Nusantech Webinar

DEVICE MANAGEMENT PLATFORM FOR INTERNET OF THINGS (IOT) APPLICATION

Nazmi Febrian

Sr. IoT Engineer at Axiata Digital Labs

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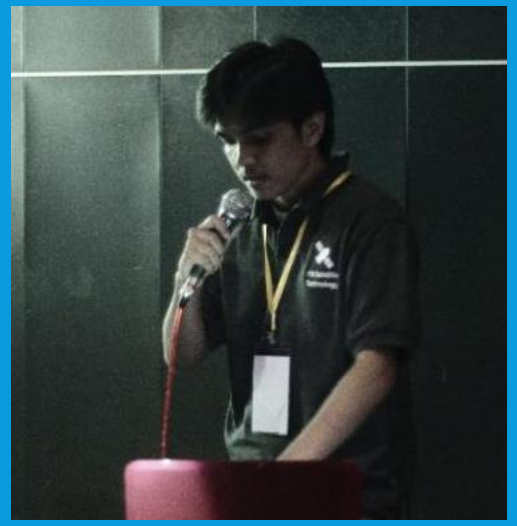
NAZMI FEBRIAN



Sr. IoT Engineer at **Axiata Digital Labs**

Past careers:
Research Fellow at **SEEI ITB**
Embedded Engineer at **QIMTronics** and **Bukalapak**
Firmware Engineer Lead at **Pernika**

Bachelor and Master Degree – Electrical Engineering – **ITB**

Github: https://github.com/nazmibojan
Linkedin: https://id.linkedin.com/in/nazmifebrian
Telegram: @nazmibojan

OUTLINE

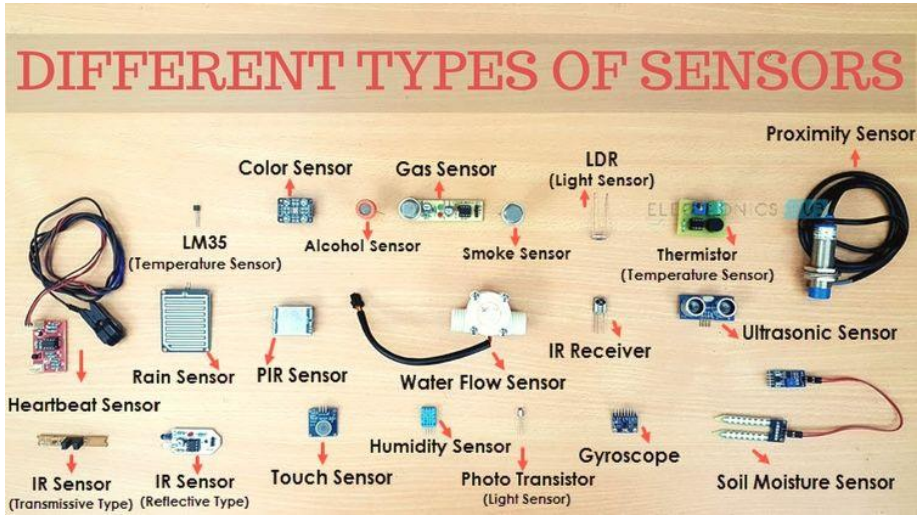
- IoT 101
  - IoT Introduction
  - IoT Sensor and Devices
  - IoT Network and Protocols
- IoT Architecture and Solutions
- IoT Real Case: Smart Building and Smart Farming
- Device Management Platform: FlexIoT
- Hands On Demo

IOT 101

- In 2009 for the first time, the number of "things" connected to the Internet surpassed the number of people
- More than 25 billion connected device in 2019, and 64 billion IoT devices by 2025
- IoT main aspects:
  - Sensors and Devices
  - Networks and Protocols
  - Big Data and Analytics
  - Cybersecurity and Privacy

IOT SENSOR AND DEVICES

- Popular embedded devices
  - 8-bit: ATMega328 (Arduino Nano and Uno)
  - 16-bit: MSP430
  - 32-Bit: STM32, ESP8266, ESP32, NRF, Renesas
  - 64-bit: Raspberry Pi 4
- Embedded Peripheral
  - USART
  - SPI
  - I2C
  - USB
  - Ethernet
  - etc



IOT SENSOR AND DEVICES

- **Buy existing devices**
  - Less cost at initial
  - Almost without development time
  - Certification handled by manufacturer

- **Develop new device**
  - More cost at initial
  - Need development time
  - Manage Lab Testing and Certification

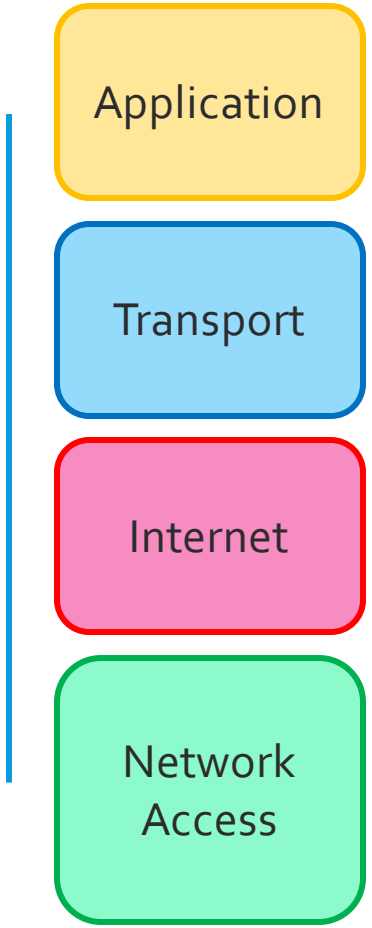
IOT NETWORKS AND PROTOCOL

Aspects to consider when choosing protocol:

