

## IOT (Internet of Things)

### Introduction

- What is IoT?
- How IoT is applied in different domains?
- Use cases ranging from Smart Cities to IIoT
- How large is the IoT Market in different domains?

### IoT Architecture

- IoT Technology stack
- Sensors & Actuators
- Hardware Platforms
- Wireless Communication Protocols
- Network communication Protocols
- Cloud, its components and IoT
- Data Streaming in IoT
- Data Store and IoT
- Analytics & Visualization for IoT

### Sensor & Actuator

- What is Sensor & Actuator?
- What is a good sensor?
- Sensor properties and their classification
- Types of Sensors & Actuators
- Working of typical Sensors and Actuators
- Categories of sensors Commercial/Industrial/Military/Medical/Food grade sensors
- Selecting a sensor for your use case
- IoT Hardware Platform & comparison
- Criteria for selecting Hardware platform

### Raspberry pi and Arduino Hardware Overview

- The Raspberry Pi and Arduino Open Source Microcontroller Platform
- Schematics, PCB Design Tools and prototype steps
- Raspberry Pi and Arduino Board Layout & Architecture
- Why Raspberry Pi and Arduino?

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## **Arduino Programming fundamentals**

- How to program Arduino with Arduino IDE
- How to make your Arduino respond to sensors and actuators
- Reading data from analog/Digital Sensors
- Writing data to analog (PWM)/Digital actuators

## **Interfacing Sensors and Actuators with Hardware**

- Connecting sensors to Arduino to read data from sensor and display on serial monitor (Temperature, Humidity, Distance, Light, Moisture, Gas (Methane/Alcohol), Proximity, Motion).
- Connecting actuator to Arduino and controlling Actuator (LED, Relay, Push button, Buzzer) Controlling a motor (actuator) by sensing Temperature
- Controlling a buzzer using Ultrasonic ranger
- PIR (Human presence) (Combining sensors to avoid false alarms)
- Controlling sprinklers using relay by sensing moisture in the soil using moisture sensor

## **Program Raspberry Pi board**

- Working with Raspberry Pi 3 Model
- Installing OS and Designing Systems using Raspberry pi
- Configuring Raspberry Pi for VNC Connection
- Getting introduced to Linux OS
- Basic Linux commands and uses
- Getting Started with Python
- Variables, Functions and control Structure
- File Handling in Python & Importing or Exporting Data
- Interface sensor and Actuator with Raspberry Pi

## **IoT Communication Protocol**

### **IoT Wireless Protocols**

- RFID, NFC, Blue Tooth, BLE, ZigBee, Zwave Mesh network
- Comparison of wireless Protocols
- How to select a wireless Protocol based on use case

### **IoT Communication Channels**

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- Wi Fi, GSM/GPRS, 2G, 3G, LTE
- Comparison of Communication Channels
- How to select a Communication Channels based on Use Case

### **IoT Network Protocols**

- MQTT/MQTTS, CoAP, 6LoWPAN, TCP, UDP, HTTP/s

### **Comparison of the Network protocols**

- How to select a Network Protocol based on Use Case

### **Introduction to IPv4 and IPv6**

- Issues with IPv4 in IoT
- How IPv6 solves the issues with IPv4
- Application issues with RF protocol
- power consumption, LOS, reliability, Security aspects

### **TCP/UDP Transport layer Protocol**

- Introduction of TCP & UDP
- Difference between TCP/UDP Transport layer protocol
- Practically testing the TCP v/s UDP by python socket programming

### **HTTP Application layer IOT Protocol**

- Introduction and structure of HTTP protocol
- Start with HTTP protocol GET/POST Method
- Work on python Flask library design web page
- Control thing from webpage using HTTP protocol
- Publish sensor data over webserver

### **MQTT IOT Protocol**

- Introduction to MQTT
- Why MQTT?
- Features of MQTT
- MQTT Subscribe/Publish
- MQTT Broker
- MQTT QoS

- MQTT Security

### **MQTT with Raspberry Pi**

- Installation of Mosquitto MQTT broker
- Publish and Subscriber test on local server broker
- Start with Paho MQTT
- Publish/subscribe test on iot.eclipse platform

### **CoAP IOT Protocol**

- Introduction of CoAP
- Architecture of CoAP IOT protocol
- Difference between HTTP & COAP
- Implement of CoAP using CoAPthon Python library
- Design server and client using Python

### **IoT Cloud Platform(Ubidot)**

- Read data from sensors,
- Create JSON Object
- Establish HTTPS connection using Wi Fi
- Send JSON data to Ubidot Rest API over HTTPS
- Create business rules in Ubidot for alarms
- Send Data to Ubidot platform
- Create rule and configure Alarm(SMS/Email) for your device
- Send data to Ubidot which will trigger the alarm
- Create and configure Chart/Graph for visualization
- Control the actuator from Ubidot using polling technique

### **Theory Introduction to the Big Data and Big data technologies**

#### **Cloud Computing**

- What is cloud?
- What is cloud computing?
- Benefits of cloud.
- Deployment Models.
- Top cloud providers.
- Service Models
- Service Catalogue

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- Advantages for different offerings
- Introduction to AWS
- Service provided by AWS E2C, SimpleDB RDS, Dynamo DB, Elastic Beanstalk, SNS, Cloud Watch, Route 53, VPC, Elastic Load Balancing, S3, EBS, IAM

## **BigData**

- Cloud data storage
- Introduction to Big Data
- BigData Definition and Characteristics
- Who is Generating Big Data
- Big Data Analytics
- Why Big Data Analytics
- Applications of Big Data Analytics
- Different Data Stores
- Big Data Technologies CouchDB, MongoDB, Node4J

## **AWS IoT Setup for Application Development**

- Introduction to AWS IoT
- Creating a Thing in AWS IoT
- Downloading SDK and configuring RaspberryPi

## **Preparing the RaspberryPi to connect to AWS IoT**

- Downloading Certificates from AWS IoT console
- Installing certificate in RaspberryPi
- Connecting Sensors to RaspberryPi II.

## **Connecting to AWS IoT**

- Configuring RaspberryPi sketch to connect to AWS IoT through Wi Fi
- Establishing MQTT Connection
- Publishing Sensor data to AWS IoT Thing Shadow
- Subscribing MQTT Topic and controlling actuator from Thing shadow

## **Send Data from raspberry Pi to AWS IoT**

- Run Ultrasonic ranger sketch in RaspberryPi and check
- Updating of data from RaspberryPi to AWS Thing Shadow

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## Dynamo DB

- Configuration of Dynamo DB
- Create table in Dynamo DB
- Create rule link dynamo DB with AWS IOT
- Store sensor data From AWS IOT in Daynamo DB

## SNS

- Setup SNS service
- Test SNS service by publish/subscribe
- Create a rule and link with AWS IOT
- Notify through mail when Publisher publish data

