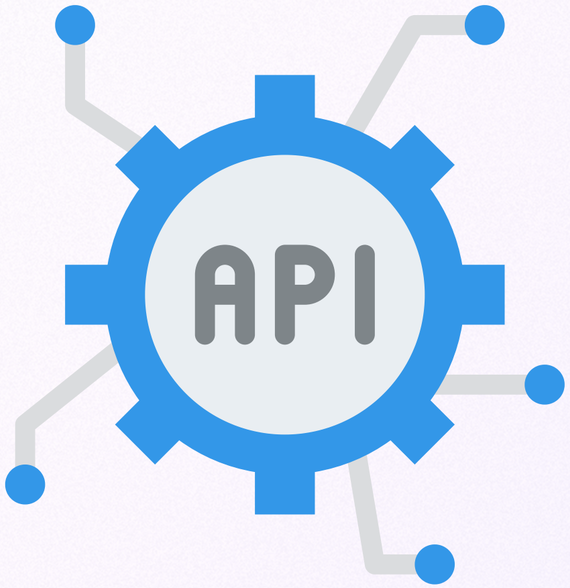
API Creation for IoT Platform

Development Process, Technology Stack, and Demonstration



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Presentor

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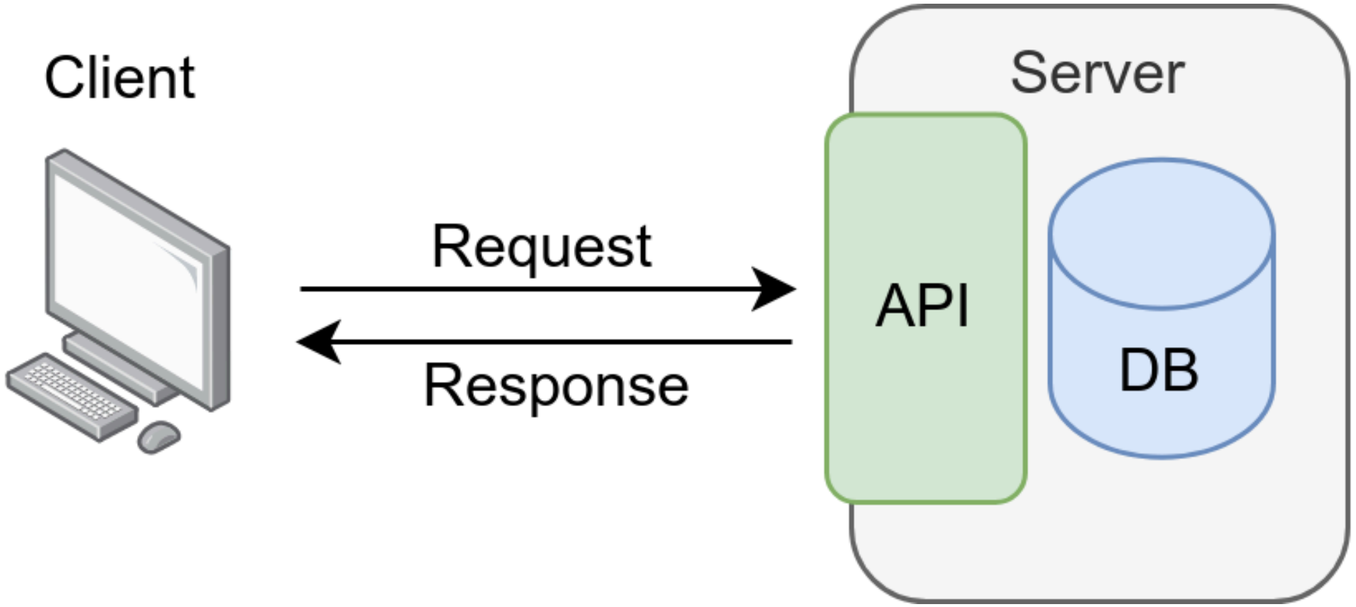
WHAT IS API

APIs are mechanisms that enable two software components to communicate with each other using a set of definitions and protocols.



Development Process

- **Planning:** Defined objectives for MQTT-based IoT platform and backend API requirements.
- **Design:** Created API architecture to handle device management, data storage, and visualization.
- **Implementation:** Developed APIs using FastAPI for efficiency and scalability.
- **Testing:** Conducted unit and integration tests for reliability.
- **Deployment:** Deployed using Docker for containerization and ensured scalability.

