



# Edge AI & IoT Hackathon Sprint

Building the Future of Embedded Intelligence

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## Hackathon Challenge Overview

### Main Goal

Develop a **modular Edge AI platform** on the Raspberry Pi that can **handle multiple real-world applications** — specifically:

- Smart Health Monitoring
- Smart Agriculture
- Smart Security & Surveillance

The aim is to design a **single flexible system** that can **run one or more of these use cases** depending on configuration, connected sensors, or operating mode — **without relying on LTE or cloud connectivity**.

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### Participation Options

Option	Description
<b>Integrated Platform (Recommended)</b>	Build one edge platform (hardware + software) that supports all three use cases, even if they operate separately. For example, the same Raspberry Pi setup can switch between “Health Mode,” “Agri Mode,” and “Security Mode” based on connected sensors or chosen code module.
<b>Focused Use Case</b>	Teams may choose to specialize in one use case — Health, Agriculture, or Security — and deliver a high-quality standalone prototype optimized for that domain.

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### Expected Architecture

- **Common Core:** Raspberry Pi as the edge computing unit for data acquisition, inference, and local control.

- **Modular Design:** Each use case is a separate module, container, or script that can run independently.
  - **Scalable Setup:** The same platform can handle any provided sensors or camera input with minimal reconfiguration.
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## Evaluation Focus

Judges will evaluate both **system-level scalability** (ability to support all three use cases) and **technical depth** (quality of implementation of at least one).

Criteria	Description
System Design	Scalability and modularity of the edge platform
Technical Completeness	Accuracy, functionality, and local performance
AI/IoT Integration	Quality of sensor data handling and inference
Code & Documentation	Clarity, structure, and reproducibility
Creativity & Innovation	Novel approaches, features, or optimizations

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## Use Case 1: Smart Health Monitoring Node

**Theme:** Edge AI for Health & Wellbeing

**Objective:**

Develop an on-device system that measures and analyzes real-time heart rate and pulse data directly on the edge device. Detect anomalies or stress indicators locally — without cloud or LTE dependency.

**Hardware Provided:**

- Raspberry Pi
- Heart rate sensor
- Pulse sensor

**Key Functions:**

- Acquire continuous heart rate and pulse data from sensors.
- Apply smoothing filters or AI-assisted anomaly detection.
- Trigger local alerts (LEDs, buzzers, GPIO output) for abnormal readings.
- Log all measurements locally (e.g., CSV or text file).

**Expected Output:**

A standalone edge node that performs local health signal processing and alerting, demonstrating how embedded AI can enable offline health monitoring.

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## Use Case 2: Smart Agriculture Node

**Theme:** Edge AI for Sustainable Farming

**Objective:**

Design a self-contained soil monitoring station that operates offline, using sensor data and basic AI logic to help farmers make real-time irrigation and fertilization decisions.

**Hardware Provided:**

- Raspberry Pi
- Soil moisture sensor
- Soil pH sensor
- (Optional) Temperature or humidity sensor

**Key Functions:**

- Collect and process sensor data at the edge.
- Detect anomalies or classify soil states (e.g., “Too Dry,” “Too Acidic,” “Optimal”).
- Trigger GPIO outputs (e.g., LED or relay) to simulate irrigation control.
- Store time-stamped data locally for trend analysis.

**Expected Output:**

An edge-based soil sensing system that autonomously interprets soil health conditions and reacts locally, with no internet connection required.



## Use Case 3: Smart Security & Surveillance Node

**Theme:** Edge AI for Safety & Security

**Objective:**

Create a lightweight AI-powered vision system that can detect people or motion locally using edge computing — suitable for remote or off-grid areas.

**Hardware Provided:**

- Raspberry Pi
- USB or CSI camera module
- (Optional) Hailo-8 AI accelerator

**Key Functions:**

- Capture live video feed.
- Run on-device object/person detection using models like YOLOv8n or MobileNet.
- Trigger local GPIO alarms or LEDs upon detection.
- Save short clips or snapshots locally for event review.

**Expected Output:**

A functional edge AI vision node capable of recognizing human activity and responding instantly — without any cloud inference, ensuring privacy and ultra-low latency.