

Lab 12

From Sensor to Dashboard

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Overview:

Objective: Demonstrate a complete IIOT data flow from edge device to dashboard.

Components:

- **Edge Layer:** Raspberry Pi with Sense HAT (collects temperature, humidity, pressure, orientation)
- **Database Layer:** PostgreSQL (stores sensor data)
- **Visualization Layer:** Streamlit (real-time dashboard)

Goal: Enable real-time monitoring and data-driven insights from IIOT sensors.



System Architecture

LAYER 1: Edge (Raspberry Pi)

Raspberry Pi 4 + Sense HAT Collects sensor values.

- Temperature Sensor
- Humidity Sensor
- Barometric Pressure Sensor
- Gyroscope (Pitch, Roll, Yaw)

Data Ingestion to Database:

Data inserted into PostgreSQL database with timestamp using Python Script:

- Reads sensor values every 2 seconds
- Adds random variation to current sensor readings ($\pm 10^{\circ}\text{C}$, $\pm 10\%$, $\pm 15\text{hPa}$)

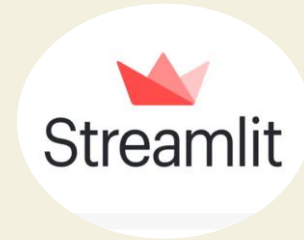
LAYER 2: Data storage (PostgreSQL)

- Schema: sensor_data
- Table: with 8 columns to store different sensors reading

LAYER 3: Visualization (Streamlit)

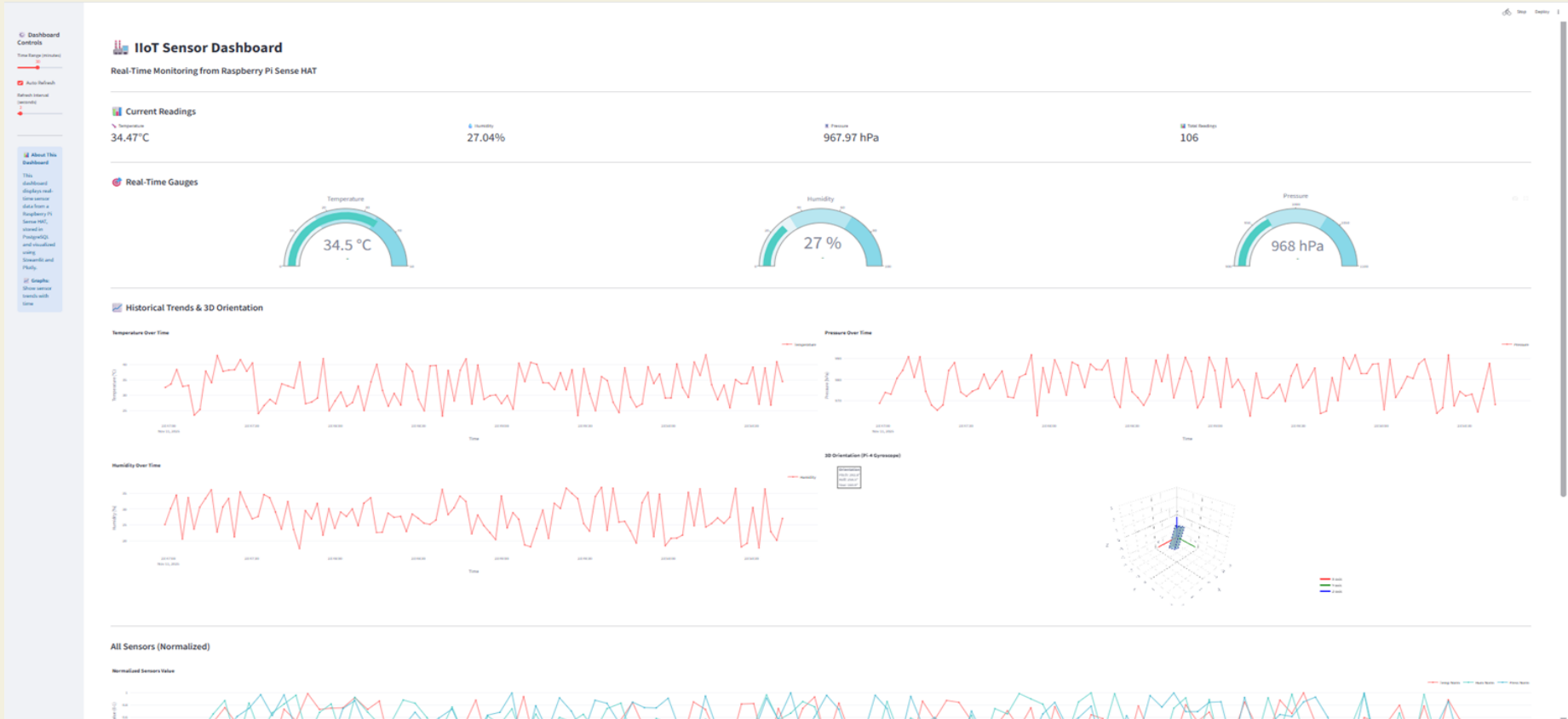
Python based Streamlit Dashboard uses SQL Queries for data retrieval & visualization of

