



edunet  
foundation



## Unit 4

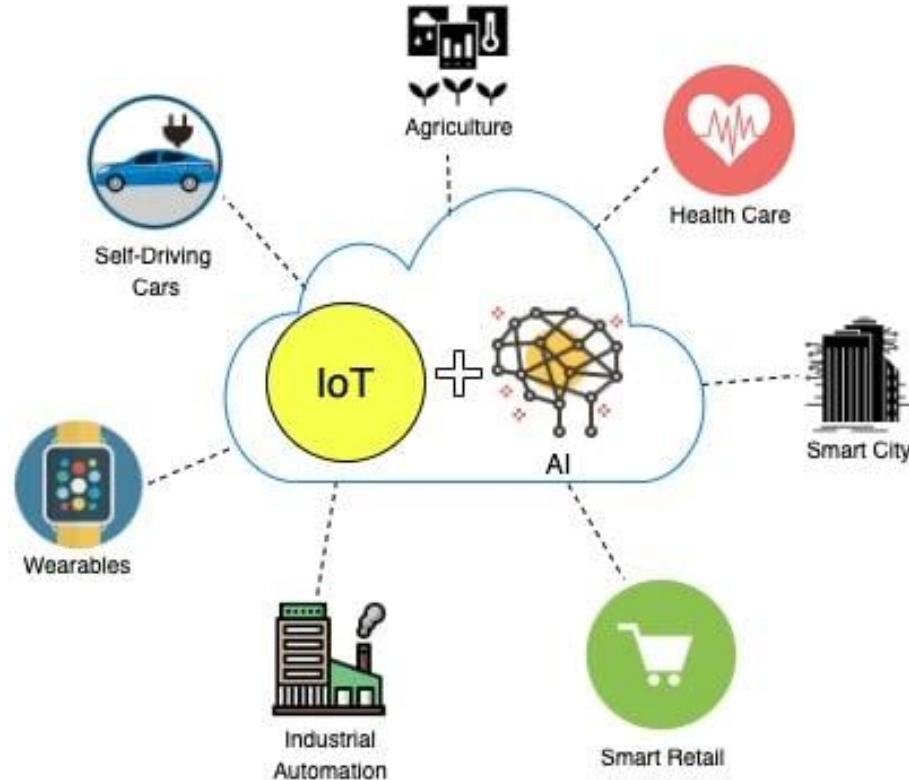
# Machine Learning with IoT



## **Disclaimer**

The content is curated from online/offline resources and used for educational purpose only

## Discussion: Some Recent Trends



[Click here](#)

[Reference link](#)

## Learning Objectives

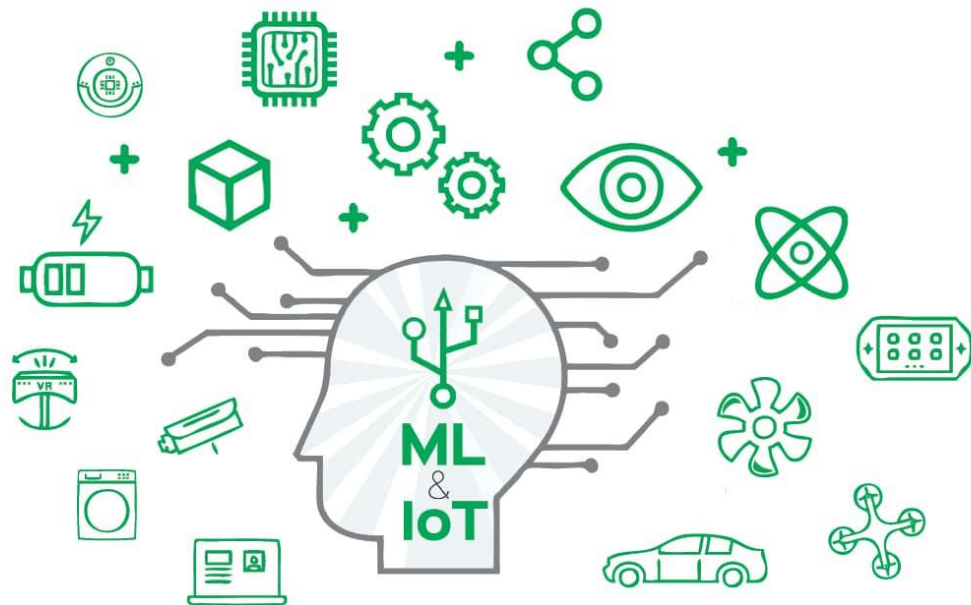
You will learn in this lesson:

