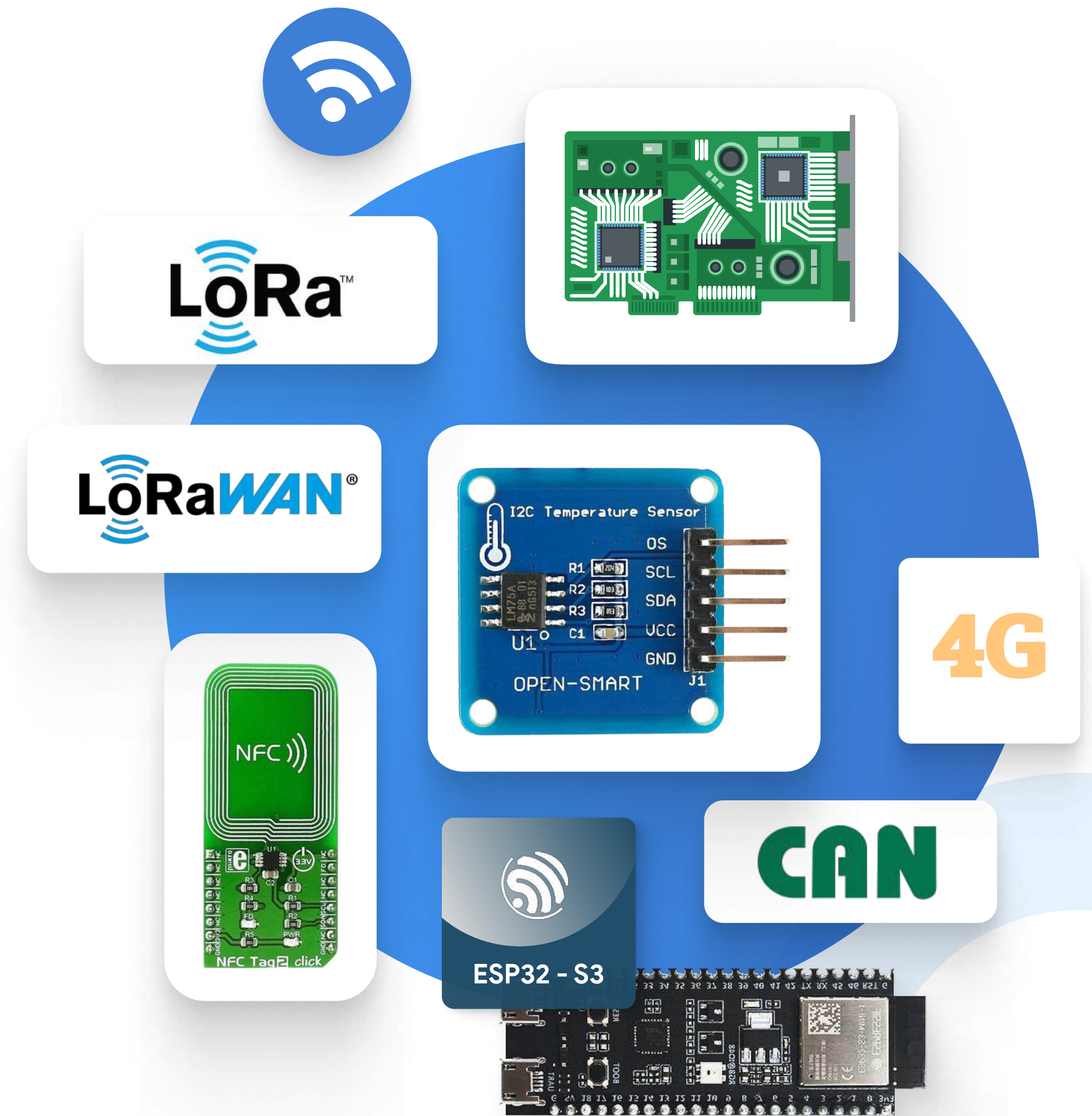
Single Board Computers (SBCs)

- GPS Modules

- <u>IoT Edge Gateways</u> - Dell, Compulab, Laird, Dusun

- Debian OS (Ubuntu, Raspbian)

- LTE Modules (Quectel, Simcom)

