

Short Term Courses-NIELIT Gangtok Centre

Certificate Course in Internet of Things (IoT) Using Raspberry Pi

Objective of the Course:

This course elucidates concepts related to Internet of Things. The students will get hands-on experience in working with Raspberry Pi and exploring IoT.

Learning Outcome:

After completion of the course, students will be able to understand the working of Raspberry Pi, its features and how various components can be used with Pi. The students will be able to understand IoT practically.

Duration of the Course: 60 hours

Minimum Eligibility Criteria:

- 1) Pursuing/Passed B.E./B. Tech (CS/IT/EEE/ECE)/ MCA/ BCA/ BSc/MSc / Polytechnic Diploma/ NIELIT 'O' Level with graduation/ NIELIT 'A' Level.
- 2) Knowledge of basic programming.

COURSE OUTLINE

Sr. No.	Modules to be Covered
1	Overview of IoT
2	Overview of Embedded Systems
3	Hardware and Software Components in IoT devices
4	Interaction between Hardware and Software in IoT devices
5	Getting started with Raspberry Pi
6	Introduction to Linux Operating System and Linux Commands
7	Introduction to Raspbian Operating System and Booting Up Raspberry Pi
8	Basic operations of the Raspberry Pi
9	Working with Python

10	General Purpose I/O (GPIO) and their control using Python
11	Introduction to networking in relation to IoT applications
12	Communication between Raspberry Pi/IoT components over the network
13	Communication between Raspberry Pi and IoT-based Clouds
14	Applications of IoT using Raspberry Pi in Social media (Use case)
15	Project (Only for students opting for Training with Project)

Detailed Course Syllabus:

1. Overview of IoT

- Understanding IoT fundamentals
- Definition of the term Internet of Things (IoT)
- Technological trends leading to IoT
- IoT and its impact on society
- IoT Architecture and Protocols
- Real time examples of IoT
- Overview of IoT components and IoT Communication Technologies

2. Overview of Embedded systems

- Definition of an embedded system in terms of its interface
- Components of an embedded system
- How embedded systems interact with the physical world

3. Hardware and software components in IoT devices

- The core hardware components commonly used in IoT devices
- Sensors and Actuators

4. Interaction between hardware and software in IoT devices

- Role of an operating system to support software in IoT devices

5. Getting started with Raspberry Pi

- Introduction to Raspberry Pi
- Comparison of various Raspberry Pi Models
- Understanding SoC architecture and SoCs used in Raspberry Pi
- Pin description of Raspberry Pi
- On-board components of Raspberry Pi and their functions
- Projects using Raspberry Pi

6. Introduction to Linux Operating System and Linux Commands

- Linux- Introduction, Architecture, File System
- Popular Linux Commands

7. Introduction to Raspbian Operating System and Booting Up Raspberry Pi

- Raspbian O.S.- Introduction
- Installing Raspbian Linux for Pi

- Setting up boot options for Raspbian and Configuration
- Tools available in Raspbian for Raspberry Pi.

8. Basic operations of the Raspberry Pi

- Concept of users and the login process
- Viewing and modifying the file system
- Files and their permissions
- The nature of processes and their management

9. Working with Python

- Introduction, Python vs. Other Languages, Applications of Python
- Understanding Python, Interpreted Languages
- How to use the Python shell and execute programs
- Variables, Keywords, Operators and Operands
- Data Types in Python, Importing Libraries
- Boolean and algebraic expressions
- Strings and their operations and methods
- How to define and invoke functions
- Flow Control, Conditional Statement, Loops

10. General Purpose I/O (GPIO) and their control using Python

- The General Purpose Input/ Output (GPIO) pins and their features
- Use of the GPIO library to access the GPIO pins
- Interfacing sensors and Actuators to Raspberry Pi using Python
 - LED Blinking, Temperature and Humidity Sensor (DHT11) Integration with Pi, Integrating Motion Sensor (PIR), Obstacle detection using Ultrasonic/Distance sensor, Servo control, Buzzer, Photo Detector/Light Dependent Resistor (LDR),
- Integration of Camera module
 - Raspberry Pi Camera Module - Picamera library
 - Camera functions: capture images, change settings, capture video, time lapse photos, etc.

11. Introduction to networking in relation to IoT applications

- Introduction to networking and basic networking hardware
- Network protocol
- Client Server concepts
- Introduction to the structure of the Internet

12. Communication between Raspberry Pi/IoT components over the network

- MQTT Protocol

- Controlling the hardware through a Web Page – creating custom web pages using HTML.
- GPIO control over Web Server.
- Installation of LAMP Web Server on Raspberry Pi.
- Communicating using RPi- GSM interfacing
- Accessing on-board Wi-Fi
- Communicating data using on-board module

13. Communication between Raspberry Pi and IoT-based Clouds

- Introduction to Cloud Computing
- Various types of Cloud Services - IaaS, PaaS, etc
- IoT clouds, API and library
- Raspberry Pi data visualization in ThingSpeak cloud
- Raspberry Pi sensor data visualization in ThingSpeak cloud
- Publish strings from Raspberry Pi to PubNub cloud

14. Applications of IoT using Raspberry Pi in Social media (Use case)

- Twitter's API; Registering your twitter app; Authentication keys
- Sending tweets & Reading twitter streams
- Callback functions
- Responding to tweets

15. Project