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Technology Stack Summary

Component	Technology Used
Programming Language	Python
Backend Framework	FastAPI
Frontend Framework	Streamlit, React
Database	MongoDB
MQTT Broker	Mosquitto
Authentication	JWT for secure token-based authentication
Data Visualization	Recharts, Plotly

Core Features:

1. **Device Management:**
   - Add, update, or delete IoT devices
   - Assign devices to users and roles
2. **Data Storage:**
   - Store incoming MQTT data in MongoDB/InfluxDB
   - Enable efficient time-series queries
3. **Visualization:**
   - Fetch processed data for charting and analysis on the frontend
4. **User Authentication:**
   - Secure endpoints with JWT tokens

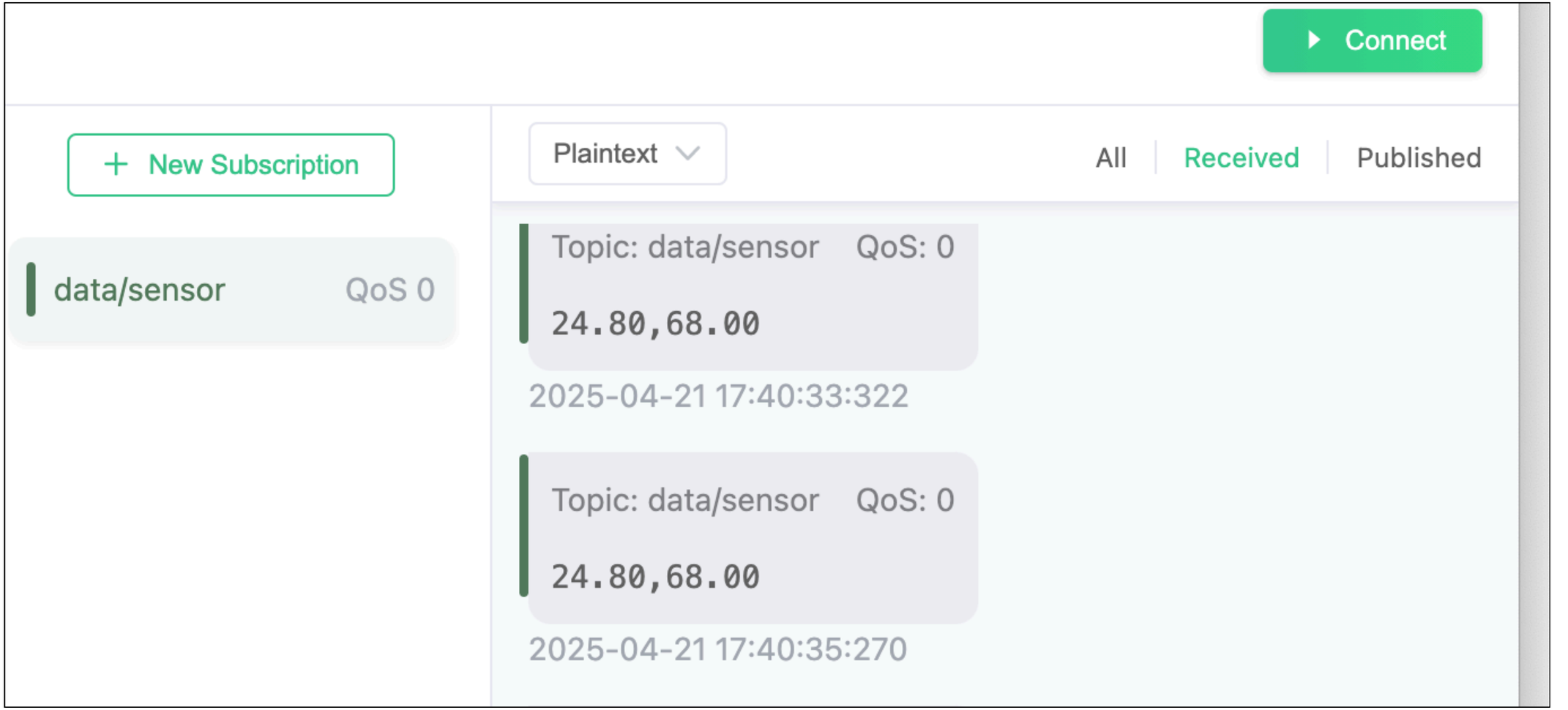
How it works?