- Significance of ML in IoT sector.
- Understand IoT Cloud features.
- Learn to connect device to cloud
- Acquire real time sensor data from cloud
- Integration of Machine learning with IoT



## Introduction: ML with IoT

- One of the top trending topics
- IoT Data fuels the ML engines
- Can work together to improve lives.



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[Reference link](#)

## Advantages of ML with IOT

- Gather big data to avail best services.
- Quick and accurate responses
- Avoid unnecessary spending to optimize business
- Can spot inefficiency and recommend best practices
- Secured M2M communication
- NLP: Speak with machines



-  ENHANCED CUSTOMER RELATIONSHIP
-  COST EFFECTIVE
-  INCREASED OPERATIONAL EFFICIENCY
-  HIGHLY SECURED & SAFE
-  FOCUS ON NEW PRODUCTS & SERVICES

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## Applications of ML with IOT

### Healthcare

Used to monitor patients remotely and provide real-time health diagnosis

### Retail

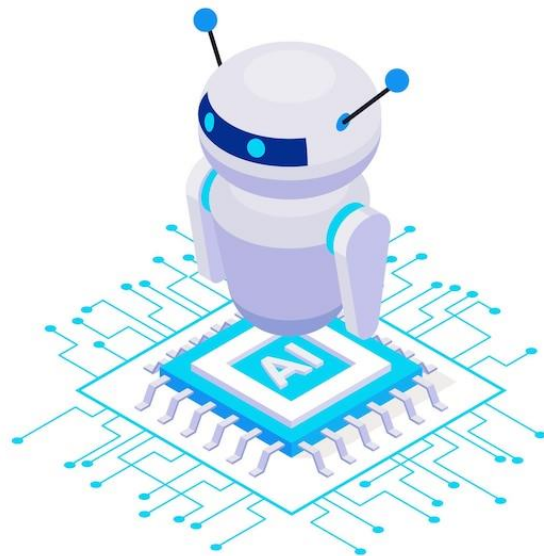
To enhance customer experiences and improve the efficiency of supply chain management.

### Manufacturing

To optimize production processes, improve quality control, and reduce waste.

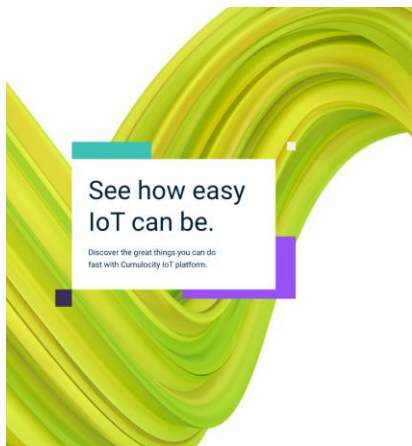
### Agriculture

To improve crop yields, minimize waste, and reduce the use of harmful chemicals.



## Transfer IoT Data to Cloud Services

Register and login to [Cumulocity IoT](#)



### Cumulocity IoT Free Trial

Complete this form to get started today! (or use the [advanced form](#) for more options)

Already have an account? [Log in here.](#)

First name	Last name
<input type="text"/>	<input type="text"/>
Error: Required	
Email	
<input type="text"/>	
Error: Required	
Password	
<input type="password"/>	
Error: Required	
<input type="checkbox"/> I agree to the <a href="#">Trial Cloud Services Agreement</a> .	
<input type="checkbox"/> I have validly countersigned and concluded the <a href="#">Data Processing Agreement</a> .	
<input type="checkbox"/> I would like to receive electronic marketing communications from Software AG. I can withdraw this consent at any time by <a href="#">unsubscribing here</a> . (optional)	