- Distance of connection
- Volume of data
- Speed and frequency

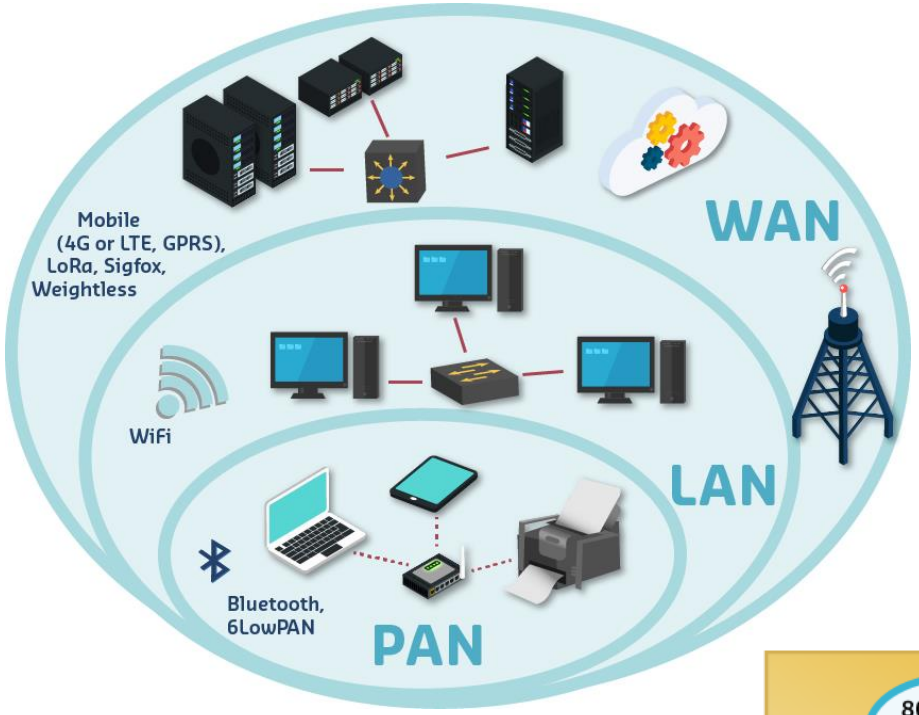
Layer	Example of IoT Protocols			
Application	MQTT	CoAP	AMQP	XMPP
Transport	TCP	UDP		
Internet	IPv6	RPL	6LowPAN	
Network Access and Physical	**PAN**: Bluetooth NFC	**LAN:** WiFi	**WAN:** LoRa, NB-IoT, Sigfox	

