

# INTERNET OF THINGS



## IoT DEVELOPMENT

### Introduction of IoT 2 Hrs

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

### IoT Device Design & Management

- Top IoT hardware platform
- Architecture, layout and comparison of different microcontroller
- Sensor, Actuator, Microcontroller

### Wireless Networking Technology

- NFC
- RFID
- WIFI
- Z WAVE
- LoRaWAN
- Zigbee
- Cellular
- Bluetooth
- SigFox
- NB-IOT

### Wired Communication Protocol

- SPI
- UART
- I2C

### Interfacing of different Sensor, Actuator, Wireless Networking Technology with different microcontroller Introduction of Arduino IDE

### Arduino Mega 10 Hrs

- Introduction of Arduino Mega
- Industry application
- Pin configuration or description of board

- Exploring Linux file system,Hardware, I/O
- Interfacing a push button
- Making led on/off by push button
- Interfacing an RGB led
- Theory of PWM Pulse width modulation
- Control light intensity using PWM
- Interfacing an LDR.
- Light dependent resistor as sensor to measure brightness
- Interfacing temperature sensor
- Motor Interfacing(DC)
- Motor Driver Introduction
- Servo motor theory
- controlling servo motor with PWM
- Interfacing IR Sensor
- Interface analog Sensor
- SPI/I2C and UART protocol

## Introduction of Python

### Raspberry Pi 10 Hrs

- Raspberry-pi Architecture
- Working with Raspberry Pi 3 Model
- Industry Use case of Raspberry Pi
- Installing OS and Designing Systems using Raspberry pi
- Configuring Raspberry Pi for VNC Connection
- Getting introduced to Linux OS
- Basic Linux commands and uses
- Interface sensor and Actuator with Raspberry-pi
- Interface relay with raspberry pi
- Interface different sensor like IR sensor/gas sensor
- Interface different sensor like LDR/Soil sensor
- Interface different sensor like Soil sensor with raspberry pi
- Interface different sensor like DHT11 with raspberry pi
- Interface PI-Camera with Raspberry
- Program Raspberry pi for click image
- Program Raspberry pi for create video
- Serial communication with raspberry pi and arduino
- Sending data to arduino to raspberry pi or raspberry pi
- Interfacing DC motor with raspberry pi
- Servo motor Concept
- Interfacing Servo motor with Raspberry pi
- Interfacing Steeper motor

### Working with different wireless networking technology 10 Hrs

- NFC
- Bluetooth
- Zigbee
- RFID

### Networking and Communication Protocol 1 Hrs

- IoT Network
- OSI Model
- TCP and UDP
- IP4 and Ip6

### IoT Transport layer protocol 1 Hrs

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

### **HTTP IOT Protocol 4 Hrs**

- Introduction and structure of HTTP protocol
- Application
- 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

### **CoAP IoT Protocol 5 Hrs**

- CoAP Architecture
- Application
- Difference between HTTP and CoAP Protocol
- Design client and server using Python library and implement it.
- Interface using Aneska android app

### **MQTT IOT Protocol 10 Hrs**

- Introduction to MQTT
- MQTT Subscribe/Publish
- MQTT Broker, QoS, Security
- Application
- MQTT with Raspberry Pi
- Installation of Mosquitto MQTT broker
- Publish and Subscriber test on local server broker
- Test with multiple client.
- Getting started with MQTT on Raspberry Pi
- Installing Mosquitto on Raspberry pi
- Making pi a local MQTT broker
- Testing Publish and subscribe model on RPi
- Publishing data from PC
- Android to RPi over a local network
- Controlling Pi GPIOs using [iot.eclipse.org](http://iot.eclipse.org) MQTT broker
- Publishing live sensor data to [io.adafruit.com](http://io.adafruit.com)
- Controlling devices from cloud platform
- Designing the IoT Gateway system
- Gathering data from multiple publishers
- Making Raspberry Pi as a IoT Gateway
- Analyzing sensor data in smartphone over internet
- Analyzing MQTT data packet using Wireshark software.

### **AMQP Protocol 5 Hrs**

- Architecture of AMQP Protocol
- Application
- Producer, Consumer, Broker
- Architecture of RabbitMQ
- Message Exchange type
- Installation of message broker
- Asynchronous message communication between publisher and RabbitMQ
- Using pika implement

### **WebSocket 3 Hrs**

- Understand Architecture of WebSocket
- Application
- Implement using python library TORNADO or pywebsocket
- MQTT over webSockets

### **OPC and UA 5 Hrs**

- Understanding the OPC UA Specification
- Servers (using a free server simulator)
- Clients (using a free client)

- Information Modeling Fundamentals
- Security Implementations
- Server Implementation
- Implementing the Secure Channel
- Methods
- Alarms and Conditions
- Historical Access
- Client Implementation

### **Database 3 Hrs**

- Introduction SQLite database
- Create table
- Syntax, query, operators
- SQLite -container
- Advance SQLite
- SQLite Interface
- Store sensor data/device information into database