[Sign up](#)

### CUMULOCITY IoT

Welcome,

Thanks for joining Cumulocity IoT. Your platform is now ready. To access it, simply click here:

[Login to Cumulocity IoT](#)

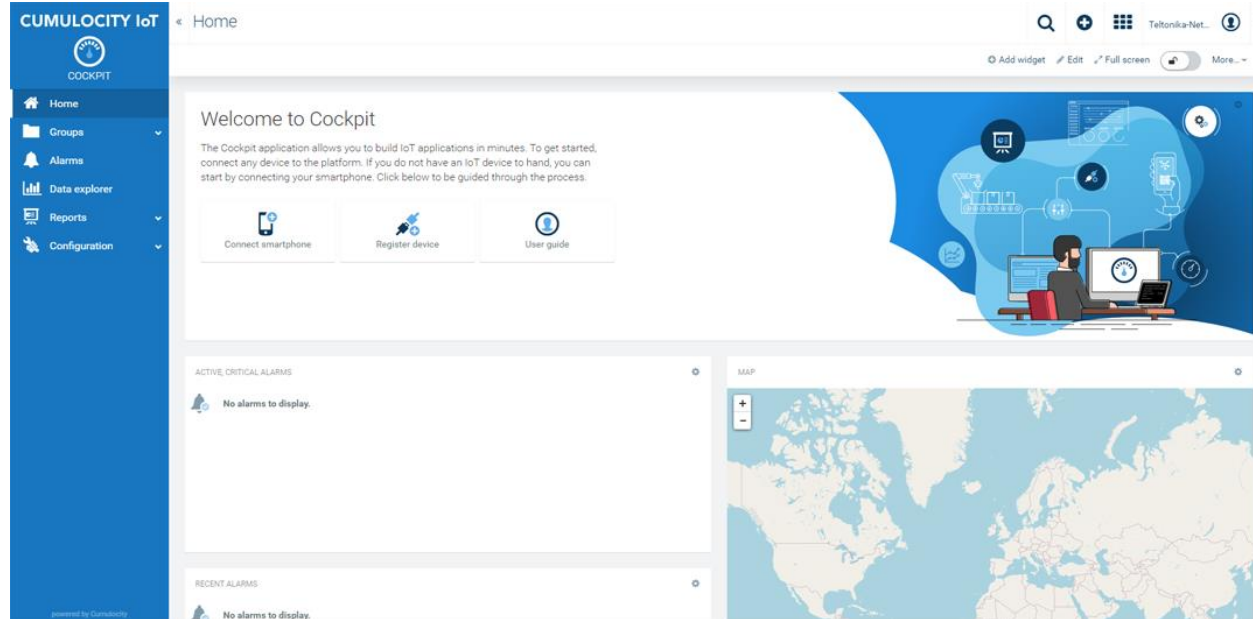
[Click here](#)

[Reference link](#)