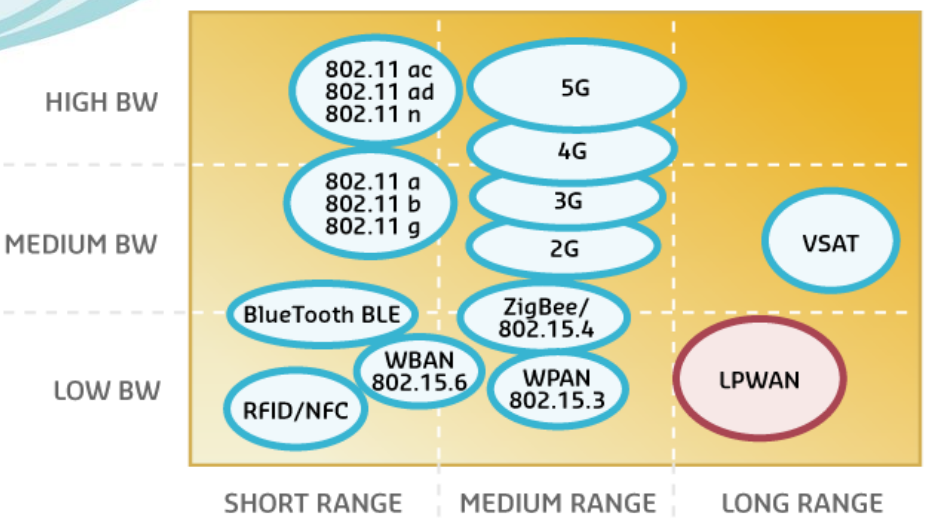
IOT NETWORKS AND PROTOCOL



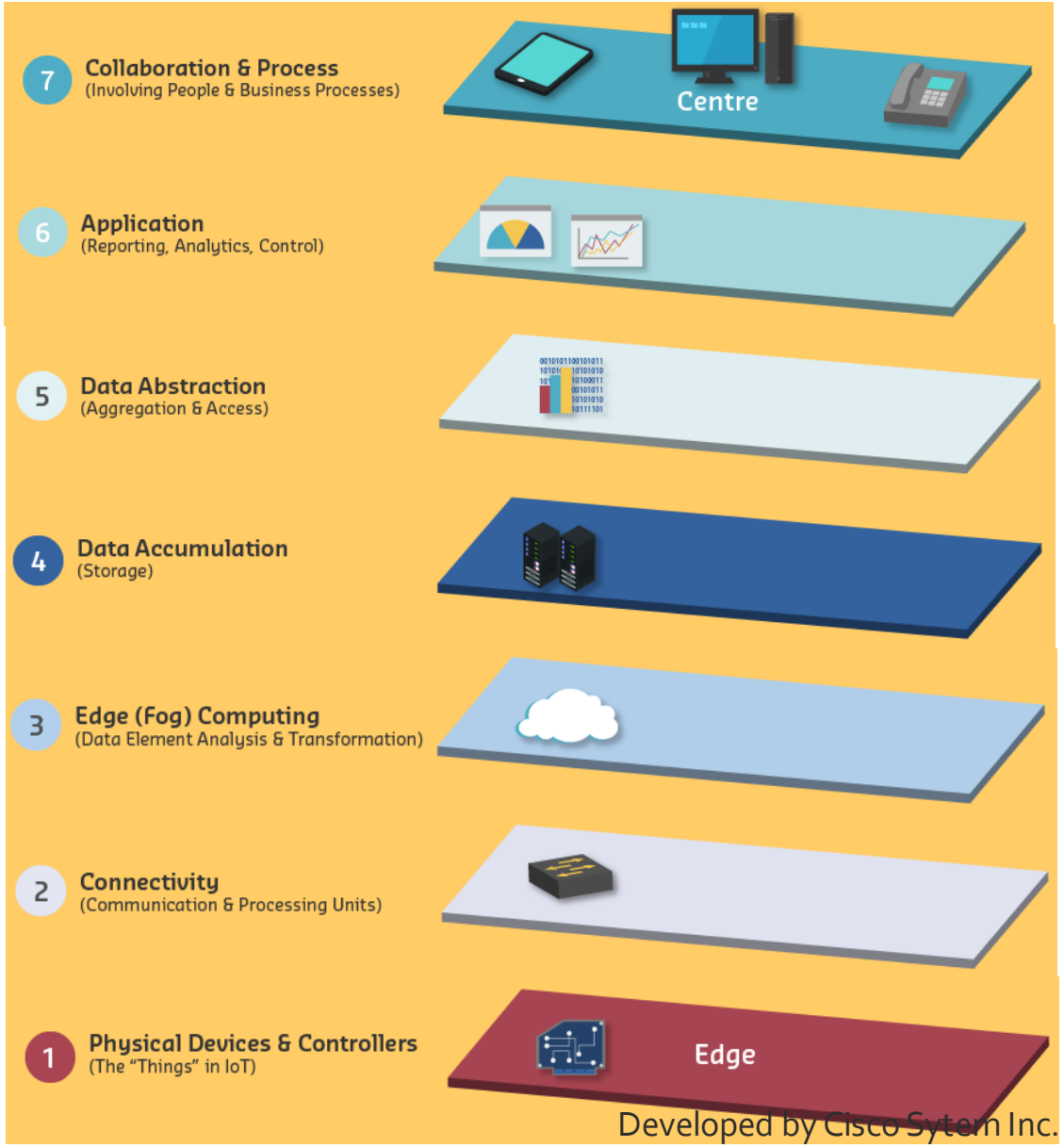
Application	CoAP, MQTT	SMTP, FTP, HTTP, POP3, IMAP4, SNMP
Transport	UDP, TCP, DTLS	TCP, UDP
Internet	IPv6, 6LowPAN, RPL, LoRaWAN	IPv4, IPv6
Network Access	IEEE 802.15.4 IEEE 802.11 a/b/g/n/ac/ad/ah/ax IEEE 802.3 Ethernet GSM, LTE, LPWAN, LoRaWAN	IEEE 802.3 Ethernet IEEE 802.11 a/b/g/n/ac

