IoT-Powered Wildlife Habitat Monitoring

Real-time Environmental Monitoring and Management Using IoT

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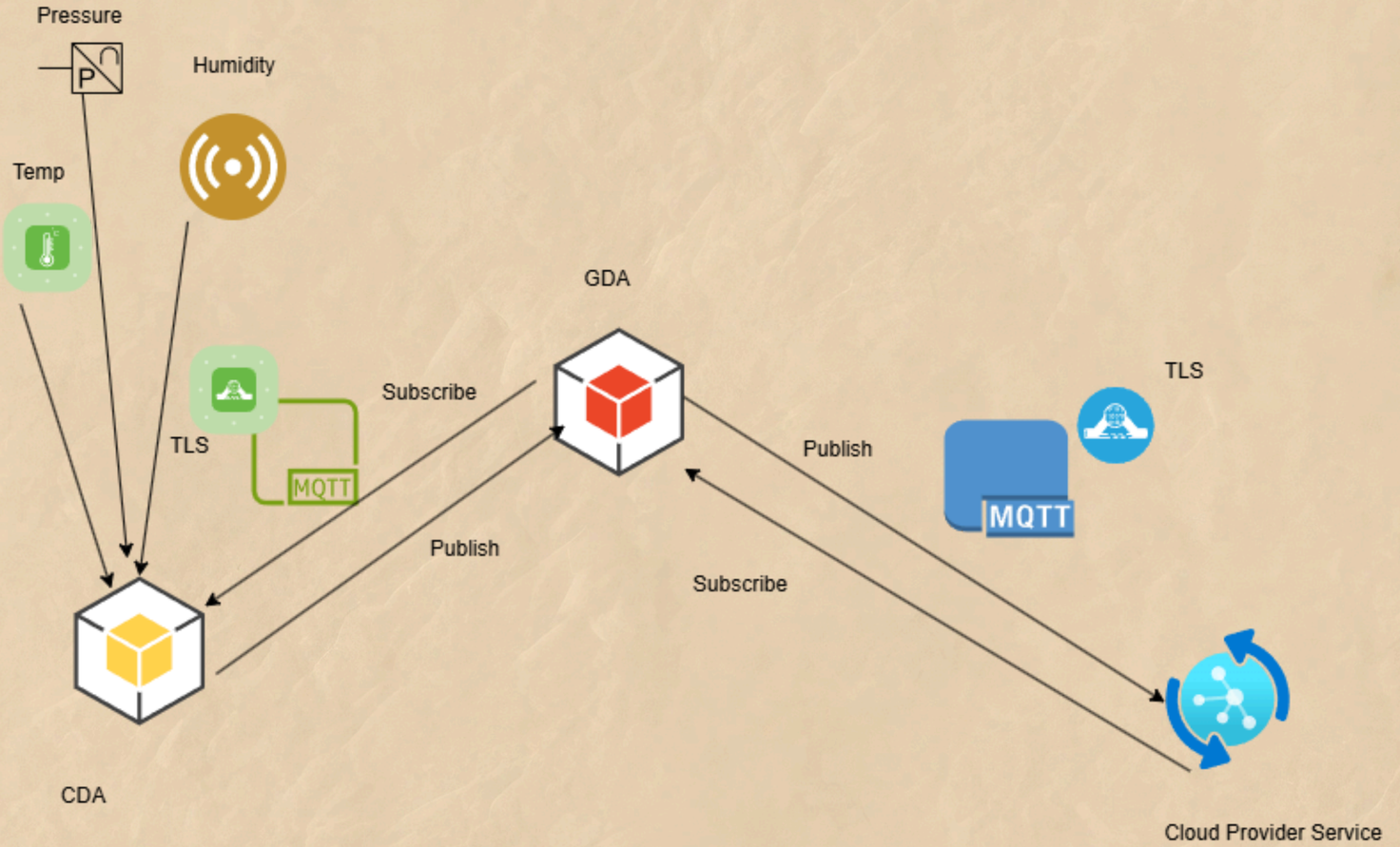
Introduction

This project aims to monitor and manage wildlife habitats using an innovative IoT-based system. By deploying sensors to track environmental conditions like temperature, humidity, and pressure, and actuators to control devices like LEDs and sprinklers, this system ensures real-time visibility and control of habitat conditions.

Key Challenges Addressed by the Solution

- Protecting endangered species by maintaining optimal habitat conditions.
- Providing real-time alerts for potential threats like extreme weather or fires.
- Enabling conservationists to make data-driven decisions for habitat management.

System Architecture



Implementation Details

Simulated Data Generation: Constrained Device Application (CDA)

- Sensor data, such as temperature, humidity, and pressure, is simulated using Python scripts to mimic real-world sensor outputs.
- Includes realistic variations and anomalies to replicate actual environmental conditions.

Role of Simulated Sensors

- Temperature, Humidity, Pressure: Enables real-time monitoring of habitat conditions.
- Customizability: Provides flexibility to test various scenarios, such as extreme weather conditions or habitat anomalies.

Implementation Details

Gateway Device Application (GDA):

- Implemented as a Java Application, the GDA acts as a mediator between the Constrained Device Application (CDA) and the Cloud Provider.
- Facilitates seamless data transmission from the CDA to the cloud and commands from the cloud to the CDA.

