

Technical Design Round – Mechatronics Engineer

Title: *IoT Sensor Enclosure & Data Simulation Prototype*

Context: This assessment is meant to gauge your comfort working with embedded system projects that require a multidisciplinary approach across various engineering fields which include mechanical engineering, computer science, and electrical engineering.

Scenario

Orbtronics is developing a field-deployable environmental sensor unit for agriculture clients. The final product will measure temperature and humidity in real time, store the data in the cloud, and allow viewing from a simple dashboard.

Your task is to design the enclosure for the device and simulate the basic IoT data flow.

Part 1 – CAD Design Task

Requirements

- Design a **weather-resistant enclosure** (target IP54+) to house:
 - **Electronics:**
 - Raspberry Pi Zero W (65mm × 30mm × 5mm) *or* Arduino Nano (45mm × 18mm × 7mm) – choose one and state choice
 - DHT22 temperature/humidity sensor module (28mm × 12mm × 10mm sensor head)
 - Small LiPo battery (60mm × 30mm × 10mm)
 - Cable entry (with strain relief)
 - Mounting method (e.g., wall mount or pole clamp)

This should not be high fidelity, this should only take you 3 -4 hours.

Deliverables

1. **3D CAD model** (STEP, STL, or native format – SolidWorks/Fusion 360/Onshape or similar)
2. **Simulate** either **computational or analytically (hand calculations)** one loading case for that this device may experience and determine its point of failure

3. **Technical drawing** with dimensions, material choice, assembly notes

4. **Short design note** (1–2 paragraphs) on:

- How the design is manufacturable (3D print, CNC, injection molding). Justify the manufacturing choice
 - How would you mass manufacture this part?
 - How can maintenance be done in the field?
-

Part 2 – IoT Simulation Task

Since you don't have physical hardware, simulate the device and data flow.

Requirements

- **Device Simulation** (Python script)
 - Simulates sensor readings for temperature (18–35°C) and humidity (40–80%)
 - Sends readings every 5–10 seconds to a backend API
 - Occasionally sends “abnormal” readings to test alerts
 - **Backend API** (FastAPI or Flask preferred)
 - Receives readings and stores them in memory (dict or SQLite)
 - Has endpoint for dashboard to fetch latest readings
 - Has endpoint to set alert thresholds
 - **Dashboard** (Simple HTML/JS or React)
 - Displays latest readings
 - Shows a red alert if readings exceed thresholds
 - Allows updating thresholds (sends to backend)
 - **Circuit** (TinkerCAD or similar)
 - Create a simple circuit diagram of what the circuit for this device might look like
-

Submission Deliverables

1. **CAD Folder** – Model + Technical drawing + Design note + Bill of Materials (Optional)
2. **Circuit Diagram**
3. **Code Folder** – Device simulation script, backend code, dashboard code
4. **README.md** – How to run the simulation, backend, and dashboard
5. **Short video demo** (max 3 min) showing:
 - Simulation running
 - Dashboard updating in real time
 - Alert triggering

Evaluation Criteria (100 pts)

Area	Points
CAD Functionality & Fit – fits components, meets brief	20
CAD Manufacturability & Design Quality	15
CAD Documentation & Detail	10
IoT Simulation Functionality – data flow works	20
Integration – clean link between simulated device, backend, dashboard	15
Code Quality – modular, readable, documented	10
Creativity & Innovation – useful extra features in design or code	5
README & Clarity	5

Timeframe

- **Take-home:** 7 days from receipt of Technical Design Round Acceptance Email