IOT NETWORKS AND PROTOCOL





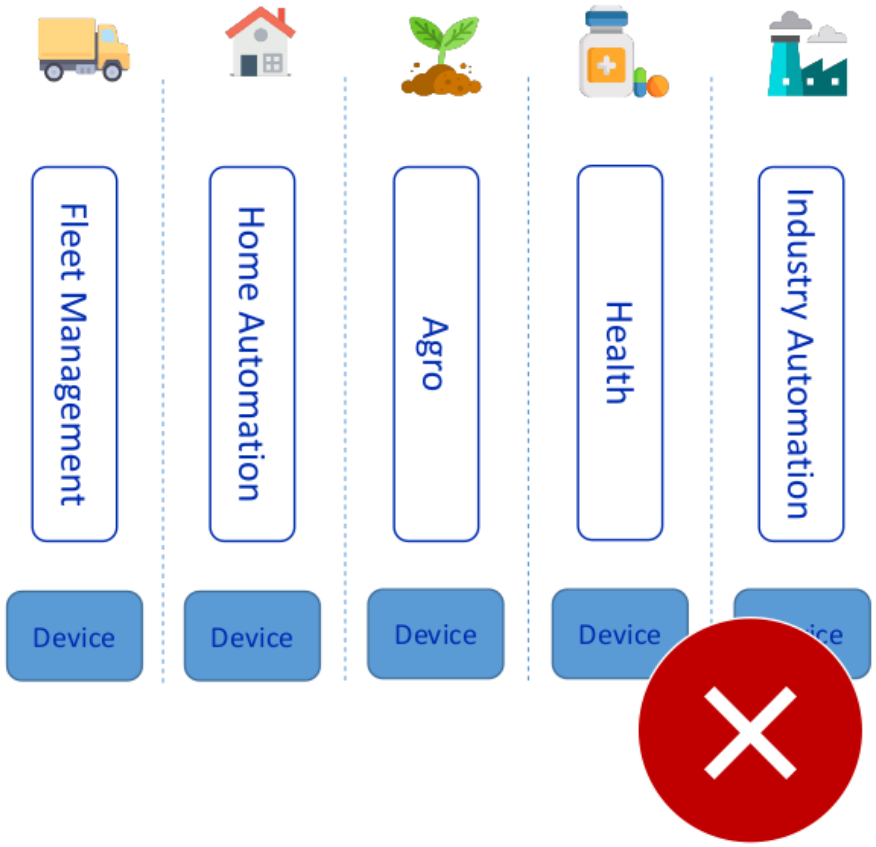
IOT MODELS AND ARCHITECTURES

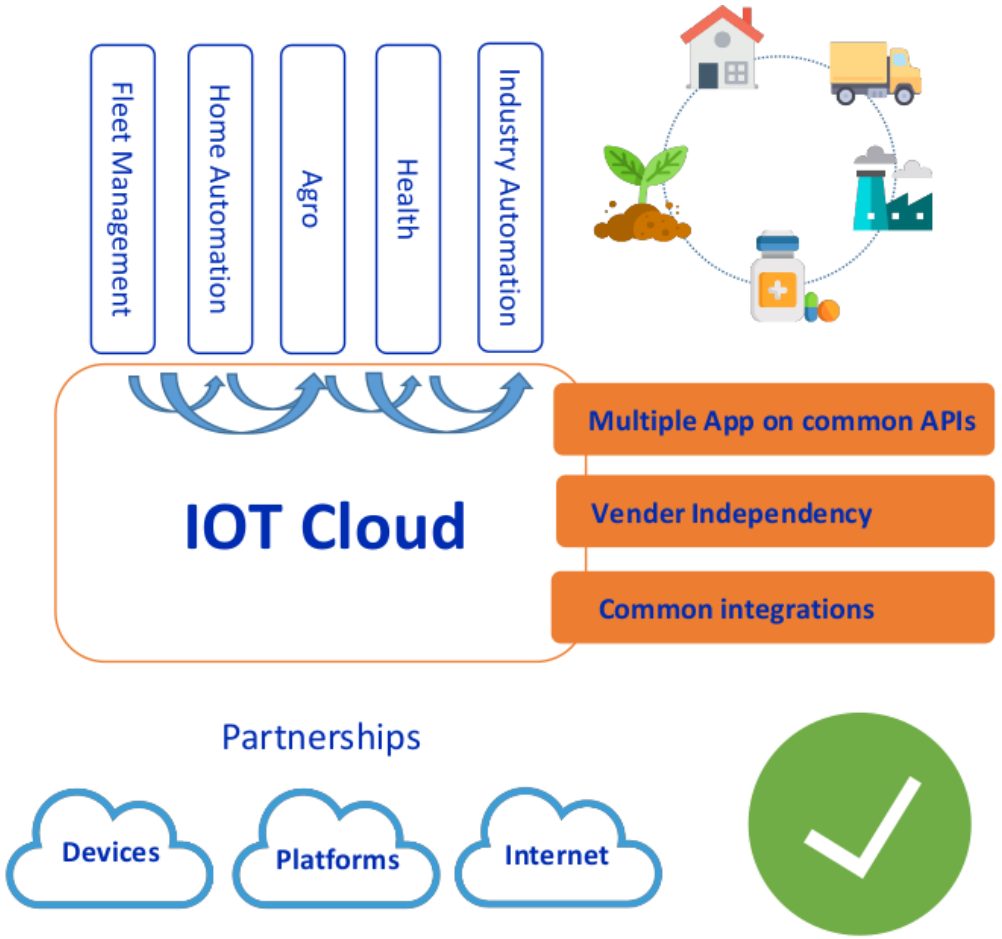


Developed by Cisco Sytem Inc.