- GPS Modules   • Bluetooth, NIMBLE

- Creating custom BLE device

- LTE Internet: NDIS, RNDIS

- LTE Internet over Serial and USB interface

- System services   • OTA (Over-the-Air) updates
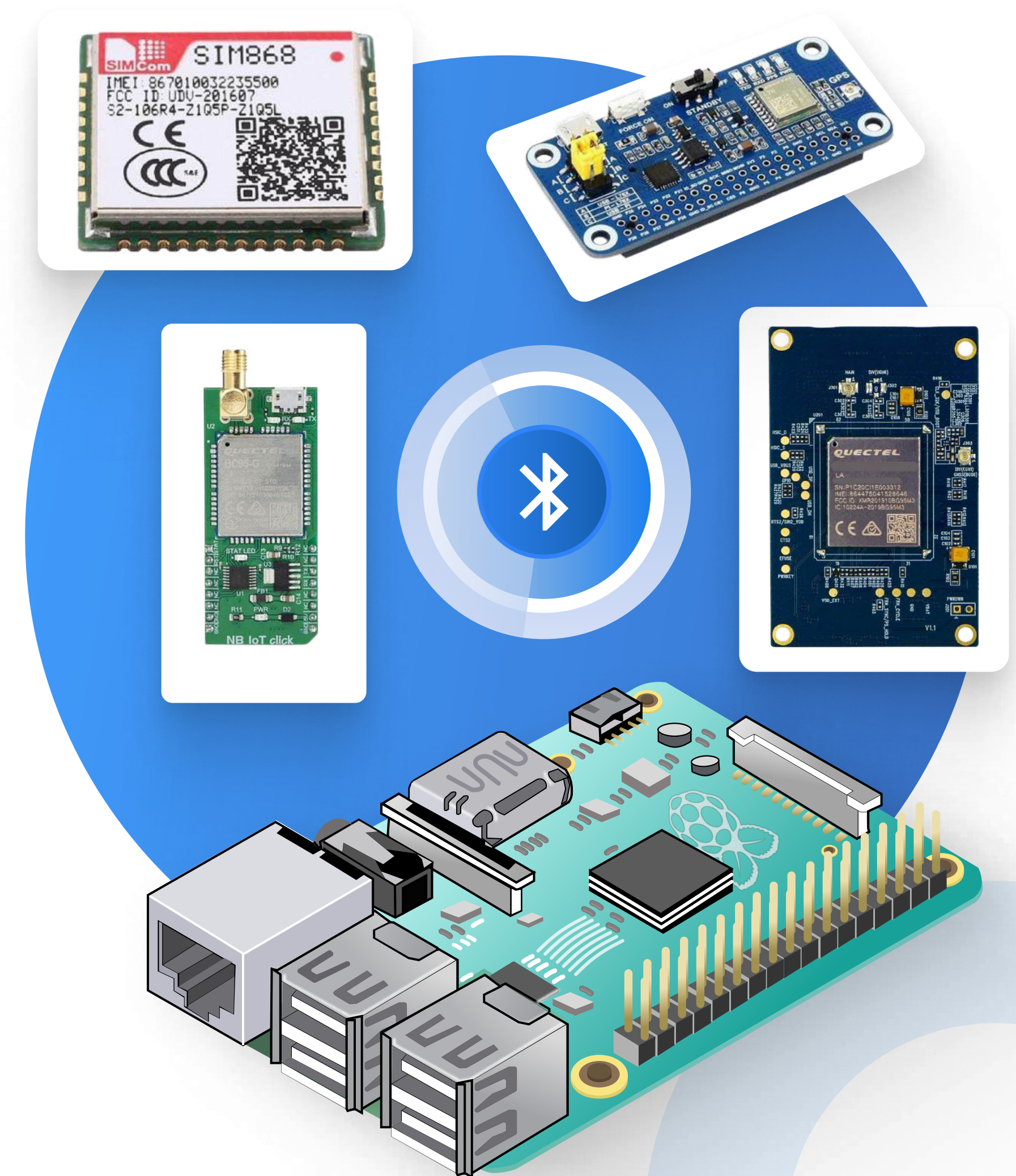
Single Board Computers (SBCs)

- Scripts (cron, python, bash)

- Applications (Node, Python)   • Kiosk modes

- Device monitoring and dashboards

- Cloud to device communication

- Captive portal for provisioning

- MQTT (local and cloud broker)

- Sockets (TCP, UDP)   • System programming

- Network priorities   • DMA

- SMI (Secondary Memory Interface)