### **IoT Applications with Data Logging and Reporting 15 Hrs**

- IoT Platform-Connect, Monitor, Notify
- AWS
- IoT Core
- IoT Analytics
- SNS
- Dynamo db
- IBM Bluemix
- Node red
- Adafruit
- Ubidot
- IFTTT
- MyDevice
- Azure IoT
- IOT Hub
- Stream Analytics
- Storage
- Power BI
- Notification

### **Notify By Twitter,Mail,SMS 2 Hrs**

- Get Notification by sms using Twilio Platform.
- Create twitter app and notify by tweet.
- Notify by mail using SMTP with Python

### **IoT Product & Project Development 2 Hrs**

- Agile Project Development
- Do's & Don't for IoT Project Development
- Indian IoT Products
- Product Development Lifecycle

### **IoT Analytics 1 Hrs**

- Introduction of IoT Analytics
- Machine Learning Technique
- Need of IoT Analytics
- Case Study

### **Sensor Analytics 6 Hrs**

- Handling of sensor data,
- data pre-processing, and integration of different data sources,
- Heterogeneity and distributed nature,
- Selection of sensor to capture right set of data,
- Analog to digital conversion,
- Time and frequency domain analysis,
- Sampling theorem, Aliasing, Selection and cleaning
- Edge analytics

### **Statistical Analytics 6 Hrs**

- Extracting meaning from data,
- Techniques for visualizing relationships in data
- Systematic techniques for understanding the relationships,
- Exploring data – Visualization, Correlation, and Regression, Probability distributions

### **Machine Learning 10 Hrs**

- Concept of machine learning,
- Introduction to Python programming(numpy,pandas,matplotlib,sklearn)
- Regression – Linear and non-linear, Algorithms
- Logistics and non-linear regression,
- Predictive Analytics
- Classification, Algorithms – SVM, Decision trees, boosted decision trees, Naïve Bayes,
- Feature selection methods for classification methods- Information value based, filter based and wrapper
- Algorithms and techniques for marketing analytics – Conjoint analysis, Hidden Markov models
- Time Series Analysis
- Clustering

### **Cloud IoT Analytics Platform 4 Hrs**

- AWS – IoT Analytics
- Azure - Machine Learning Platform

### **IoT Security 1 Hrs**

- Need of IoT Security
- Requirements and Basic Properties
- Main Challenges
- Confidentiality
- Integrity
- Availability
- Non-Repudiation

### **Cryptology 3 Hrs**

- Cipher
- Symmetric Key Algorithms (AES and DNS)
- Attacks
- Dictionary and Brute Force
- Lookup Tables
- Reverse Look Tables
- Rainbow Tables
- Hashing
- MD5, SHA256, SHA512, RipeMD, WI
- Objectives of Data Mining
- Key aspects of Data Mining
- Attack Surface and Threat Assessment
- Embedded Devices
- UART, SPI, I2C, JTAG

### **Network Attacks 1 Hrs**

- Active/Passive Attacks
- Eavesdropping
- Identity Spoofing
- Man-In-The-Middle (MITM)
- IOT Protocol Built-In Security Features
- On Transport Layer
- SSL / TLS and DTLS

### **On Application Layer 1 Hrs**

- MQTT
- CoAP
- XMPP
- AMQP
- Security Management
- Identity and Access Management
- Case Studies and Discussion

### **PLC and IoT 1 Hrs**

### **Augmented Reality with IoT 5 Hrs**

### **Block chain with IoT 6 Hrs**

### **Use Cases (IoT Development, IoT Security, IoT Analytics) 5 Hrs**

- Health Care Sector
- Smart City (Smart parking, lighting, dustbin, trees, using LPWAN Technology)
- Telecommunication
- Energy or Power distribution
- Automobile
- Smart wearable device (Using NFC)
- Agriculture (Smart planting)
- Manufacturing - Industry 4.0 (using PLC, SCADA)

### **Special Advance topic 15 Hrs**

- Introduction to LPWAN
- Communication technology: Wired and wireless
- Internet of Things: Different wireless technologies
- Low Power Wide Area Network (LPWAN)
- Market players

### **LoRa (Radio Modulation)**

- LoRa characteristics
- Radio propagation
- LoRa modulation
- Frequency bands

### **LoRaWAN Architecture**

- Overview
- LoRaWAN network server
- Device classes
- Scalability
- Uplink and downlink messages

## LoRaWAN Hardware

- Gateways
- Nodes
- Prototyping and what hardware to choose
- Production
- Power consumption
- Antennas

## LoRaWAN Solutions

- Case studies and examples
- Sketch on the node libraries
- Payload functions
- Setting up end-to-end application
- Protocols: MQTT, HTTP integration

## Data modeling and processing

- Data storage and visualization
- Cloud platforms and integrations
- Tools: Grafana, InfluxDB, NodeRed

## LoRaWAN Security

- OTAA/ABP Frame counters
- Secure elements
- Encryption and decryption

## LoRaWAN Deployments

- Placing gateways and site surveys
- Enabling ADR (scalability)
- NOC, alerting, updates
- Mass commissioning
- OTA updates
- Security: setting up own handler

Partners :



Java



development | consultancy | training

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