

# **IoT Embedded**

## **Duration- 3 Month**

### **RECAP of EMBEDDED C**

- Datatypes
- Array
- Conditional Statements
- Functions / Callback function
- Structures
- Pointers
- Storage classes

### **EMBEDDED SYSTEM**

- Basic Concepts
- Sensors/Actuators
- Microcontroller units and Architecture (Arduino)
- Interfaces (serial port, SPI, I2C, UART)
- ADC, Timers, RTC, Interrupts, Polling, DMA
- Memory architecture and handling (stack, heap, cache)
- Application driven Selection of Microcontrollers

### **IOT ARCHITECTURE**

- Architecture. Tech Stack.
- Hardware Development Platforms
- Software Development Platforms
- Communication Protocols
- Power Requirements in IoT
- Cloud, its components and IoT
- Data Streaming and IoT
- Data Store and IoT

- Analytics & Visualization and IoT
- IoT Security

### **NODEMCU (ESP8266)**

- Install IDE Software
- Introduction to NODEMCU(Esp8266)
- Pinout of NODEMCU
- Programming Of NODEMCU
- Weather monitoring solution
- Automatic street lights

### **COMMUNICATION**

- Introduction to communication architecture - Network protocol stack
- Different protocols
- RF: ZigBee, BlueTooth, BLE, Zwave, Google thread, Mesh network.
- Communication Channels: GSM/GPRS, 2G, 3G, 4G, LTE, WiFi, PLC
- LPWAN - LoRa & LoRaWAN, Sigfox, Weightless. 3GPP - NB-IoT, LTE -M
- Comparison between different RF Technologies.
- IPv4 addressing problem for IOT and introduction to IPV6

### **ARM MICROCONTROLLER (STM32)**

- Introduction to Microcontrollers (Based on Architecture Selected)
- Instruction set architecture - pipelines
- Registers banks/mode and states
- Clock and reset systems, timers and Memory Organisation
- IDE Configuration, Linker Script, Compiler Optimization Options
- Exception/Interrupt handling
- C and Embedded C Migration
- Memory /IO and peripherals - (I2C/SPI/UART/GPIO/Timer/PWM/ADC)
- Debugging tools like JTAG debugger, CRO
- MMU
- CubeMX

## **ARM PROCESSOR AND ARM BASED SUBSYSTEM**

- ARM Processor Architecture
- Memory /IO and peripherals - (I2C/SPI/UART/GPIO/Timer/PWM/ADC)
- Debugging tools like JTAG debugger, CRO
- MMU
- ARM Based Embedded Subsystem Architecture
- Multicore Architecture

## **NODE-RED**

- Installation of Nodejs,
- Installation of Node-Red,
- Building your first flows
- Basic nodes and flows
- A tour of the core nodes
- The Node-RED programming model
- Dashboards and UI techniques
- Local broker installation,
- Connection between local broker and Node-RED

## **CLOUD COMPUTING**

- Cloud Computing
- Benefits of Cloud
- Deployment Models
- AWS-IOT Core/ Sage-Maker
- Green-grass
- Google IOT Cloud
- Thingspeak
- IBM Bluemix
- AWS
- AZURE
- Google Firebase
- SQL and NoSQL Data bases
- Integration with MySQL

- MongoDB
- IoT Cloud Platform: Device Management

## **IOT SECURITY**

- Introduction to mbed TLS and SSL
- Importance of IoT application
- AES encryption

## **EDGE AI**

- Standards and best practices
- Types of analytics and machine learning
- Supervised/ Un-supervised learning
- Python for IoT analytics
- Computer vision for image data
- Anomaly detection
- Edge Impulse/ TinyML

## **INDUSTRY4.0**

- Road to Industry 4.0
- Role of data, information, knowledge and collaboration in future organizations.
- Related Disciplines, System, Technologies for enabling Industry 4.0
- IoT Deployment with legacy systems PLC/SCADA/OPC-UA