IoT Temperature Sensor Data Collection and Dashboard Visualization

1. Introduction

The rapid development of Internet of Things (IoT) technologies has enabled real-time data collection and monitoring across various domains such as smart homes, healthcare, and industrial automation. One of the key tasks in IoT systems is the acquisition of sensor data, its storage, and visualization for monitoring and analysis purposes.

The aim of this work is to design and implement a simple IoT data collection system that simulates a temperature sensor, stores the collected data in a database, and visualizes it using a dashboard.

2. System Architecture

The developed system consists of three main components:

1. **IoT Sensor (Simulation)**
   A temperature sensor is simulated using Python. The sensor periodically generates temperature values within a predefined range.
2. **Database**
   The collected sensor data is stored in a SQLite database. Each record contains the temperature value and a timestamp.
3. **Visualization Dashboard**
   The stored data is retrieved from the database and visualized using Python's matplotlib library in the form of a time-series dashboard.

Architecture Flow:
Sensor → Database → Dashboard

3. Technologies Used

- **Python** — data generation, processing, and visualization
- **SQLite** — lightweight relational database for data storage
- **Matplotlib** — data visualization
- **Google Colab** — development and execution environment

4. Implementation

The system simulates an IoT temperature sensor by generating random temperature values between 20°C and 30°C at fixed time intervals. Each generated value is stored in a SQLite database along with the current timestamp.

After data collection, the database is queried, and the retrieved data is loaded into a pandas DataFrame. The temperature values are then visualized as a line chart, representing temperature changes over time.

This approach imitates a real IoT data pipeline, where sensor data is continuously collected, stored, and monitored.

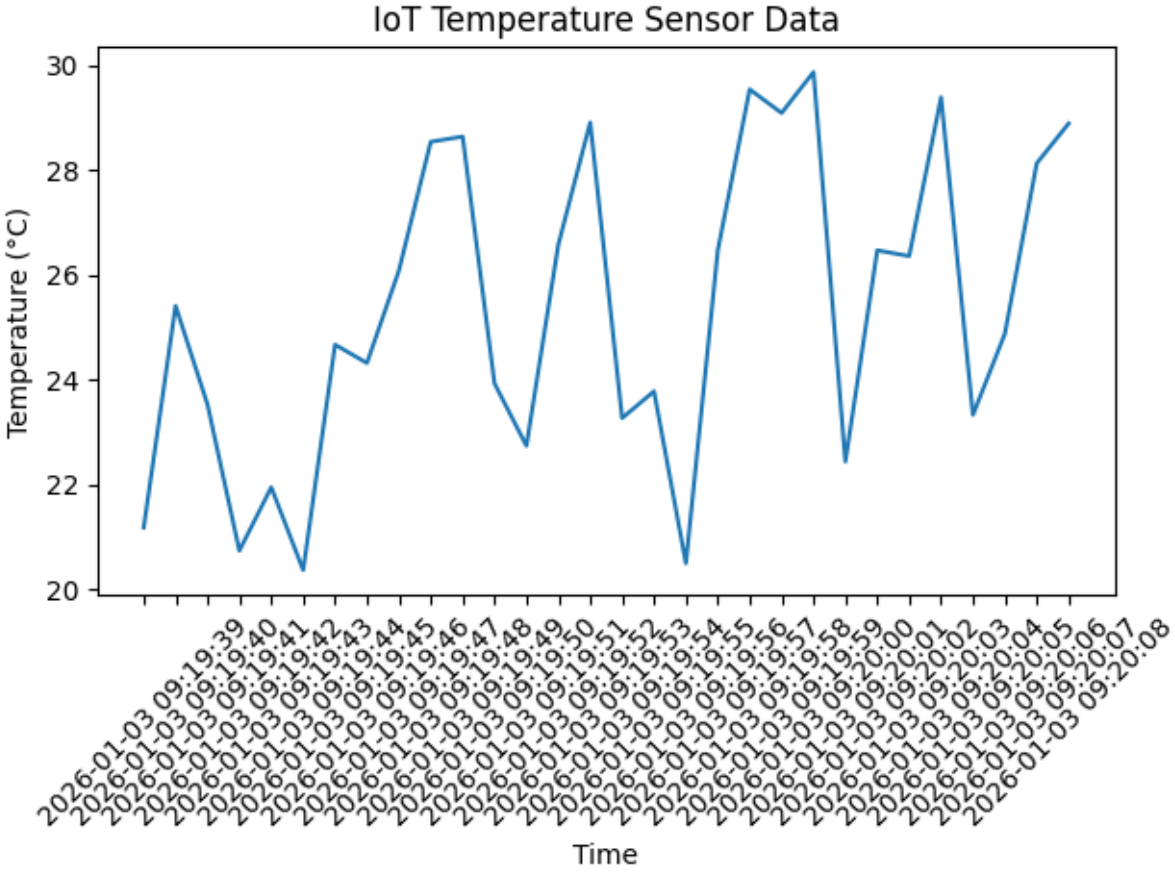
5. Results

As a result of the implementation:

- Sensor data was successfully generated and stored in the database.
- A dashboard was created showing temperature changes over time.
- The visualization allows monitoring of temperature trends in a clear and intuitive manner.

The dashboard output includes a line chart with labeled axes and timestamps, providing a real-time monitoring view of the simulated sensor data.

	id	value	timestamp
0	1	21.18	2026-01-03 09:19:39
1	2	25.41	2026-01-03 09:19:40
2	3	23.53	2026-01-03 09:19:41
3	4	20.74	2026-01-03 09:19:42
4	5	21.95	2026-01-03 09:19:43



6. Conclusion

This project demonstrates a basic IoT data collection and visualization system. The results confirm that Python can be effectively used to simulate IoT sensors, manage data storage, and build monitoring dashboards.

In future work, the system can be extended by integrating real IoT sensors, using MQTT or HTTP protocols, and applying advanced visualization tools such as Grafana or Power BI.