**Project Objective:**

Develop an edge-embedded monitoring system that collects equipment sensor data (temperature, vibration, etc.), processes it on the edge (microcontroller), runs ML-based fault prediction, visualizes insights in Power BI, and triggers automated alerts — all within an Agile Scrum framework ,ideal for manufacturing, automotive, or semiconductor equipment.

**Real-World Industry Use Cases & Companies(prompt engineering):**

| **Industry** | **Company Name** | **Use Case Scenario** |
| --- | --- | --- |
| Semiconductor | **Intel** | Smart equipment monitoring inside fabs using embedded systems + AI |
| Automotive | **Bosch**, **Continental** | Real-time diagnostics in ECUs for vibration, powertrain health, etc. |
| Industrial IoT | **Siemens**, **Honeywell** | Predictive maintenance with embedded edge devices (S7 PLC, Edge gateways) |
| Smart Factories | **Schneider Electric** | Embedded controllers + data science for factory automation |
| Robotics | **ABB**, **Fanuc** | Embedded health monitoring in robotic arms |

These companies build or use edge-based embedded systems to monitor equipment status, reduce downtime, and improve productivity using AI.

**Tech Stack for Project:**

| **Domain** | **Tools/Tech Used** |
| --- | --- |
| Embedded Systems | Arduino/Raspberry Pi + C++/Python |
| Data Science / ML | Jupyter Notebook, Pandas, Scikit-learn, NumPy |
| Visualization | Power BI |
| Automation | Microsoft Copilot Studio + Power Automate |
| Version Control | GitHub |
| Agile Management | Trello / Jira / Excel Sprint Board |

**Project Workflow:**

## **Agile Scrum Integration**

* Defining Scrum Team Roles

**2. Embedded Sensor Data Collection (generate csv file using python) and Data Processing**

* + Use real sensors (or simulated virtual platform) to collect data like temperature of motor , Vibration (acceleration patterns), Current flow or load ..
* Program Arduino/RPi to:
  + Read sensors periodically
  + Calculate RMS, FFT, or temperature trends
  + Send data via serial or write to CSV (simulated cloud sync)

**3. AI/ML on Edge or PC**

* Train ML model in Python (Jupyter):
  + Classify normal vs faulty patterns (SVM or RandomForest)
  + Save model outputs (failure predictions)

**4. Send Output to Power BI**

* Store prediction logs in Excel (OneDrive)
* Create dashboard with:
  + Motor health trend
  + Fault classification results
  + Sensor reading graphs

**5. Automation + Copilot**

* Trigger alert if predicted fault = TRUE
* Use Copilot Studio bot to ask:
  + “Which machine has high vibration today?”
  + “Show fault trend this week”

## **Agile Scrum Integration:**

### Scrum Team Roles:

| **Role** | **Responsibility** |
| --- | --- |
| Product Owner | Define backlog items (e.g., sensor features, dashboards, alert rules) |
| Scrum Master | Facilitate sprint ceremonies and remove blockers |
| Development Team | Implement embedded code, ML models, dashboards, and automations |

### Suggested Sprint Plan (4 Sprints – 1 Week Each):

| **Sprint** | **Deliverable** | **Key Backlog Items** |
| --- | --- | --- |
| 1 | Sensor Data Collection & Simulation | Python simulation, logging to CSV |
| 2 | Embedded Processing + ML Model | Feature extraction, fault classification in Jupyter |
| 3 | Power BI Dashboard & GitHub Repo | Dashboard, GitHub code + README |
| 4 | Copilot Bot + Power Automate Integration | Chatbot with questions + alert flow setup |

### 🔁 Agile Ceremonies in Project:

| **Ceremony** | **Description** |
| --- | --- |
| **Sprint Planning** | Decide which backlog items to tackle (e.g., temperature sensor script) |
| **Daily Stand-ups** | Short updates on what was done, what’s next, and blockers |
| **Sprint Review** | Demo progress (sensor working, ML model tested) |
| **Sprint Retrospective** | Reflect on what went well and what to improve (e.g., time estimation) |
| **Backlog Grooming** | Add or refine tasks (e.g., add battery health monitoring) |

**Power BI Dashboard Example Widgets: Power BI Dashboards**:

1. Machine status by zone
2. Vibration & temperature trend
3. Fault probability forecast
4. Uptime/Downtime % across sprints

## **Example Copilot Bot Questions:**

* “Which machine reported high vibration in the last 48 hours?”
* “Show me the predicted faults for this week.”
* “Summarize the current downtime status.”

**GitHub Folder with Agile Traceability:**