## Lab 1: [Transferring IoT Data to Cloud Services](#)

## Cumulocity Dashboard

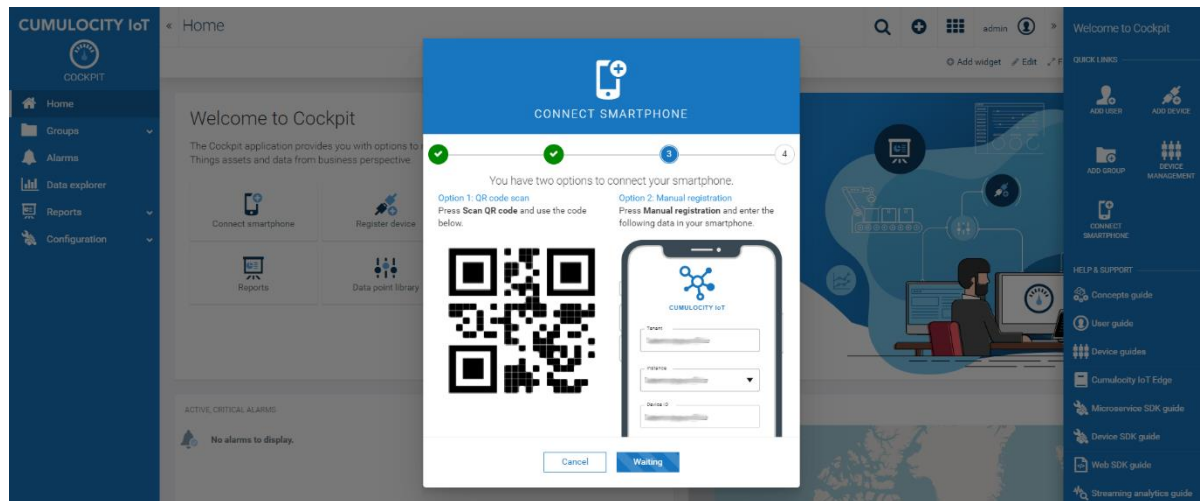


Click here

[Reference link](#)

## Connect Mobile Sensor Data to Cloud

- Click **Connect Smartphone** in the Welcome widget



- Install **Cumulocity app** and **scan the QR code** shown on your PC's web browser

## Lab 2: [Registering a Raspberry PI on Cloud](#)

## Registering Raspberry PI on Cloud

- Clone below repository on RaspberryPi  
<https://github.com/SoftwareAG/cumulocity-devicemanagement-docker-example.git>
- Open repository and notedown device id
- cat cumulocity-devicemanagement-docker-example/Agents/config/config.ini

```
pi@raspberrypi:~ $ cat cumulocity-devicemanagement-docker-example/Agents/config/
config.ini
[CBV]
tenantInstance = eu-latest.cumulocity.com

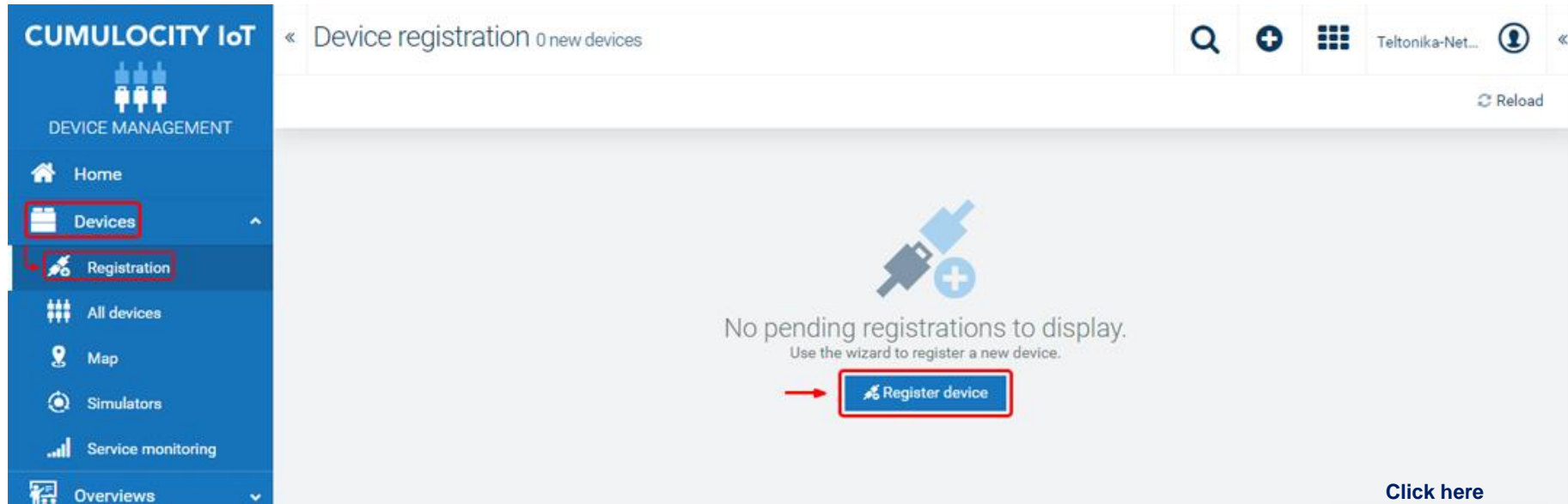
[Device]
id = 08152

[Registration]
user = management/devicebootstrap
password = Fhdt1bb1f
tenant = management
tenantPostFix = /devicecontrol/deviceCredentials

[MQTT]
prefix = aggregated
prefixSignaltype = signalType
broker = localhost
port = 1883
```