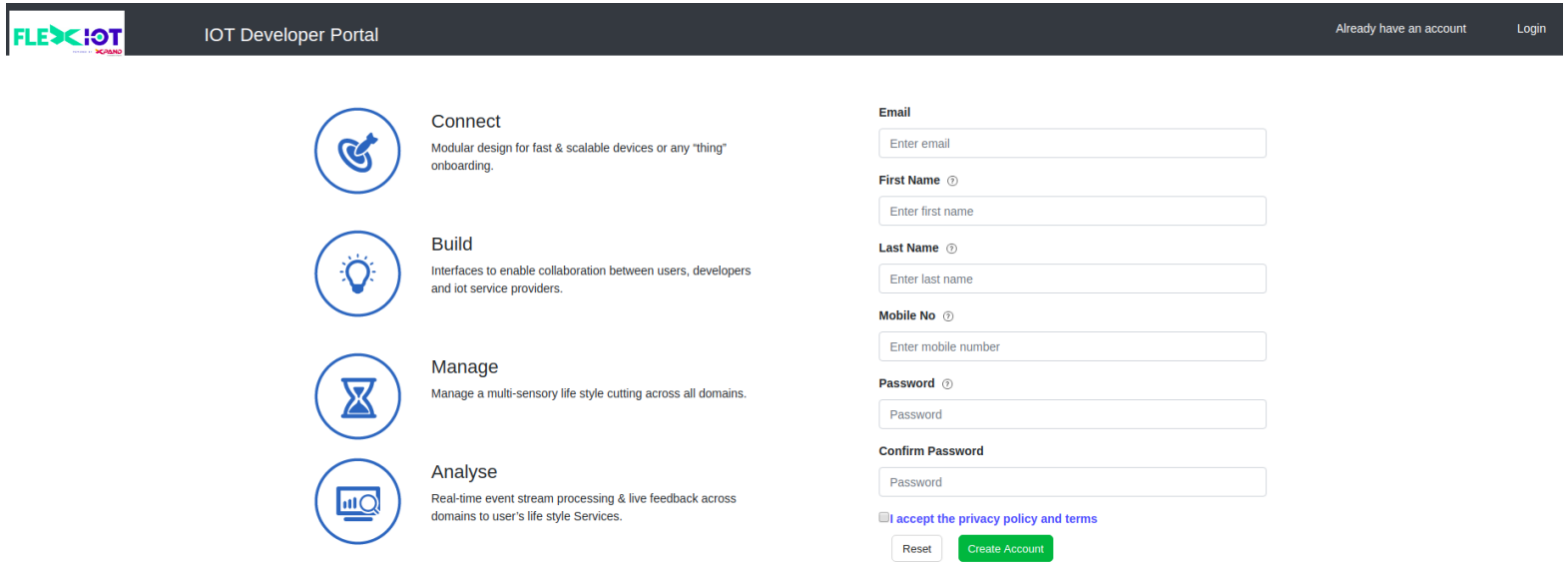
DEVICE MANAGEMENT PLATFORM

VERTICAL SOLUTIONS VS PLATFORM PLAY



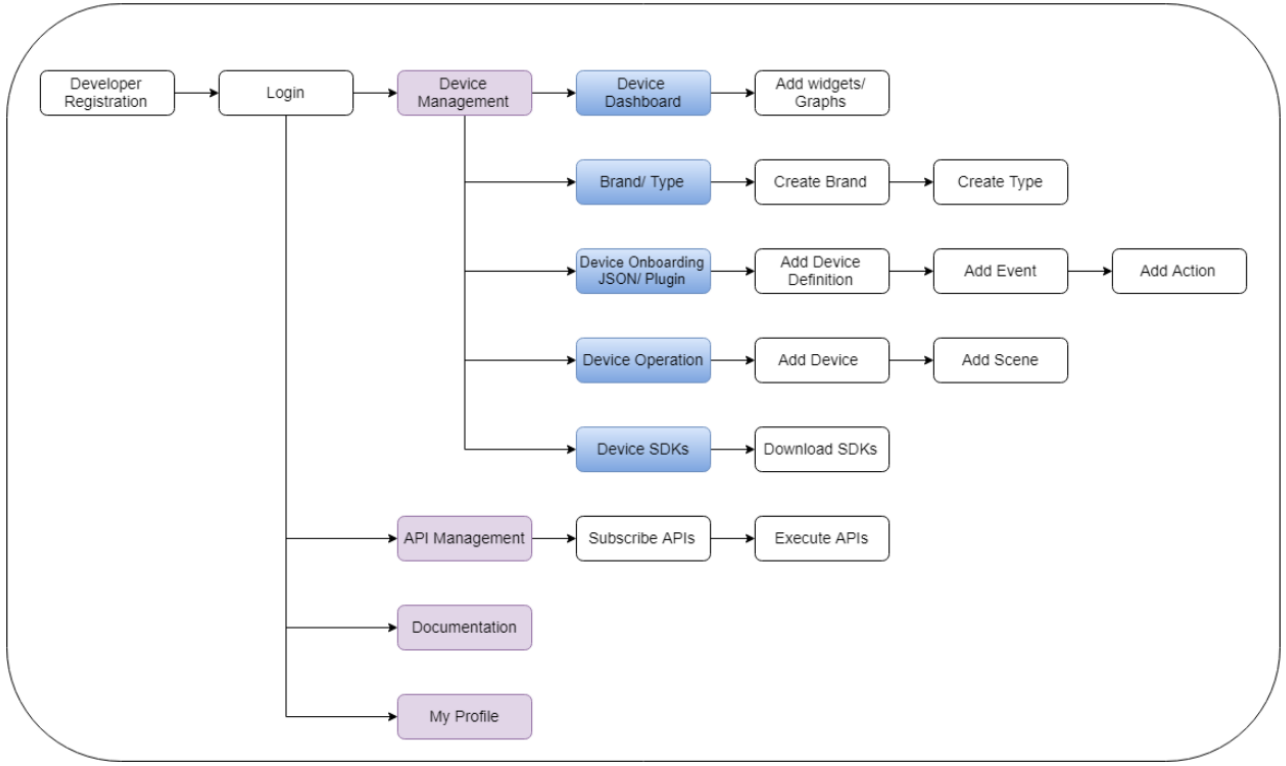


FLEX IOT

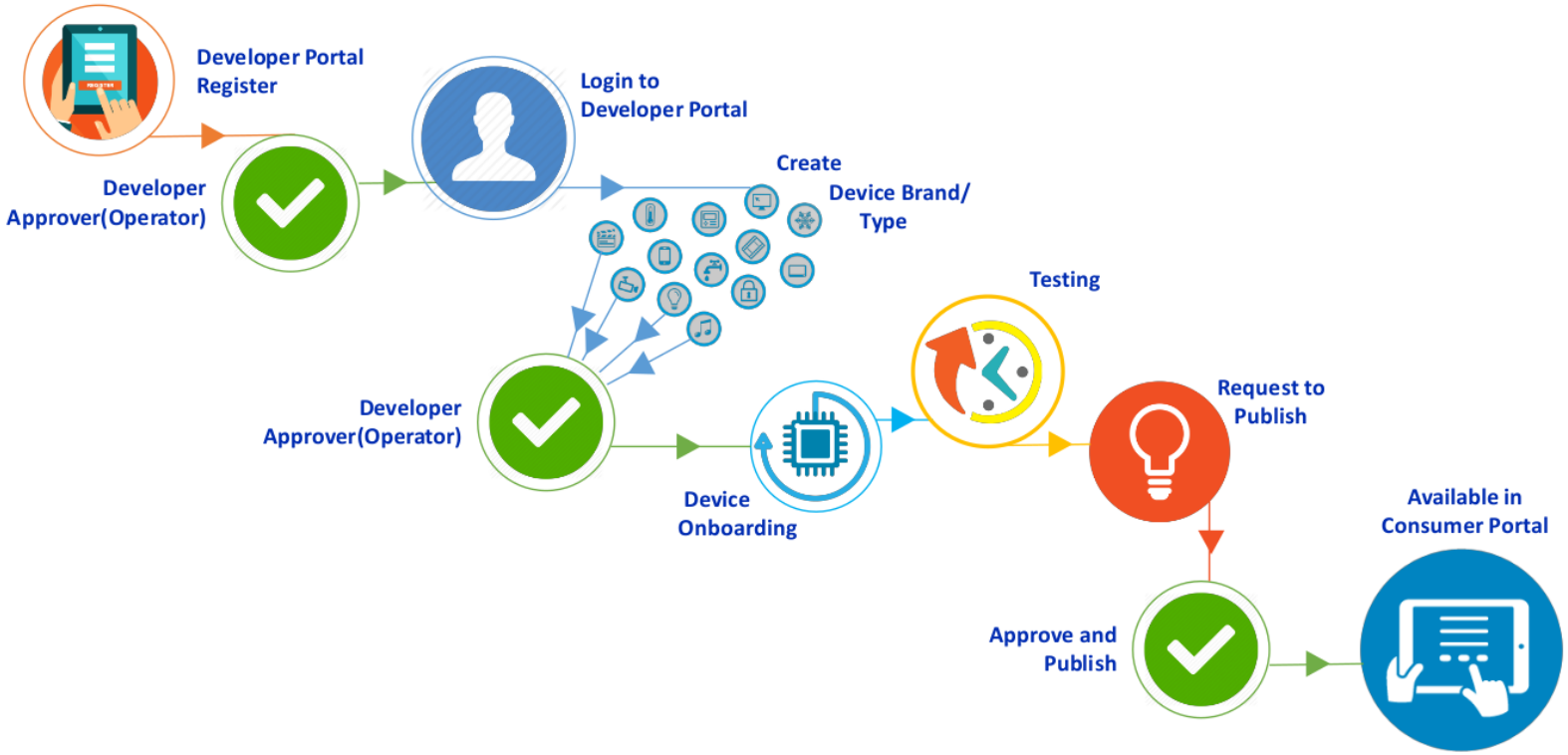


https://portal.flexiot.xl.co.id/

FLEX IOT


Developer Registration
Login
Device Management
Device Dashboard
Add widgets/ Graphs
Brand/ Type
Create Brand
Create Type
Device Onboarding JSON/ Plugin
Add Device Definition
Add Event
Add Action
Device Operation
Add Device
Add Scene
Device SDKs
Download SDKs
API Management
Subscribe APIs
Execute APIs
Documentation
My Profile

