

:- Internet of Things – Our Course Contents :-

Preface:

About this course, Duration, What all we cover, Who this course is for, What all you can expect from this course, What all you cannot expect from this course.

IoT Basics:

What is IoT, Current state of IoT, Progress of IoT, Future scope of IoT, IoT and Raspberry Pi, You as an IoT Magician.

Introductory Session – The Baby World:

Understanding Raspberry Pi: Features, Different parts, Power requirement, Various models, Pre-requisites.

Installation & Settings: Complete installation, Various interface options/settings including VNC & Putty, Connecting to internet using various available methods, Remote access using Putty and Samba, Hello World!, Raspberry Pi and IP address, Headless mode, Understanding Python, Installing essential Python libraries.

Session Level: 1 – The Digital World:

Understanding Components: Resistors, Breadboard, Jumper wires, LEDs, Potentiometer, Voltage division, Resistive Voltage Divider, Analogies and Examples.

Understanding GPIO: Basics of GPIO, Voltage requirement, GPIO pinout of Raspberry Pi 3, Different pin numbering schemes, Programming the GPIOs, LED blinking project.

Digital Programming: Pull-down and Pull-up resistors, Understanding push buttons, Push button & LED, Understanding active & passive buzzers, Programming the buzzer, Understanding 20x4 LCD display, Interfacing & programming the 20x4 LCD display.

Digital Sensor Programming: Characteristics, technical details, features, working principles and interfacing of: DHT11 (humidity & temperature sensor), PIR (motion sensor), IR obstacle detector.

Session Level: 2 – The Talking World:

1-Wire: Basic concepts, Usages, Enabling & disabling 1-Wire in Rpi, 1-Wire communication in Rpi, Understanding and programming the 1-Wire DS18B20 Temperature Sensor.

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UART: Basic concepts, Why UART?, Serial vs Parallel data communication, Understanding UART data frame, Advantages and disadvantages of UART, Types of UARTs in Rpi, Enabling & disabling UARTs in Rpi, Rpi and PC talk.

I2C: Basic concepts, Hardware involved in I2C, Master & slave communication, Understanding the data frame, Data transfer protocol, Clock stretching, I2C interface in Rpi, Enabling & disabling I2C in Rpi, Detecting I2C devices.

SPI: Basic concepts, Why SPI?, Master & slave communication, Different types of master and slave configurations, SPI modes, Advantages and Disadvantages of SPI, I2C vs SPI, SPI interface in Rpi, Enabling & disabling SPI in Rpi.

Session Level: 3 – The Analog World:

PWM: Understanding PWM, Why PWM?, Secret behind PWM, Understanding common terms – Voltage, Amplitude, Cycle, Period & Frequency, Understanding duty cycle, PWM in Rpi, Enabling & disabling PWM channel in Rpi, Hardware vs Software PWM.

Analog to Digital conversion: Sampling rate & resolution, Nyquist Theorem, Quantization, Hold & sample, ADC process, Improvement of accuracy.

ADC ADS1115: Features, I2C addressing, ADS1115 network, Reading potentiometer, LED dimming.

ADC MCP3008: Features & functionality, MCP3008 timing specifics, Reading potentiometer.

Various Sensors: LDR, Measuring Light Intensity, Rpi interface with LDR, LM35 parameters & features, Working of LM35, Rpi interface with LM35, BMP180, Atmospheric Pressure, Measuring Absolute Pressure, Rpi interface with BMP180, Tips and Tricks for BMP180, Cayenne UI tool, HC-SR04, Understanding Ultrasound & Ultrasonic transducers, Working of Ultrasonic Sensors, Working of HC-SR04, Rpi interface with HC-SR04.

Session Level: 4 – The Mechanical World:

DC Motor: Features of DC Motor, Principle of DC Motor, L293D IC, Features of L293D, Pinout of L293D, DC Motor control using L293D & Raspi.

Servo motor: Open loop system, Closed loop system, Servomechanism, Working of a Servo Motor, Gear assembly in Servo Motor, Standard vs Continuous Rotation Servo Motors, Servo Motor control using Raspi.

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Stepper motor: Basics of Stepper Motor, Working principle, Stepper Motor Types and Construction, Unipolar & Bipolar Motors, Wave Mode, Full Step, Half Step, Microstepping techniques. Advantages and Disadvantages of Stepper Motor, Stepper Motor Uses and Applications.

28BYJ-48 Stepper Motor: Characteristics of 28BYJ-48, Electromagnetic behind 28BYJ-48, ULN2003 Driver Board, Different driving methods for 28BYJ-48, Understanding Step Angle, Reversing the Direction, Gearing System & its Impact on Rotation, 28BYJ-48 Motor control using ULN2003 breakout board & Raspi.

Session Level: 5 – The Cool World:

Radio-frequency identification: How RFID works, Transceiver vs Transponder, RFID Applications, RC522, RC522 Features, RC522 Pinout, RC522 Based Security System.

Camera Module: Types, Hardware & Software specifications, Raspi interfacing, Hands-on, Super Cool Web Streaming, Building IP Camera.

Relay: Understanding Relay, Functioning of Relay, Applications of Relay, Relay Controlling LEDs, Relay Controlling Real Bulb.

AC Dimmer – 1289: About AC Dimmer, Features & Specifications, Parallel & Serial input method, Brightness Control of a Bulb – AC Dimmer 1289.