## Registering Raspberry PI on Cloud..

- On dashboard click **Register Device**
- Enter your device's serial number into the '**Device ID**' field



CUMULOCITY IoT

DEVICE MANAGEMENT

Home

Devices

Registration

All devices

Map

Simulators

Service monitoring

Overviews

Device registration 0 new devices

Search

+ Register device

Reload

No pending registrations to display.  
Use the wizard to register a new device.

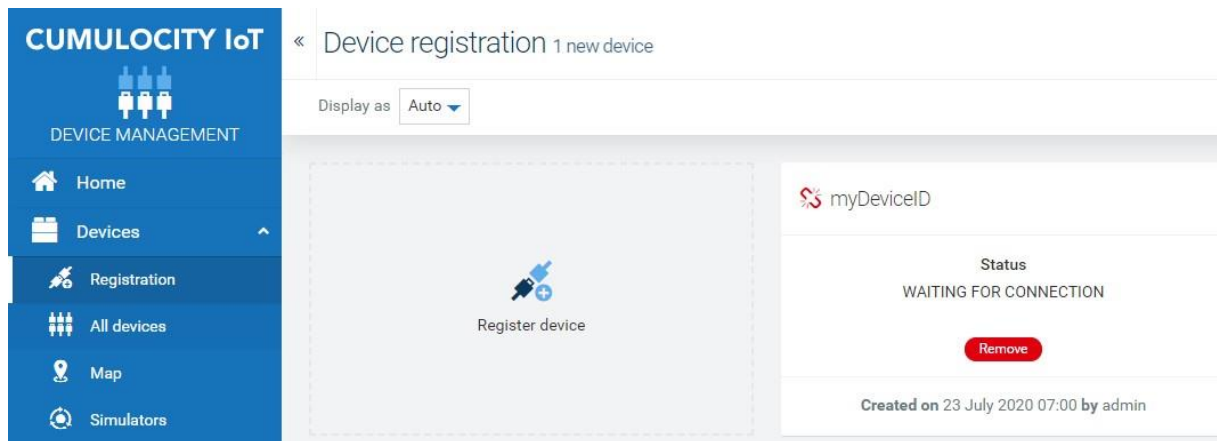
Register device

Click here

[Reference link](#)