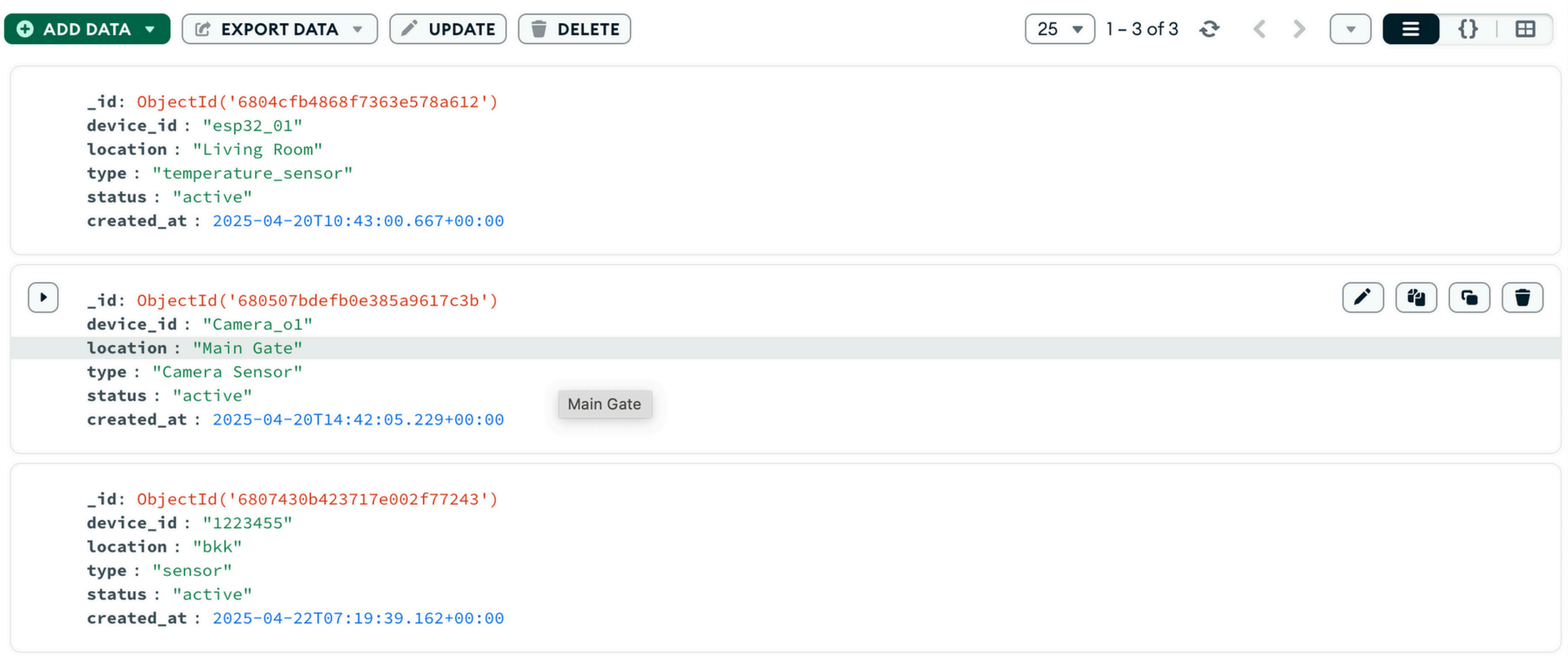
Device Data Flow:
Devices publish data to the MQTT broker
MQTT broker forwards data to FastAPI for processing

Data Storage Process:
FastAPI receives and validates the data
Stores structured data in MongoDB and time-series data in InfluxDB

Data Retrieval for Visualization:
User requests processed data via FastAPI endpoints
API aggregates and serves data for frontend charts