DEVELOPER PORTAL FLOW



FLEXIOT

IOT Developer Portal

Hi Nazmi Febrian

Dashboard

Share Dashboard

+ Add Widget

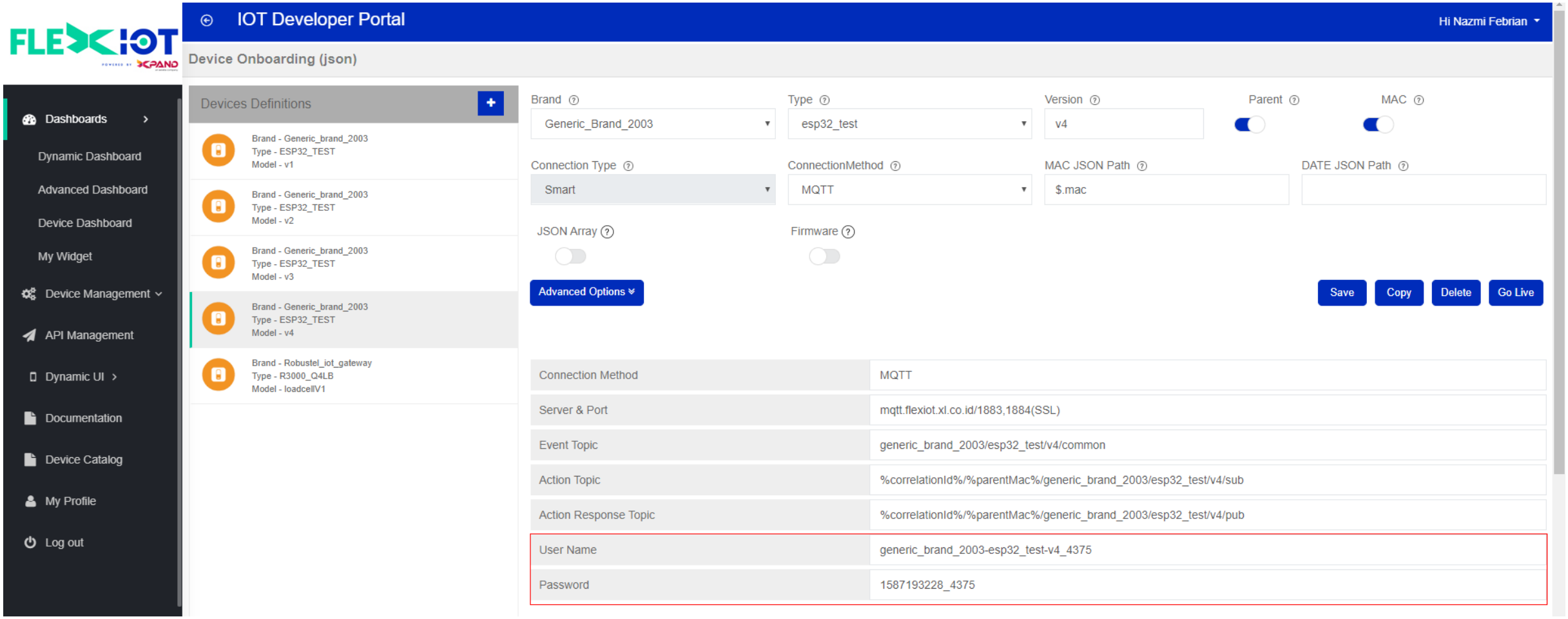
- Dashboards
  - Dynamic Dashboard
  - Advanced Dashboard
  - Device Dashboard
  - My Widget
- Device Management
- API Management
- Dynamic UI
- Documentation
- Device Catalog
- My Profile
- Log out

+ Add Brand

Name	Status	Date
Generic_Brand_2003	APPROVED	2020-03-18 20:06:13
Robustel_IoT_Gateway	APPROVED	2020-04-22 09:58:57

+ Add Type

Name	Brand	Status	Date
esp32_test	Generic_Brand_2003	APPROVED	2020-03-18 20:19:48
R3000_Q4LB	Robustel_IoT_Gateway	APPROVED	2020-04-22 10:20:55


IOT Developer Portal
Hi Nazmi Febrian
Device Onboarding (json)
Dashboards
Dynamic Dashboard
Advanced Dashboard
Device Dashboard
My Widget
Device Management
API Management
Dynamic UI
Documentation
Device Catalog
My Profile
Log out
Devices Definitions
Brand - Generic_brand_2003
Type - ESP32_TEST
Model - v1
Brand - Generic_brand_2003
Type - ESP32_TEST
Model - v2
Brand - Generic_brand_2003
Type - ESP32_TEST
Model - v3
Brand - Generic_brand_2003
Type - ESP32_TEST
Model - v4
Brand - Robustel_iot_gateway
Type - R3000_Q4LB
Model - loadcellV1
Brand
Generic_Brand_2003
Type
esp32_test
Version
v4
Parent
MAC
Connection Type
Smart
ConnectionMethod
MQTT
MAC JSON Path
$.mac
DATE JSON Path
JSON Array
Firmware
Advanced Options
Save
Copy
Delete
Go Live
Connection Method
MQTT
Server & Port
mqtt.flexiot.xl.co.id/1883,1884(SSL)
Event Topic
generic_brand_2003/esp32_test/v4/common
Action Topic
%correlationId%/%parentMac%/generic_brand_2003/esp32_test/v4/sub
Action Response Topic
%correlationId%/%parentMac%/generic_brand_2003/esp32_test/v4/pub
User Name
generic_brand_2003-esp32_test-v4_4375
Password
1587193228_4375