## Registering Raspberry PI on Cloud..

- On dashboard Device shows **awaiting state**



- Run docker in Raspberry PI

**sudo bash cumulocity-devicemanagement-docker-example/start.sh**

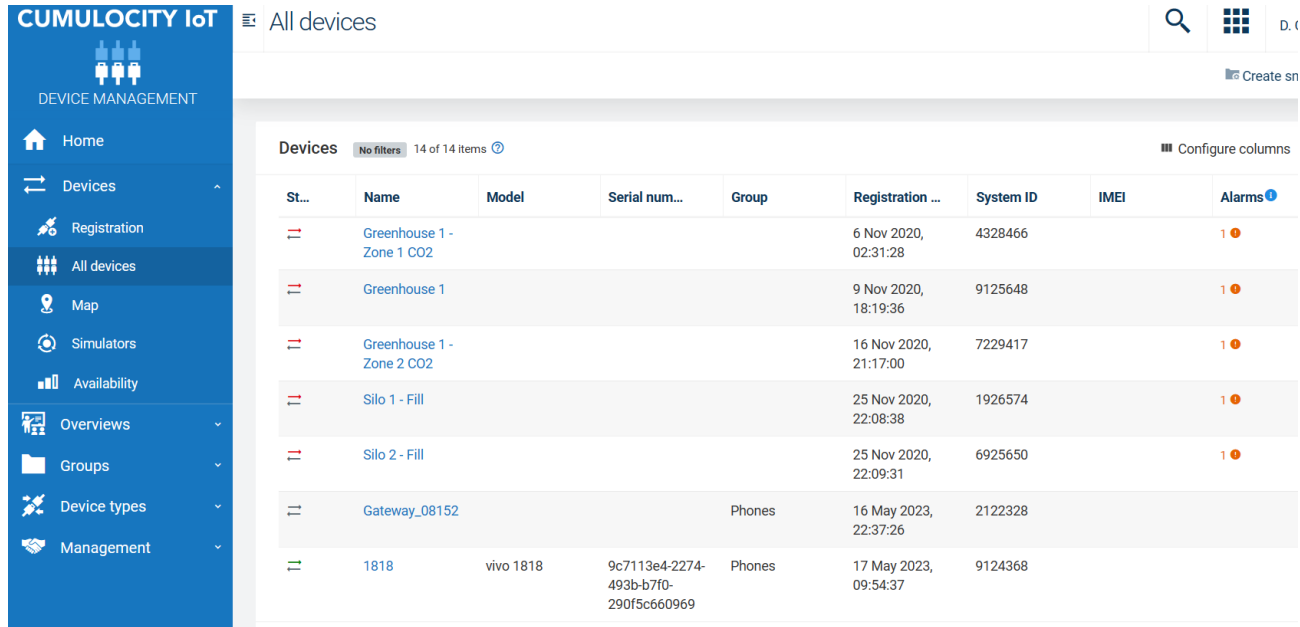
- Refer back to dashboard to accept connection and now your device is connected to cloud.

## Lab 3: [Collecting Sensors Data from Cloud](#)



## Collecting Sensors Data from Cloud

- Open **Cumulocity IOT Device Management** dashboard
- Click on **All Devices** shown in left

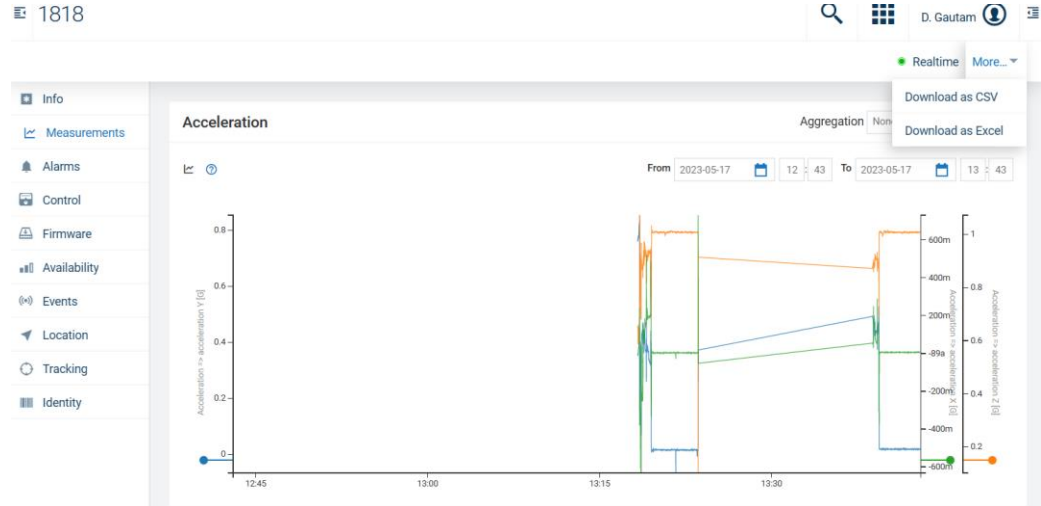


The screenshot displays the Cumulocity IOT Device Management dashboard. The left sidebar contains navigation options: Home, Devices, Registration, All devices (selected), Map, Simulators, Availability, Overviews, Groups, Device types, and Management. The main area shows a table of devices with columns: St..., Name, Model, Serial num..., Group, Registration ..., System ID, IMEI, and Alarms. The table lists 14 items, with filters applied to show 14 of 14 items. The devices are categorized into Greenhouse 1, Greenhouse 1 - Zone 1 CO2, Greenhouse 1 - Zone 2 CO2, Silo 1 - Fill, Silo 2 - Fill, Gateway\_08152, and Phones.

