Device Condition Monitor

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Tools & Technologies: C++, wxWidgets, Power BI, CSV

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1. Project Overview

Device Condition Monitor is a desktop application built in **C++ (wxWidgets)** that collects and logs device condition and usage metrics. The project demonstrates an end-to-end workflow — from **data collection in a C++ UI** to **data visualization in Power BI**, aligning with Siemens Energy's focus on **data-driven grid technology solutions**.

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2. Objectives

Objective	Description
Build a **C++ application with UI**	Collect device and operator data with proper validation.
Collect **usage metrics**	Record device conditions, operator actions, and performance indicators.
Store **structured data**	Save all inputs into a CSV file for easy data transfer.
Create a **Power BI dashboard**	Present collected data visually to identify trends and insights.
Document **design & decisions**	Explain architecture and reasoning for implementation choices.

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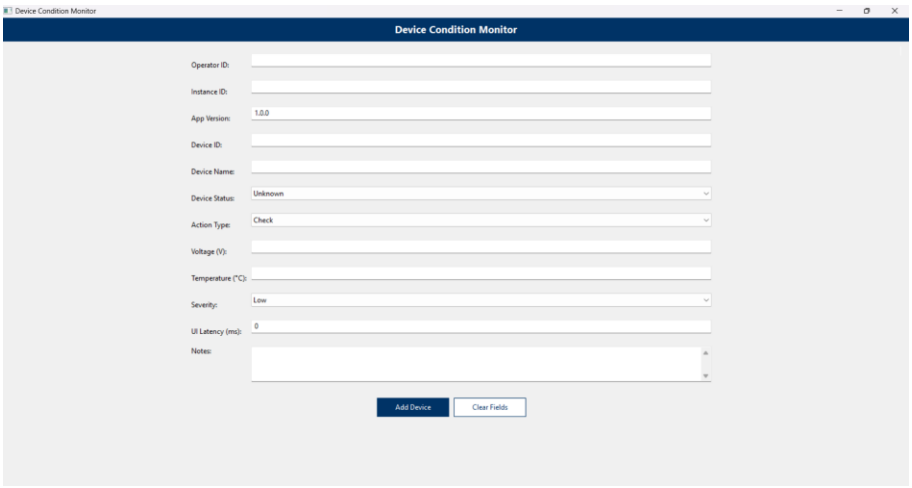
3. System Architecture

Device Condition Monitor (C++ App):

- wxWidgets-based GUI
- User fills form → generates UUID + timestamp
- Validates data & appends record to devices.csv

Power BI Dashboard:

- Reads devices.csv as data source
- Displays KPIs and charts
- Visualizes device health, actions & performance



4. Data Model (CSV Schema)

Column	Data Type	Example
uuid	string (UUID v4)	6b8f5a10-2a3b-4cdf-8f0e-7d0c5a1a2b3c
created_at	datetime (ISO8601)	2025-11-05T13:51:30Z
operator_id	string	Vaishnavi_M
instance_id	string	host-01
app_version	string	v1.0.0
device_id	string	TR-101
device_name	string	Transformer A
status	string	Online
action_type	string	Maintenance
voltage	float	229.8
temperature	float	67.4
severity	string	Warning
ui_latency_ms	integer	135
notes	string	Manual breaker open after overvoltage.