IMPLEMENTATION - SMART BUILDING

- Background
  - Environment issue
  - Energy efficiency -> Cost saving
- International Standard
  - LEED from USA
  - BREEAM from UK
- Smart Building Features:
  - Optimize HVAC System
  - Managed electricity reductions
  - Maximized building security
  - Smart sensor for lightning
  - Control appliances from remote locations

SMART BUILDING

The Edge – Amsterdam

- 98.3% BREEAM score
- Innovation: Smart LED by phillips

New Logic III - The Tube

- 99.4% BREEAM score
- Full solar cell at roof
- Produces more energy than consumes it

BUILDING MANAGEMENT SYTEM

- Platform features
  - Entity, Building, Floor and User management
  - Alert via e-mail and SMS
  - Data history
  - Widget Management
- Sensor Features:
  - AQI index
  - Energy consumption monitoring
  - Light room control
  - HVAC monitor and control
  - Water tank monitor

SMART POULTRY

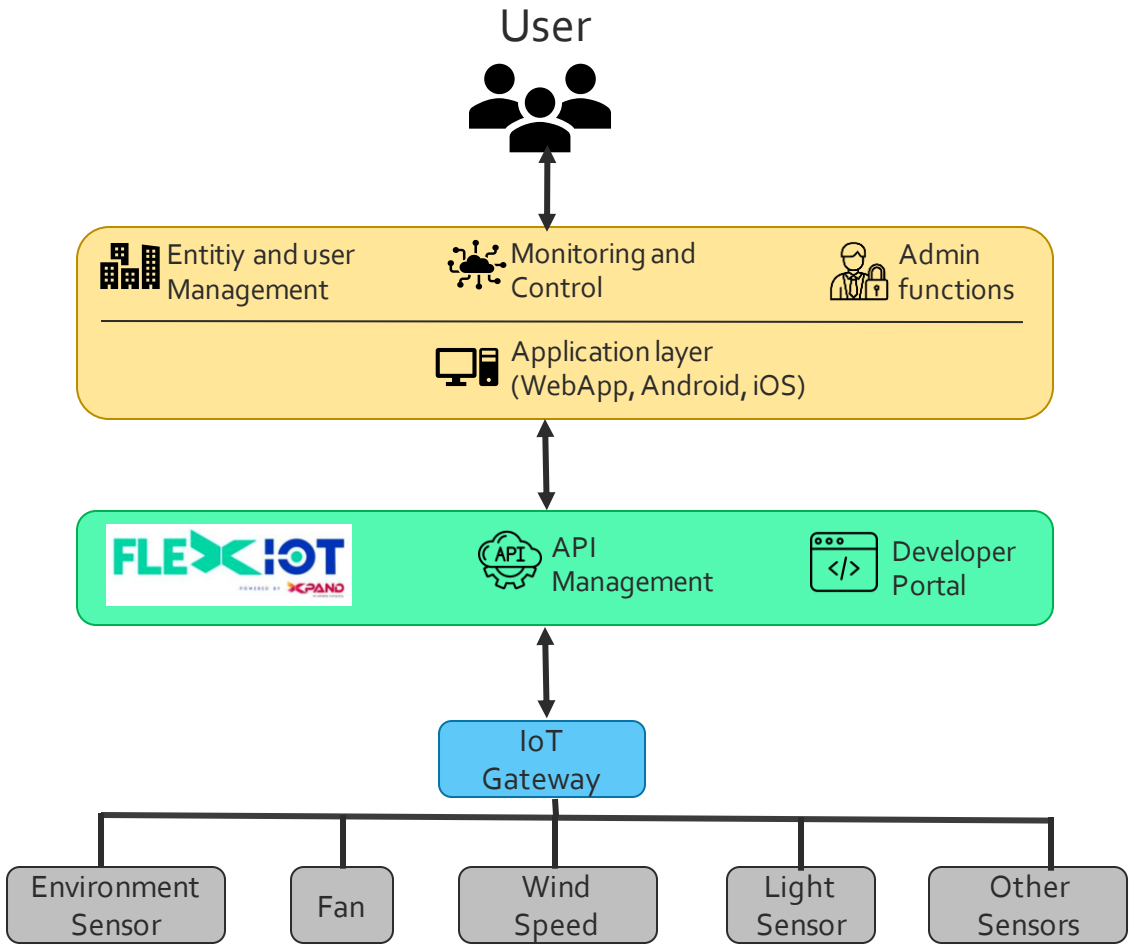
Issue: Ventilation, lighting, enviromental, NH_3, CO_2, Manual measurement, late action, low food efficiency

Features:

- Handle ~250000 chickens
- ~50 sensors
- Manage multiple farm and floor site in one platform
- Alert and notification system by threshold
- Historical data
- Monitor and control: water level, light intensity, air speed, fan, CO_2, population, FCR, Body weight, environment, NH_3
- Data analytics based on farming experiences

Sources:
https://www.youtube.com/watch?v=8AHyNsffsCo
https://www.youtube.com/watch?v=-39rK06owII