- OBD (On-Board Diagnostics), CAN BUS

- RS232, RS485, Modbus
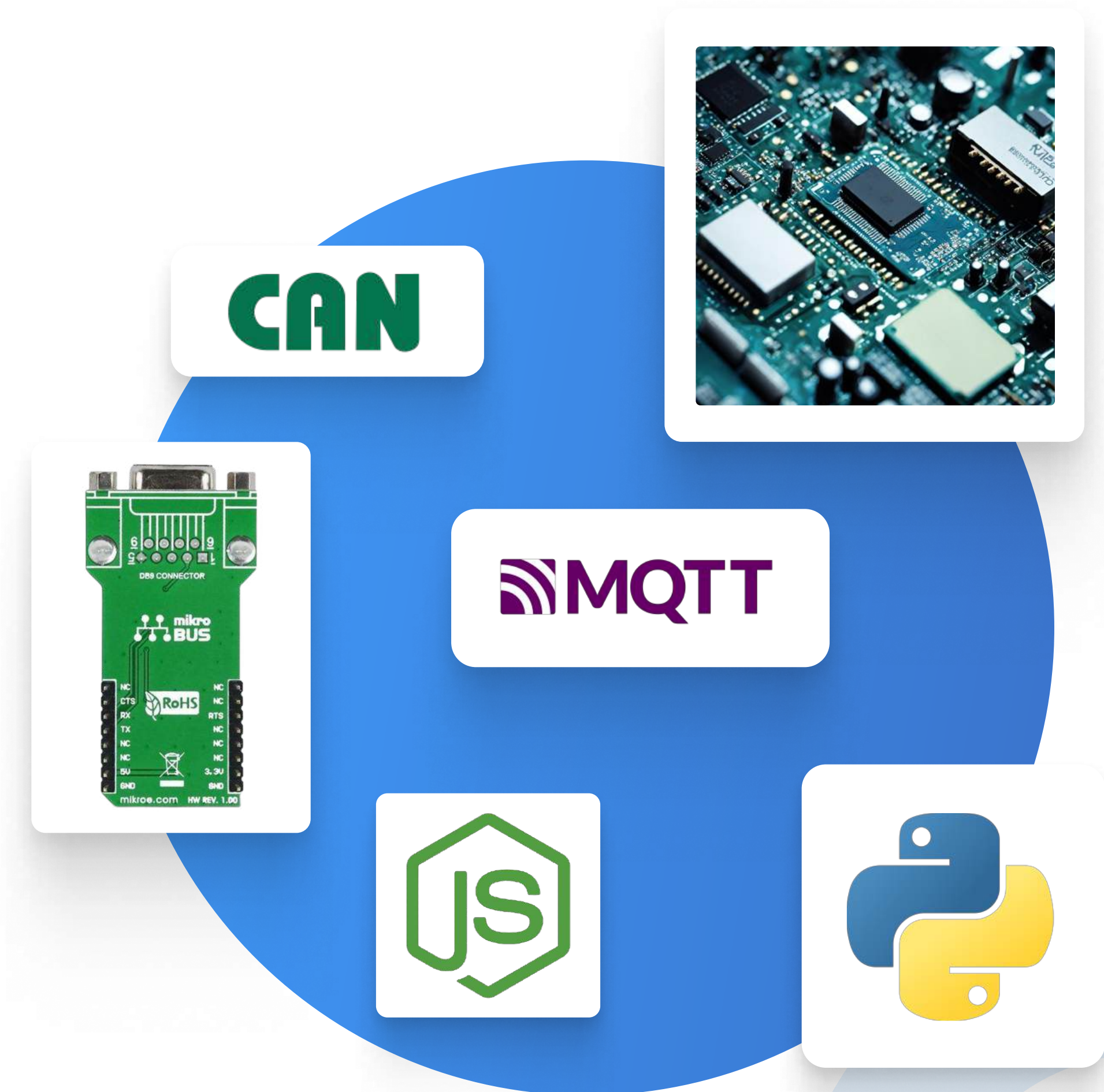
Cloud

- <u>AWS</u> (Greengrass, IoT Core, Thing, S3, DynamoDB, Kafka, MQ, Postgres, IAM, Amplify, SNS, SES, Lamda, Cloud Watch, Cognito)

- <u>Azure</u> (AD, IoT hub, Event hub, Stream Analytics, Blob storage, Cosmos db, Change feed, Signal R)

- <u>GCP</u> (firebase, authentication, firestore, storage, notifications, App engine, Compute engine, Reserved IPs)