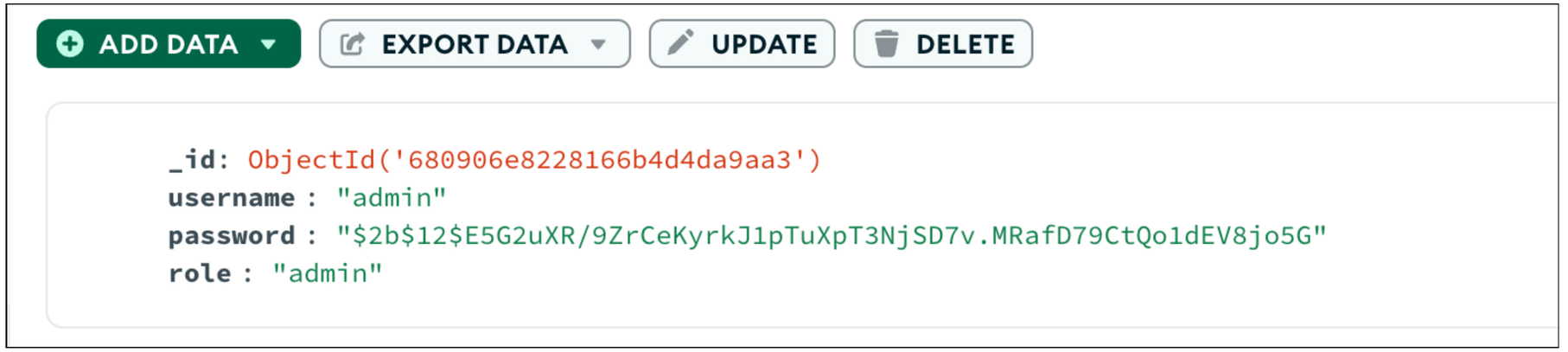
Secure Operations:
Role-based access ensures only authorized users access sensitive endpoints


Connect
New Subscription
Plaintext
All
Received
Published
data/sensor
QoS 0
Topic: data/sensor QoS: 0
24.80,68.00
2025-04-21 17:40:33:322
Topic: data/sensor QoS: 0
24.80,68.00
2025-04-21 17:40:35:270

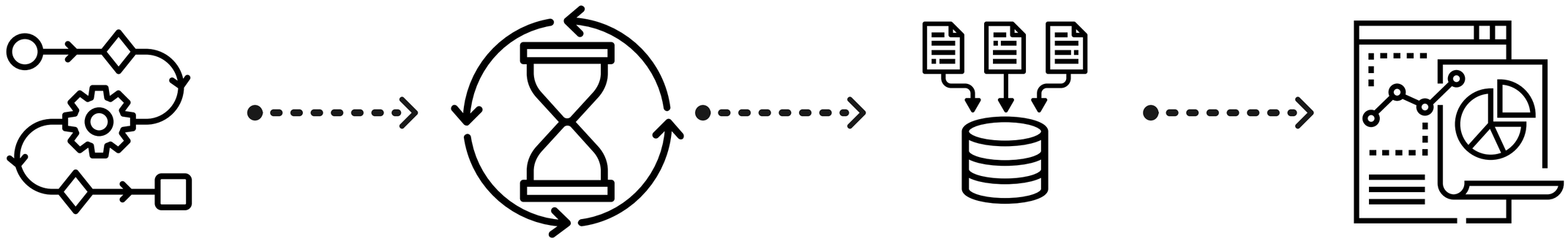

ADD DATA
EXPORT DATA
UPDATE
DELETE
25
1 – 3 of 3
_id: ObjectId('6804cfb4868f7363e578a612')
device_id : "esp32_01"
location : "Living Room"
type : "temperature_sensor"
status : "active"
created_at : 2025-04-20T10:43:00.667+00:00
_id: ObjectId('680507bdefb0e385a9617c3b')
device_id : "Camera_o1"
location : "Main Gate"
type : "Camera Sensor"
status : "active"
created_at : 2025-04-20T14:42:05.229+00:00
Main Gate
_id: ObjectId('6807430b423717e002f77243')
device_id : "1223455"
location : "bkk"
type : "sensor"
status : "active"
created_at : 2025-04-22T07:19:39.162+00:00

```python
def initialize_admin():
    admin_username = "admin"
    admin_password = "admin123"
    hashed_password = bcrypt.hash(admin_password)


    if not db["users"].find_one({"username": admin_username}):
        db["users"].insert_one({
            "username": admin_username,
            "password": hashed_password,
            "role": "admin"
        })
```



EXAMPLE WORK FLOW



1 - API Request

Client sends a request to the /add_device endpoint with device details.

2 - Processing

FastAPI validates the request, updates the database, and confirms the operation.

3 - Real Time Data

Devices publish live data via MQTT, stored via API to databases.

4 -Visualization

Frontend fetches real-time data through APIs to generate dashboards.

Conclusion

- API is the backbone of the IoT platform, enabling device interaction and data handling.
- Scalable architecture ensures future-proofing for additional features.
- Demonstrated a robust integration of MQTT, FastAPI, and databases.

THANK YOU