IOT SOLUTIONS - ARCHITECTURE



FLEX IOT DEMO

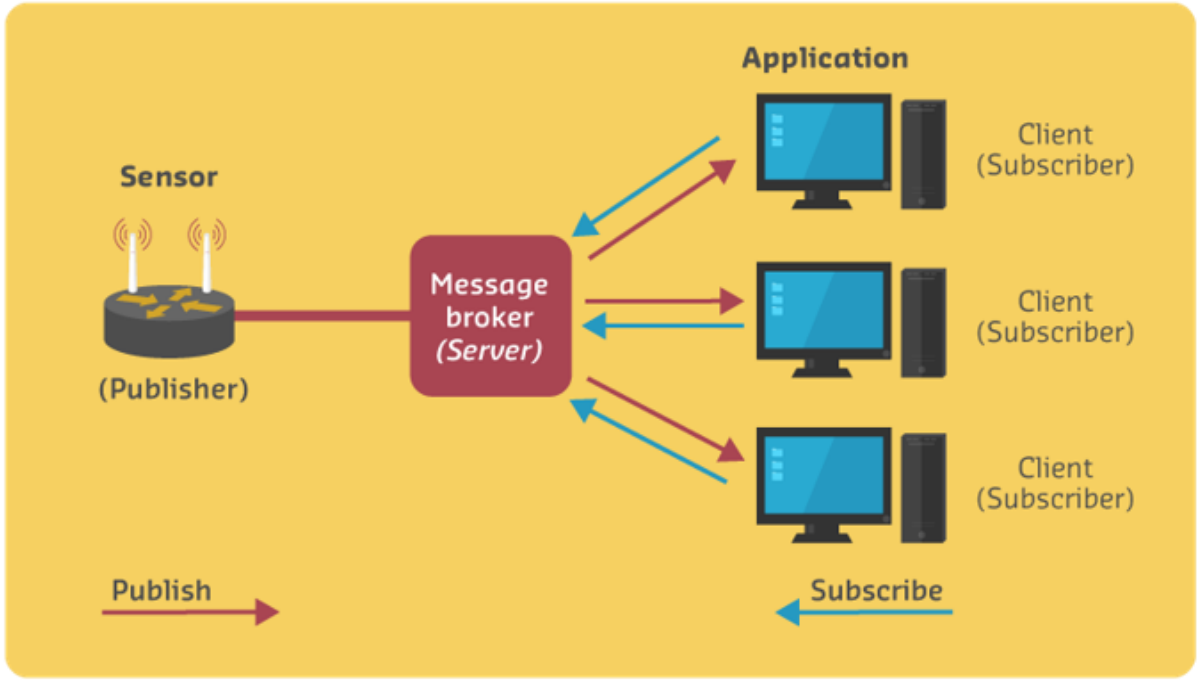
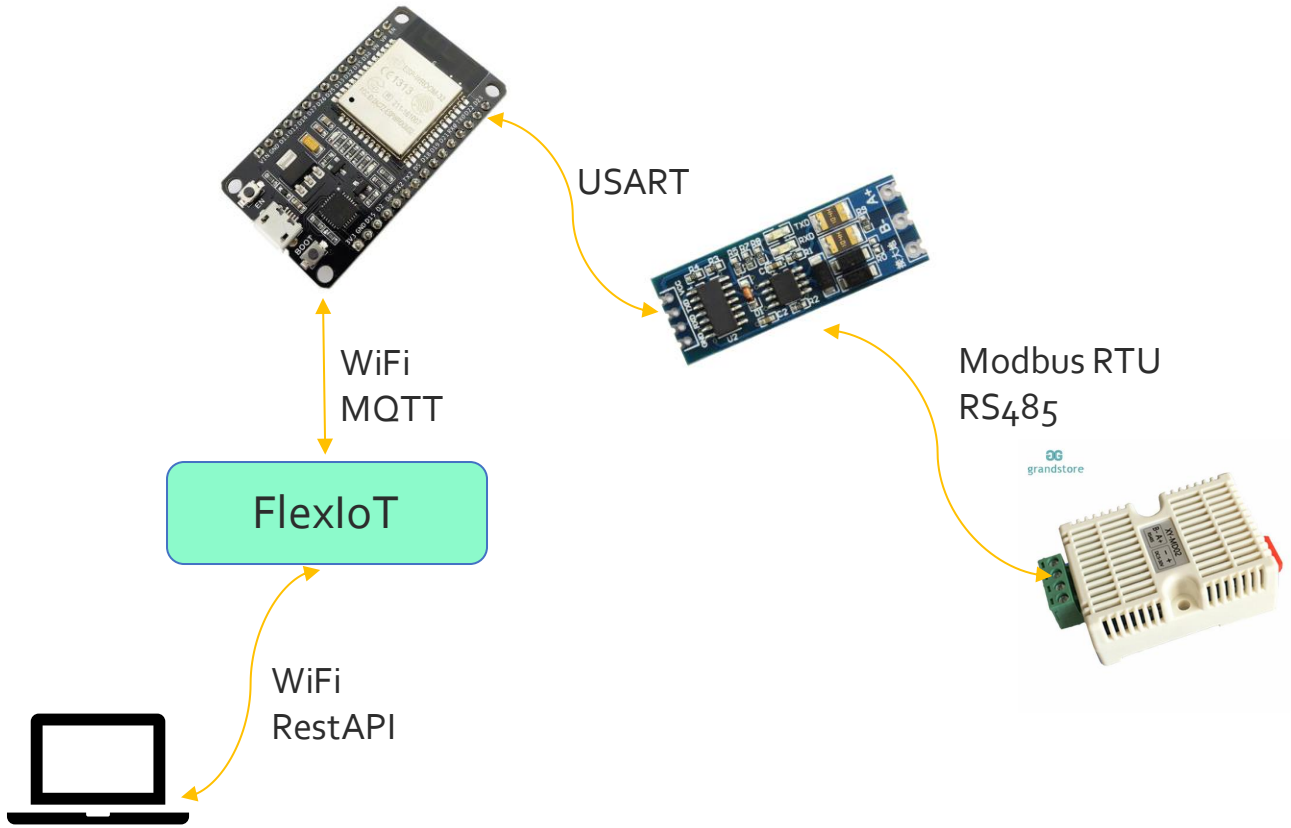
MODBUS PROTOCOL

- ~40 years old protocol
- Still popular in Industry and Automation
- Physical layer: RS385, RS232, Ethernet
- Master Slave communication
- Support up to 254 slave

Device Address	Function Code	Starting Address Hi	Starting Address Li	Quantity Hi	Quantity Li	CRC Hi	CRC Li

Register Type	Register Address	Register contents	Number of bytes
Input Register	0x0001	Temperature	2
	0x0002	Humidity	2
Keep Register	0x0101	Device Address	2
	0x0102	Baud Rate 0:9600 1:14400 2:19200	2
	0x0103	Temperature correction(/10) -10.0~10.0	2
	0x0104	Humidity correction(/10) -10.0~10.0	2

MQTT PROTOCOL



ARCHITECTURE