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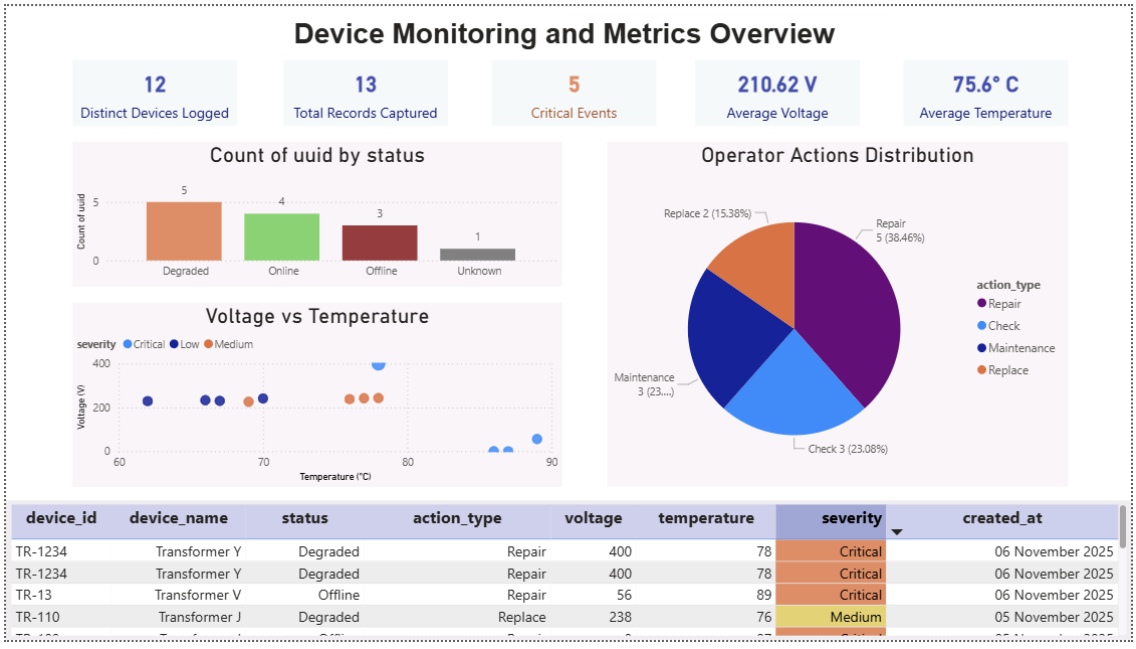
7. Power BI Dashboard Design

Dashboard Preview



7.1 KPIs (Top Section)

KPI	Measure	Description
Distinct Devices Logged	DISTINCTCOUNT(devices[device_id])	Total unique devices captured
Total Records Captured	COUNTROWS(devices)	Total log entries
Critical Events	COUNTROWS(FILTER(devices, LOWER(devices[severity])="critical"))	Number of critical records
Average Voltage (V)	AVERAGE(devices[voltage])	Mean voltage reading
Average Temperature (°C)	AVERAGE(devices[temperature])	Mean temperature reading

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7.2 Charts (Middle Section)

Visual	Fields	Purpose
Bar Chart – Count of UUID by Status	X: status, Y: count(uuid)	Shows device health distribution
Pie Chart – Operator Actions Distribution	Legend: action_type, Values: count(uuid)	Displays distribution of user actions
Scatter Chart – Voltage vs Temperature	X: temperature, Y: voltage, Legend: severity	Shows device behavior and potential overheating patterns

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7.3 Table (Bottom Section)

Displays complete dataset for transparency and analysis.
Columns: device_id, device_name, status, action_type, voltage, temperature, severity, created_at

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8. Design Decisions

Decision Area	Choice	Reason
Framework	wxWidgets (C++)	Lightweight, easy native UI for prototype
Data Format	CSV	Human-readable, easily imported into Power BI
Visualization Tool	Power BI	Siemens-standard BI platform
Local Storage	File system	Simplifies proof of concept

Decision Area	Choice	Reason
UUIDs & Timestamps	Ensures event uniqueness	
Enum Fields	Prevent invalid entries	
Power BI Layout	Compact KPI + 3 charts + table	Clean and logical visualization structure

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12. Future Enhancements

Enhancement	Description
SQLite integration	Store metrics in a local lightweight database
REST API	Enable remote data upload
Auto-refresh dashboard	Connect Power BI to live data updates
Alert system	Highlight devices with high temperature or low voltage

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12. Summary

The *Device Condition Monitor* project demonstrates how a C++ desktop application can serve as a data source for analytical dashboards. It collects, structures, and visualizes operational metrics — bridging software engineering with data analytics. I believe this aligns with Siemens Energy's digitalization initiatives in **data-driven grid monitoring and performance optimization**.