Session Level: 6 – The Networking World:

IR Communication: Visible spectrum & IR, Applications of Infrared Waves, IR Communication Basics, Signal Modulation, IR Transmitters & Receivers, Understanding Raspi rc-core, Configuring remote control for IR signals, Remote Controlled Bulb using Raspi, IR Communication in Raspi.

RF Communication: What is RF?, IR vs. RF, 433MHz RF Module (Transmitter & Receiver), ASK - Amplitude Shift Keying, Where to use 433MHz RF modules, Improving range of 433MHz RF modules, Calculating the length of the Antenna, RF 433MHz Communication in Raspi.

Bluetooth: What is Bluetooth?, Brief history of Bluetooth, Bluetooth profiles, Bluetooth Versions, Bluetooth vs. Bluetooth Low Energy (BLE) in IoT, Understanding Bluetooth Module – HC-05, Configuring HC-05 as Master & Slave role, HC-05 Bluetooth Communication in Raspi, HC-05 controlling with Mobile app in Home Automation.

XBee: What is XBee?, Data Modes in XBee, IoT Topologies for Networking, How XBee devices communicate – Wireless and Point-to-Point communication in XBee, Different Roles of XBee in

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Star Topology, Unicast and Broadcast, Configuring XBee as Coordinator and End Device using XCTU, XBee Basic Chat in Transparent Mode, XBee - Raspi - Thing Speak Talk.

Session Level: 7 – The IoT World:

URL Forwarding: Understanding port forwarding, Say NO to port forwarding, NGROK, Telebit, Localtunnel, USB camera live streaming.

MQTT: Understanding MQTT in IoT, MQTT-SN, MQTT client & broker, MQTT devices & applications, MQTT topics, MQTT publish/subscribe, MQTT - live demo, MQTT QoS simulation, MQTT over Websockets, MQTT Mobile App - Home control across the globe, Understanding Mosquitto, Installing / Upgrading mosquitto in Raspi, Mosquitto live testing, Mosquitto Web App - Home control across the globe.

Firestore: What is Firestore? Building real-time DB in firestore, Installing & configuring firestore in Raspi, Inserting Records into Firestore Realtime Database, Firestore Web App - Home control across the globe.

Understanding CoAP

Amazon AWS:

- What is Amazon AWS
- Understanding AWS IoT Core
- Configuring AWS IoT core
- AWS IoT concepts, components & core services
- Understanding certificates and keys
- AWS IoT Core - developing, configuring & controlling a "thing"
- Managing AWS IAM users, roles & policies
- AWS IAM best practices
- AWS IoT named and un-named shadows
- Python REST APIs to access AWS IoT shadow
- Web REST APIs to access AWS IoT shadow
- Understanding device shadow service document
- JavaScript SDK Web App - Home control across the globe
- Python SDK - Home control across the globe
- Configuring AWS IoT logging
- Monitoring AWS IoT using CloudWatch logs
- Creating/configuring/managing Amazon Cognito identity pool
- Creating/configuring/managing Amazon DynamoDB

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- AWS DynamoDB live demo with graph - storing Raspi health data
- AWS DynamoDB access from Raspi using boto3
- Creating/configuring/managing Amazon SNS
- Features and capabilities of Amazon SNS
- Amazon SNS live demo - sending email
- Amazon SNS access from Raspi using boto3
- Creating/configuring/managing Amazon Lambda
- Amazon Lambda live demo - invoking SNS service
- Lambda function monitoring in CloudWatch
- Amazon Lambda access from Raspi using boto3

Amazon Alexa Voice Service: Understanding the Alexa Voice Service (AVS), Overview of the AVS Device SDK, SDK architecture, Microphone & Speaker configuration, Registering an AVS device with the Amazon, Installing & configuring AVS Device SDK on your Raspberry Pi, Building the AVS sample app and run it on your Raspberry Pi, Developing Smart Home Skill from scratch, Understanding, creating & testing AWS Lambda function, Monitoring Lambda function in CloudWatch, Controlling home devices using Raspberry Pi Alexa.

XMPP, Sensors talking to Android app, Sensors talking to IoT server, Android app controlled home appliances, IoT server controlled home appliances, Android app controlled stepper motor, IoT server controlled stepper motor, Android app controlled room's brightness, IoT server controlled room's brightness, Developing chat application using XMPP, Google voice assistance, Home control across globe implementing OK Google!

Session Level: 8 – The ESP World:

ESP: Understanding an ESP, Features, Supported SDKs, Installing drivers, pip, ampy, esptool, openssl, WebREPL & Tera Term, Burning the MicroPython firmware in ESP, Connecting ESP to our WiFi, Learning ESP8266 & MicroPython from scratch to hello world, Push button and LED glow on ESP8266 using MicroPython, Sending sensor data to Amazon AWS using ESP8266 & MicroPython, Sending sensor data to Firebase Realtime Database using ESP8266 & MicroPython, Understanding & implementing ESP8266 webserver, Learning ESP32 & MicroPython from scratch to hello world, Understanding & developing Telegram Bot, Developing ESP32 - MicroPython & Telegram integration, Controlling ESP32 from Telegram app, Understanding ESP32 & SD card reader module, ESP32 & Arduino IDE, Understanding & implementing ESP SPIFFS File systems.