Cloud

- <u>DigitalOcean</u>, GCP, AWS, Azure

- Fleet provisioning   • Fleet monitoring on maps

- Grafana dashboards   • Load balancers

- Nginx, gunicorn   • Cron jobs, System services

- Websockets   • <u>SQL (Postgre database)</u>

- X509 certificate security

- noSQL (Mongo, firestore, cosmos, dynamoDB)

- Timeseries database - Influx database
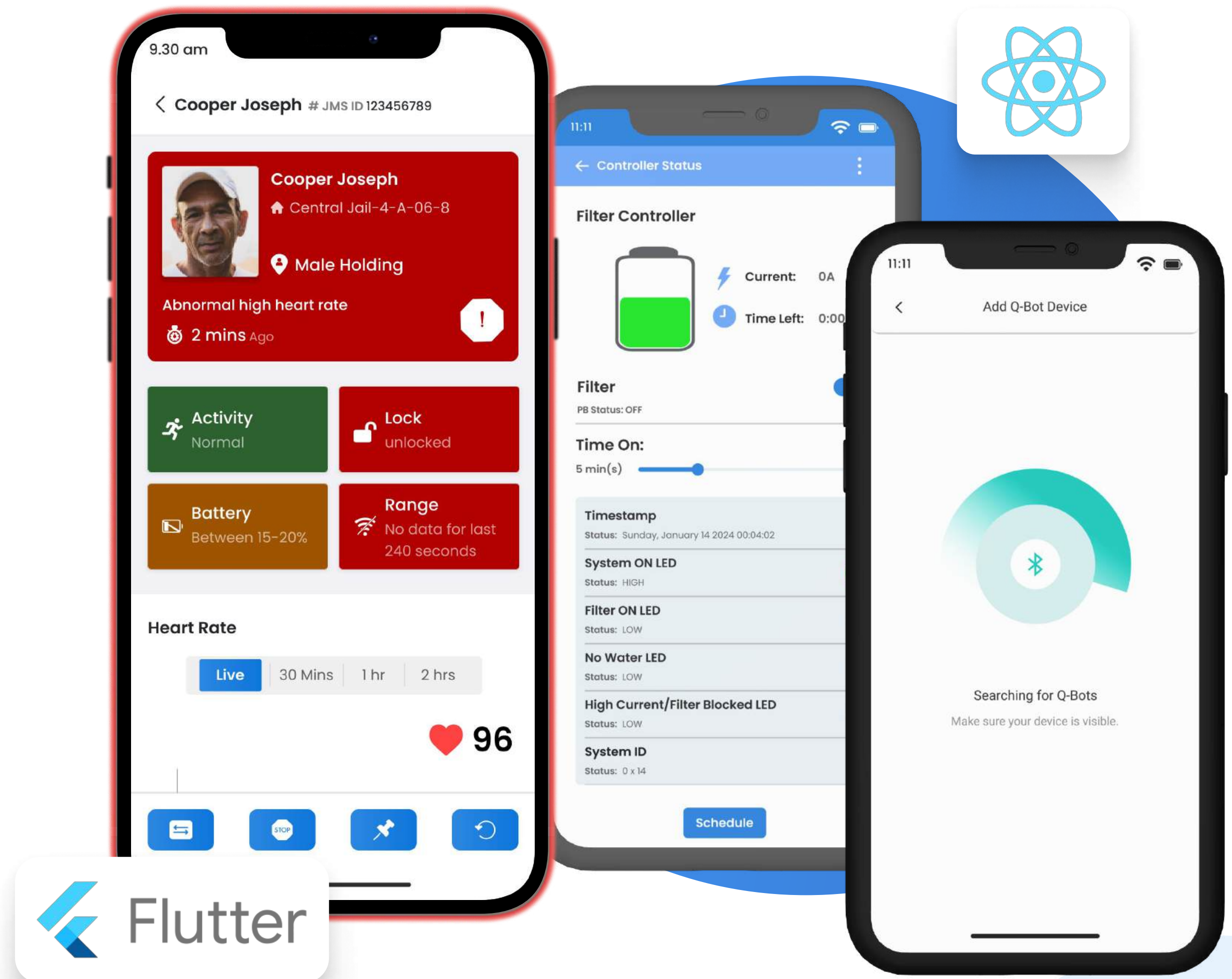
Smart Devices