- Real-time gauges
- Time-series line graphs
- 3D orientation
- Auto-refresh every 2 seconds



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Layer 3: Visualization



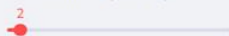
Dashboard Controls

Time Range (minutes)



☒ Auto Refresh

Refresh Interval (seconds)



About This Dashboard

This dashboard displays real-time sensor data from a Raspberry Pi Sense HAT, stored in PostgreSQL and visualized using Streamlit and Plotly.

Graphs: Show sensor trends with time



IIoT Sensor Dashboard

Real-Time Monitoring from Raspberry Pi Sense HAT



Current Readings

Temperature

27.74°C

Humidity

26.89%

Pressure

982.59 hPa

Total Readings

26



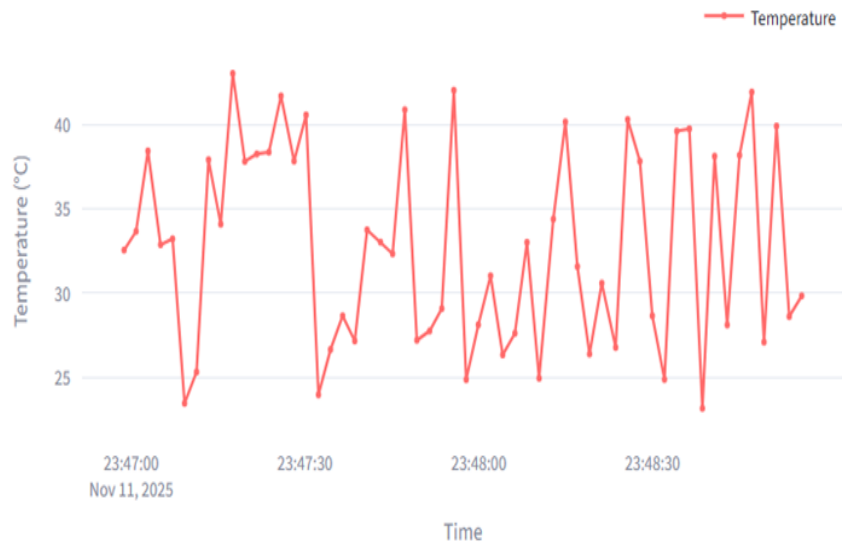
Real-Time Gauges



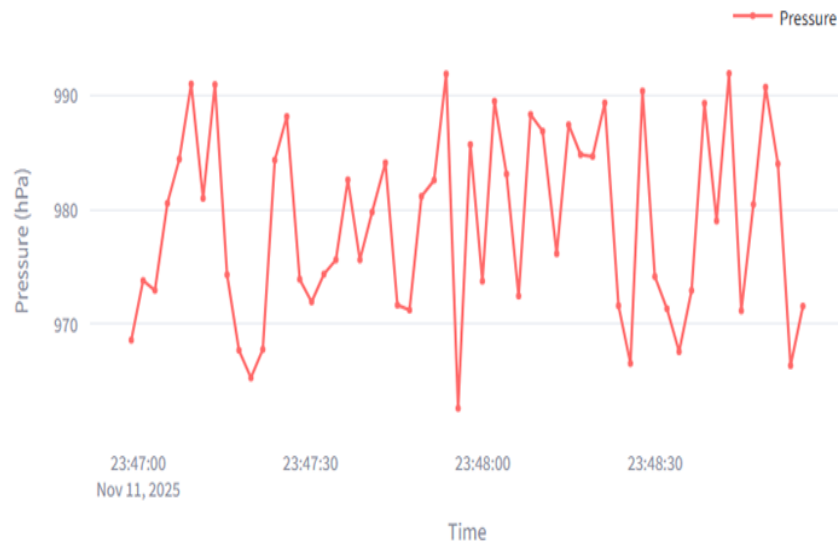
Historical Trends & 3D Orientation



Temperature Over Time



Pressure Over Time

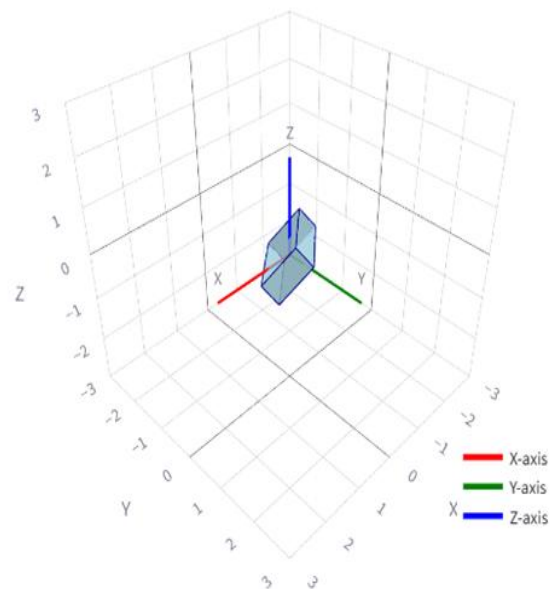


Humidity Over Time



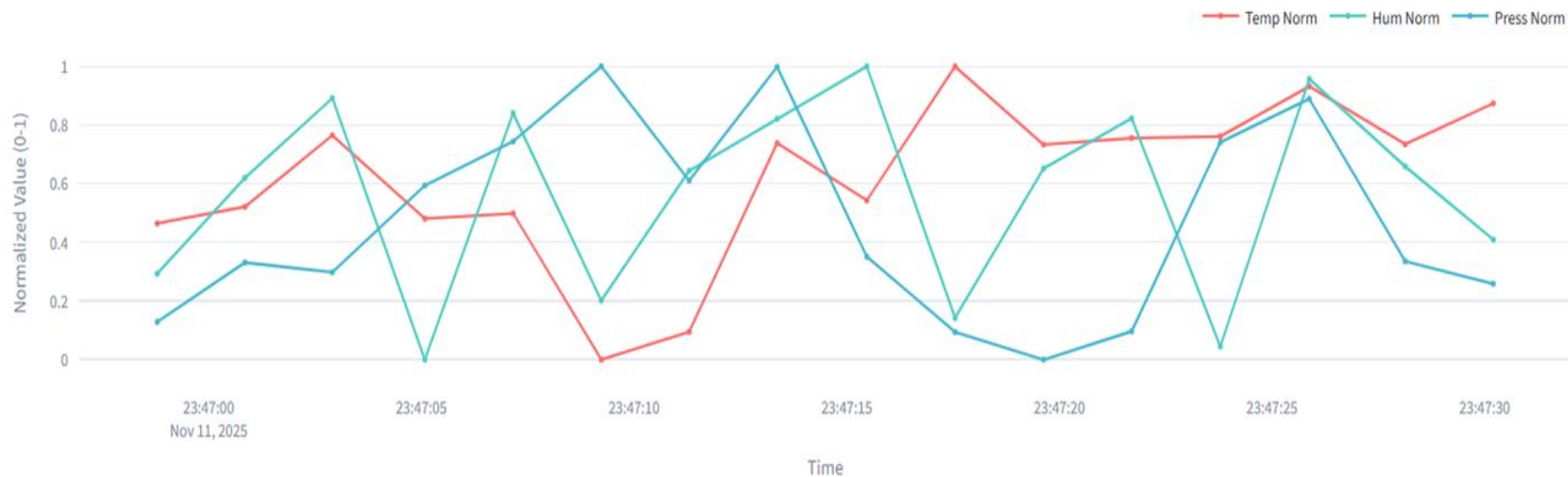