Key Functionalities:

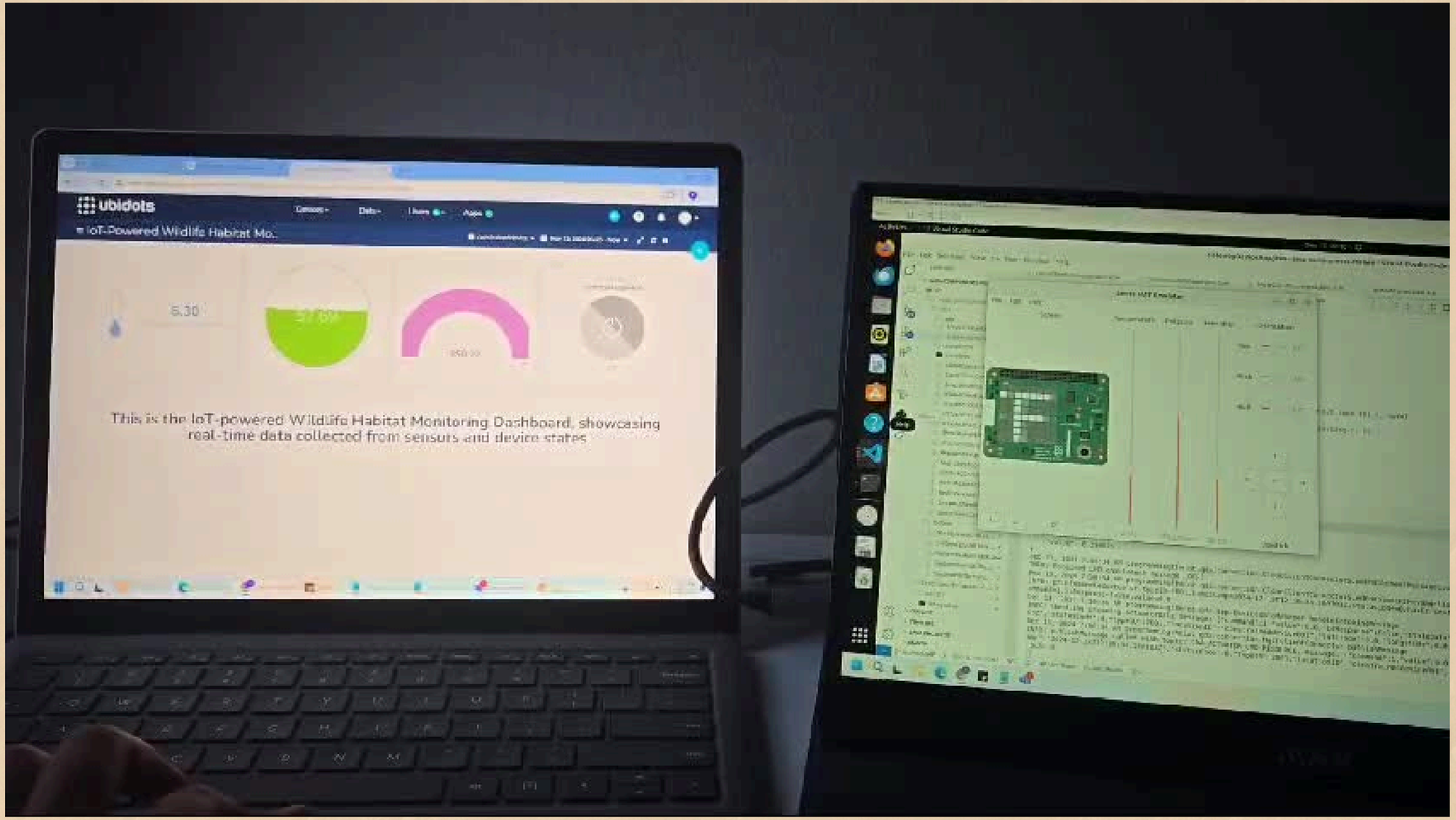
- Real-time Data Relay: Ensures reliable communication between devices and the cloud.
- Self-Health Monitoring: Tracks CPU utilization and memory usage of the gateway application. Sends these metrics to the cloud for performance analysis and proactive troubleshooting

Implementation Details

Cloud and Actuators

- The system leverages MQTT for lightweight communication, transmitting data from simulated sensors via the Gateway Device Application (GDA) to the cloud. Actuators such as LED, sprinklers, and alarms respond dynamically to cloud commands based on analyzed data, ensuring real-time control and habitat management.

Demonstration



Findings and Challenges

Findings:

- IoT enables scalable and real-time wildlife monitoring.
- Improved response times for critical events.

Challenges:

- Ensuring reliable connectivity in remote areas.
- Durability of sensors in extreme conditions.
- Powering devices in off-grid locations.

Conclusion and Future Work

Conclusion:

IoT-powered wildlife monitoring is a step towards sustainable conservation efforts.

Future Work:

- Adding AI for predictive analytics (e.g., fire or migration prediction).
- Expanding the system to monitor diverse species across multiple habitats.


Thank You