- Matter

- Thread

- Smart Locks

- SmartThings

- Smart Water Valves

- Z-Wave protocols

- Samsung SmartThings

- Hub drivers

- Smart device capability and feature enhancements

Mobile Apps

- Frameworks (Flutter)

- Native Mobile apps

- Bluetooth Low Energy

- Media compressions and encoding

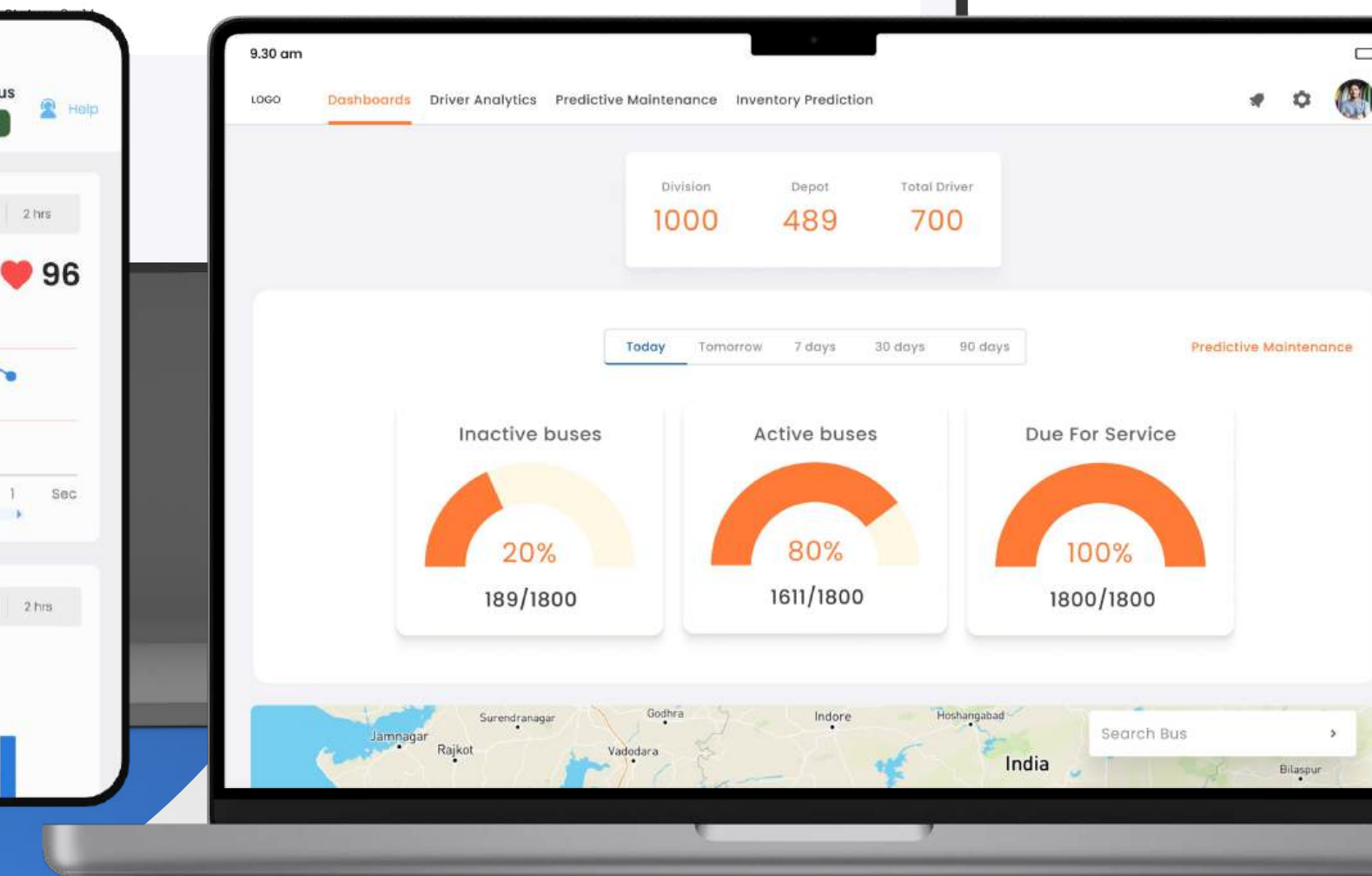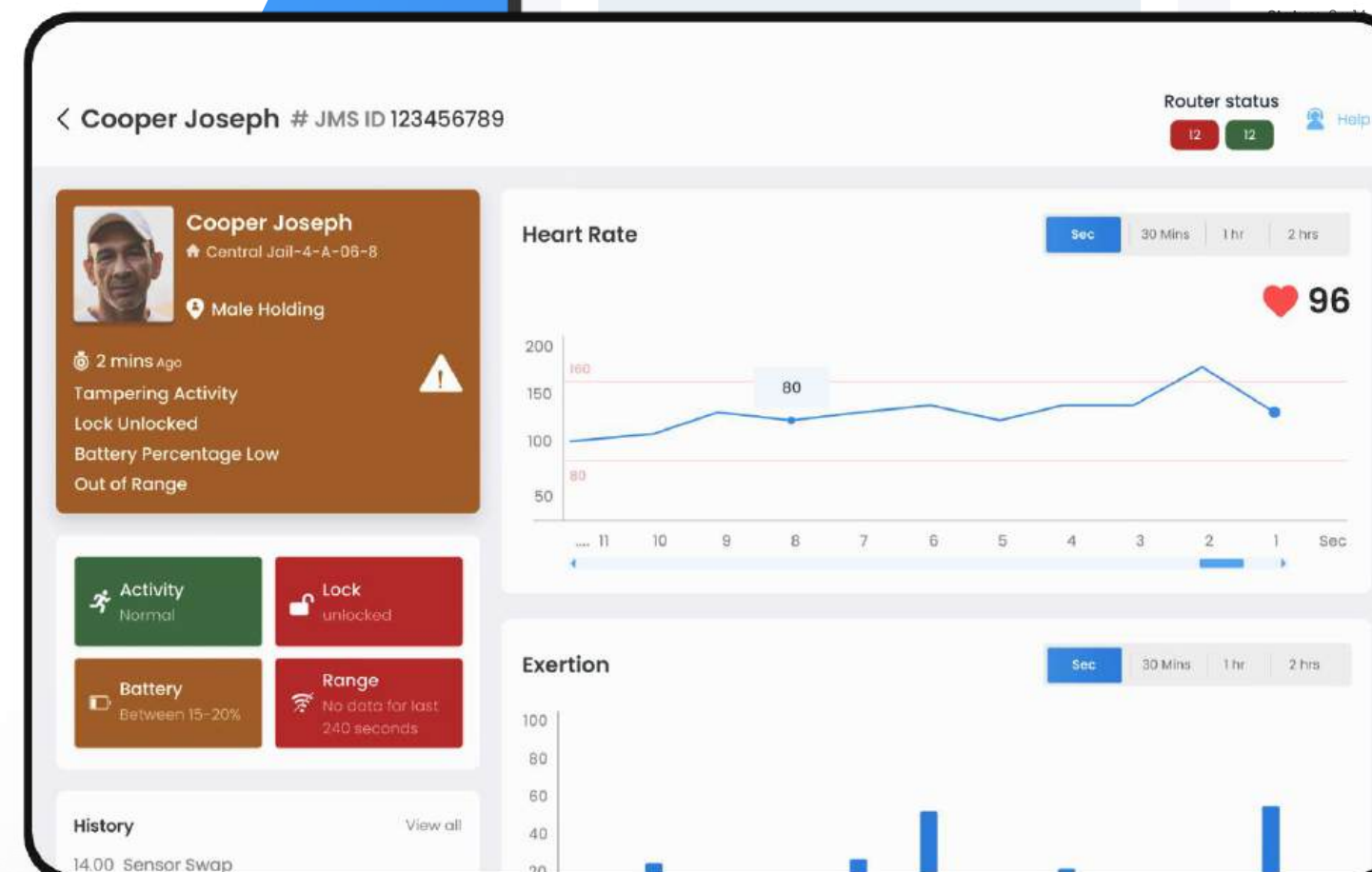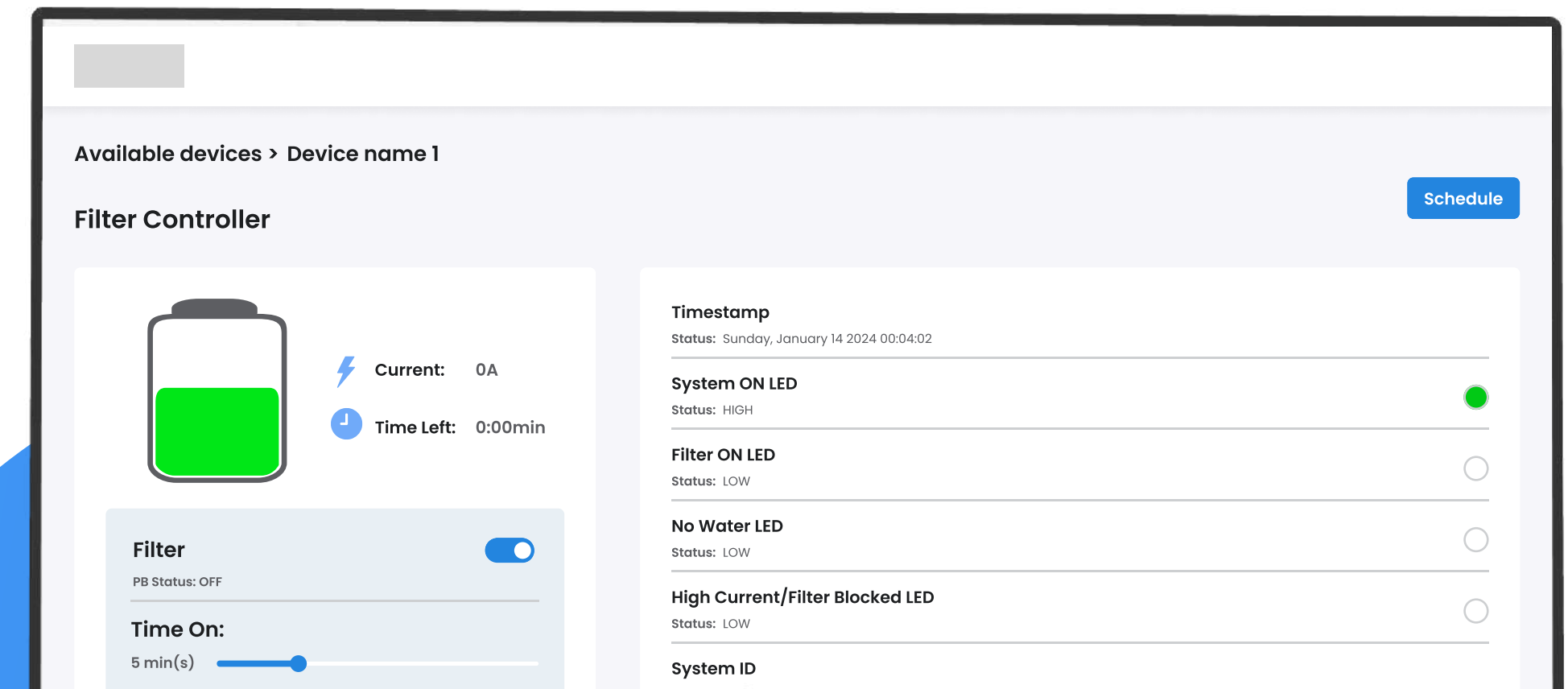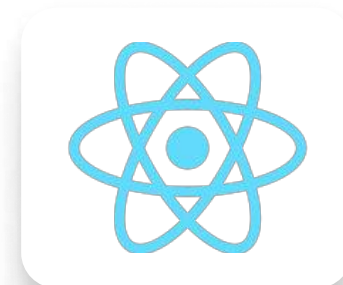Flutter