3D Orientation (Pi-4 Gyroscope)

Orientation
Pitch: 320.1°
Roll: 209.4°
Yaw: 301.3°



All Sensors (Normalized)

Normalized Sensors Value



▼  View Raw Data

	id	timestamp	temperature	humidity	pressure	pitch	roll	yaw
32	391	2025-11-11 23:48:06+00:00	27.6	30.09	972.46	311.56	122.42	283.09
33	392	2025-11-11 23:48:08+00:00	33.01	24.75	988.34	307.43	118.03	281.39
34	393	2025-11-11 23:48:10+00:00	24.93	31.88	986.88	303.44	113.8	279.98
35	394	2025-11-11 23:48:12+00:00	34.39	33.61	976.16	304.41	112.37	271.76
36	395	2025-11-11 23:48:14+00:00	40.17	22.58	987.44	305.88	110.4	264.89
37	396	2025-11-11 23:48:17+00:00	31.57	22.66	984.83	307.14	107.88	258.5
38	397	2025-11-11 23:48:19+00:00	26.37	28.73	984.67	308.27	104.22	252.84
39	398	2025-11-11 23:48:21+00:00	30.58	27.4	989.35	309.15	100.29	247.68
40	399	2025-11-11 23:48:23+00:00	26.76	27.7	971.61	309.34	96.28	242.59
41	400	2025-11-11 23:48:25+00:00	40.31	22.9	966.56	309.63	92.6	237.8

Thank you