St...	Name	Model	Serial num...	Group	Registration ...	System ID	IMEI	Alarms
	Greenhouse 1 - Zone 1 CO2				6 Nov 2020, 02:31:28	4328466		1
	Greenhouse 1				9 Nov 2020, 18:19:36	9125648		1
	Greenhouse 1 - Zone 2 CO2				16 Nov 2020, 21:17:00	7229417		1
	Silo 1 - Fill				25 Nov 2020, 22:08:38	1926574		1
	Silo 2 - Fill				25 Nov 2020, 22:09:31	6925650		1
	Gateway_08152			Phones	16 May 2023, 22:37:26	2122328		
	1818	vivo 1818	9c7113e4-2274-493b-b7f0-290f5c660969	Phones	17 May 2023, 09:54:37	9124368		

## Collecting Sensors Data from Cloud..

- Open your connected device of interest.
- Refer to Measurement section to view the device activity
- Click on **More** to download device sensor data



## Machine Learning on Sensor Data

- Downloaded data is majorly in form of unsupervised data.
- Try to aggregate data from various sensors and apply Machine Learning Algorithms.
- Identify the clusters and data homogeneity.



## Lab 4: [Machine Learning on Sensor Data](#)

## Summary

- In this session we have learned:
- What does it mean by the term ML-IoT?
- How to connect sensor data from mobile to cloud?
- How to connect device data from Raspberrypi to the cloud?
- How to manage devices on the Cumulocity cloud platform?
- How to implement machine learning on IoT data?
- Different aspects that come under IoT cloud services.

## Quiz

**Q1. What is the primary purpose of integrating Machine Learning with the Internet of Things (ML-IoT)?**

- A) To enhance network security
- B) To automate data collection and analysis
- C) To reduce IoT device costs
- D) To improve IoT device battery life

Correct Answer: B) To automate data collection and analysis

## Quiz

**Q2. Which of the following is a key challenge in implementing ML algorithms on IoT devices?**

- A) Limited computational resources
- B) Abundance of power supply
- C) High-speed internet connectivity
- D) Expensive hardware components

Correct Answer: A) Limited computational resources

## Quiz

**Q3. In an ML-IoT system, what role does edge computing play?**

- A) It handles all machine learning tasks in the cloud.
- B) It manages device connectivity.
- C) It processes data locally on IoT devices.
- D) It serves as a database for IoT data storage.

Correct Answer: C) It processes data locally on IoT devices.



## Quiz

**Q4. What is the significance of data preprocessing in ML-IoT applications?**

- A) It ensures that IoT devices are connected to the internet.
- B) It prepares raw sensor data for analysis by removing noise and outliers.
- C) It determines the physical location of IoT devices.
- D) It encrypts communication between IoT devices and the cloud.

Correct Answer: B) It prepares raw sensor data for analysis by removing noise and outliers.

## References

- <https://www.softwareag.com/corporate/products/cumulocity-iot/overview.html>
- [https://www.softwareag.com/en\\_corporate/resources/iot/article/machine-learning.html](https://www.softwareag.com/en_corporate/resources/iot/article/machine-learning.html)
- <https://www.iotforall.com/>
- <https://aws.amazon.com/iot-core/>
- <https://azure.microsoft.com/en-us/services/iot-hub/>
- <https://cloud.google.com/iot-core>
- <https://www.ibm.com/cloud/watson-iot-platform>
- <https://docs.microsoft.com/en-us/samples/azure/iot-samples/>
- <https://cloud.google.com/community/tutorials/iot-overview>
- <https://aws.amazon.com/getting-started/hands-on/build-end-to-end-ml/>

**Thank You...!**