Backend

- <u>NodeJS</u>, ExpressJS

- Python/Flask/Django   • APIs

- Media compressions and encoding

- Authentication, authorization, roles

- ORMs (Prisma, Sequelize)

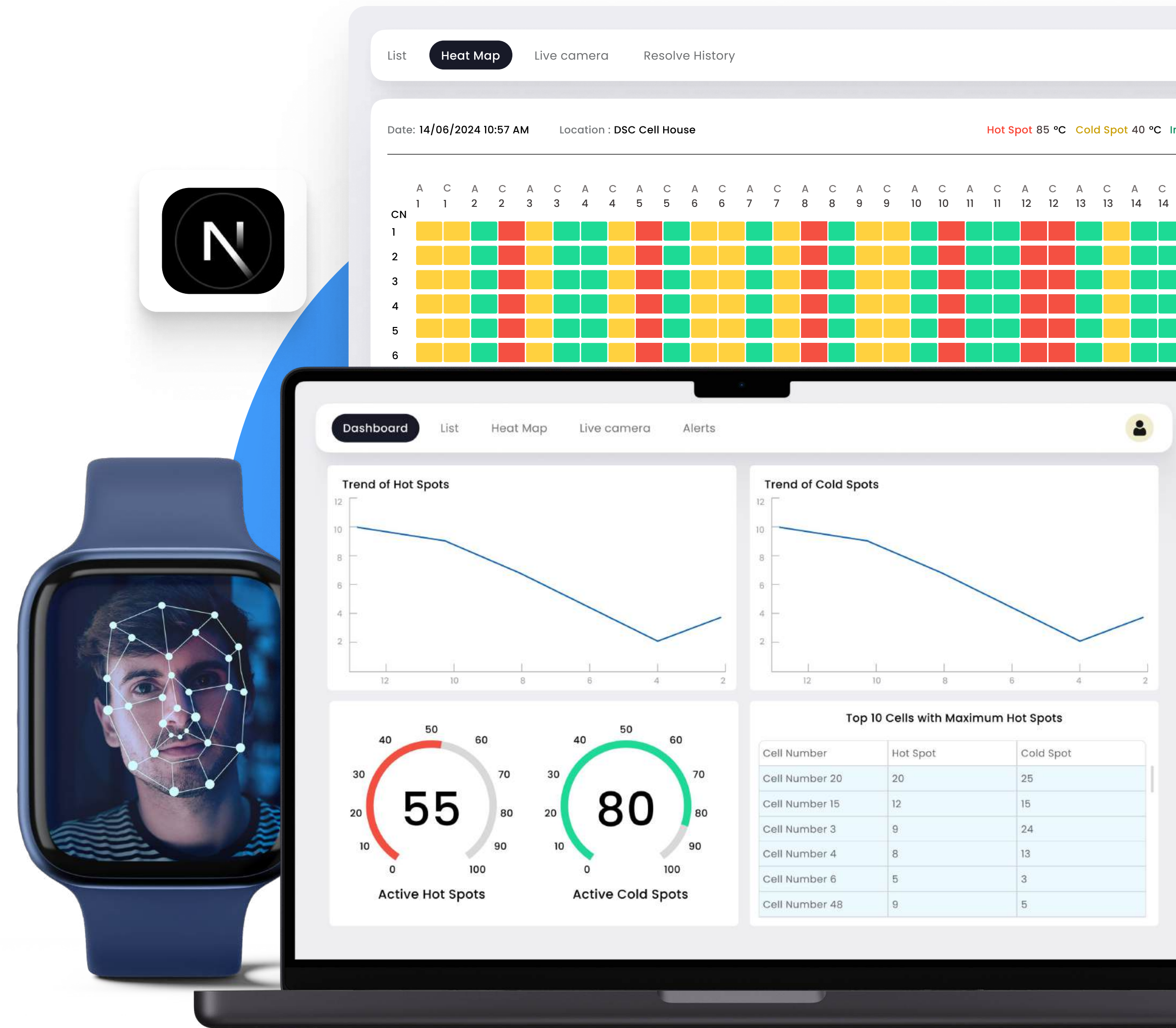- Websockets

- Swagger documentation

Web Apps

- <u>ReactJS</u>

- NextJS

AI/ML Skills and Models

- Pronunciation assessment (cognitive skills)

- Mobilenet   • FaceNet (SVM)

- VGGFace   • Yolo v3   • UNET   • <u>Python</u>

- <u>TensorFlow</u>, TF-Lite, HL5

- Transformer   • BERT   • LLM   • NLP

- Hotspot and Coldspot monitoring for Industrial IoT

Algorithms

- FFTs (Fast fourier transforms)

- PWM (Pulse wave modulations)

- DSP (Digital Signal Processings)

Initial Data

Refined Data
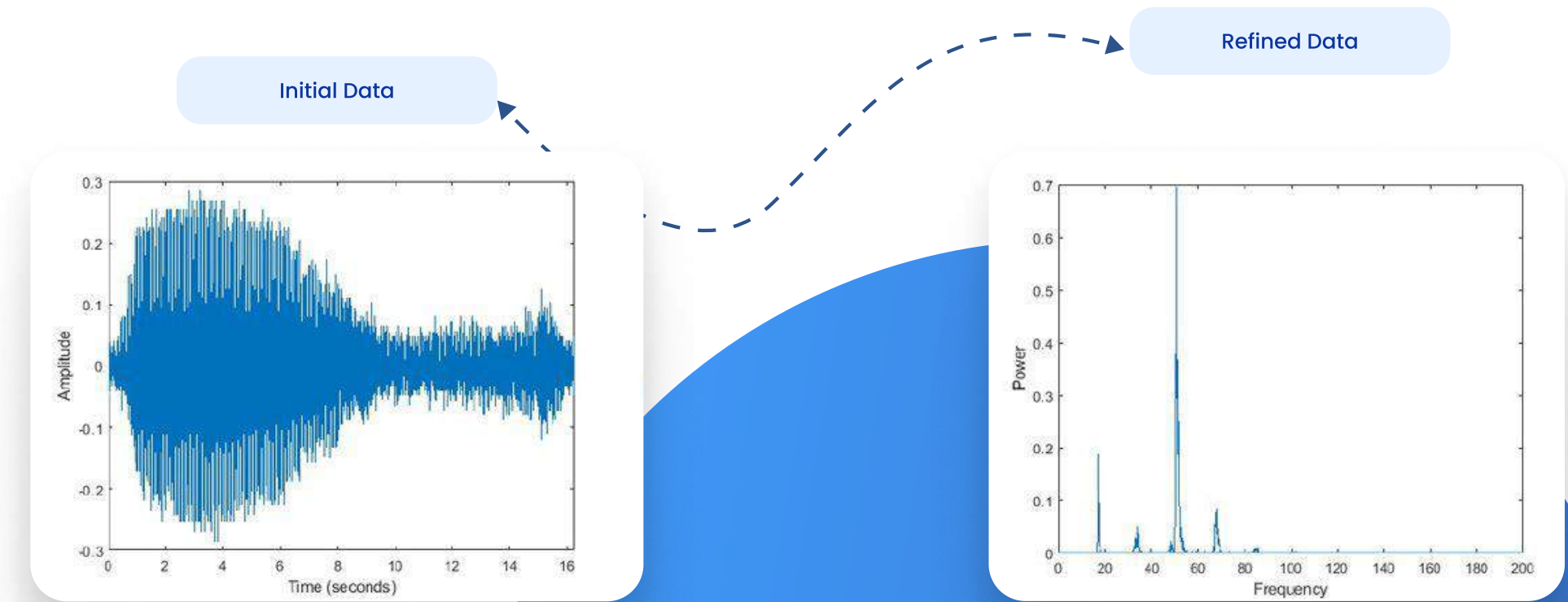
Solution sectors

- Healthcare
- Critical health monitoring

- Telematics
- Mobility

- Home Automation

- Restaurant Management

- Order/PoS Management

- Hospitality

UI/UX

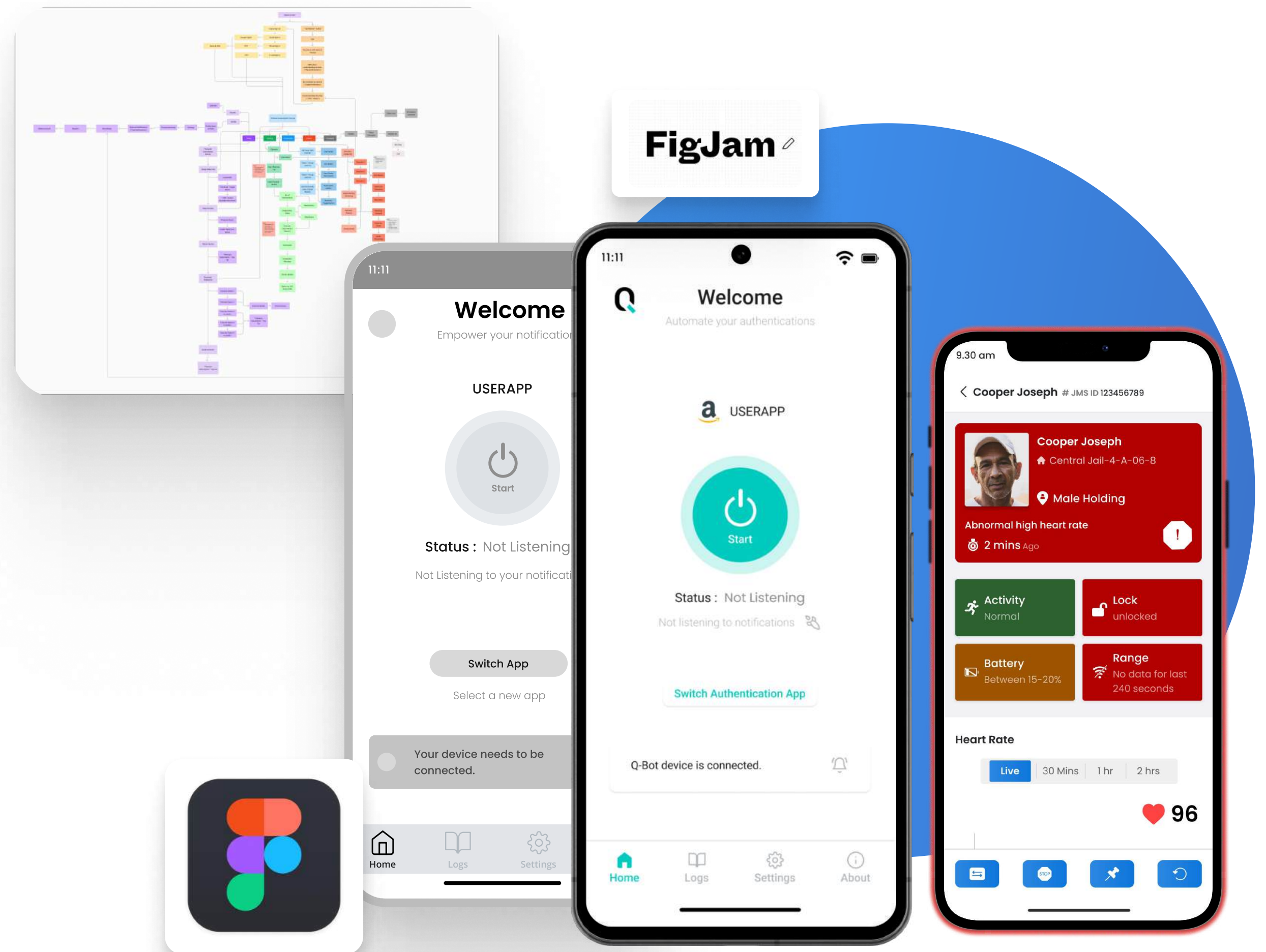- Information architecture

- Prototyping • Wireframes

- Low-fidelity, mid-fidelity, high-fidelity

FigJam ✎

Welcome
Empower your notification

USERAPP

⏻
Start

Status : Not Listening

Not Listening to your notification

Switch App

Select a new app

🔔 Your device needs to be connected.

🏠 Home   📖 Logs   ⚙️ Settings

Welcome
Automate your authentications

a USERAPP

⏻
Start

Status : Not Listening

Not listening to notifications 🛠

Switch Authentication App

Q-Bot device is connected. 🔔

🏠 Home   📖 Logs   ⚙️ Settings   ⓘ About

9.30 am

‹ Cooper Joseph # JMS ID 123456789

Cooper Joseph
🏠 Central Jail-4-A-06-8
📍 Male Holding

Abnormal high heart rate
⏱ 2 mins Ago   ⬡ !

🏃 Activity
Normal   🔒 Lock
unlocked

🔋 Battery
Between 15-20%   📶 Range
No data for last
240 seconds

Heart Rate

Live 30 Mins 1 hr 2 hrs

❤️ 96

QA

- <u>Selenium framework</u>

- <u>Appium mobile automation framework</u>

- Test engine   • Hybrid framework

- Behavior Driven Development (BDD)

- Test Driven Development (TDD)   • Pynt

- Newman   • Jest