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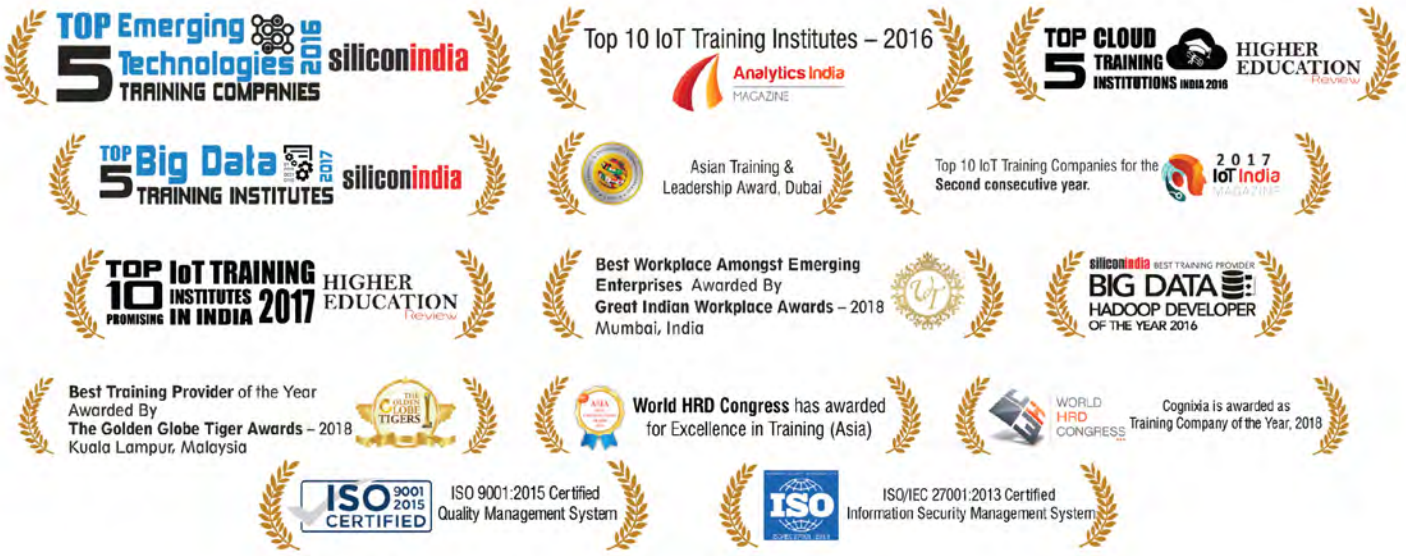
360°
Master's Program
Internet of Things Security Expert



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Internet of Things Security Expert

Program Modules

- **Python**
- **Advance IoT Training & Certification Program**
- **Internet of Things Security**

Python Overview Course Content

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Python

Python overview
- Syntax and structure
- Comparisons to other languages (C, C++, Java, etc)
- Available Python Resources
- Whitespace, Indentation and program formatting
- Variables and Naming Conventions
- Operators
- Statement structure
- Comments
- Program Construction

Data Types
- Built-in Types
- Strings and Numbers
- Formatting Data, Numbers, Dates
- Using Lists/Arrays
- Tuples
- Dictionaries
- Understanding Dynamic Typing
- Working with Functions
- Python Code Execution
- Basic Input / Output
- String Operations
- Working with Tuples and Lists
- Introducing Control Flow Statements

Functions
- Variable Scope
- Variable Parameters
- Default Values
- Positional Parameters
- Keyword Parameters
- Introducing Lambdas
- Exception Handling

Classes in Python
- Creating Classes in Python
- Classes are Namespaces
- Constructors
- Self and Instances
- Class Variables
- List Comprehensions

- Advance Python Modules
- Default Values
- Positional Parameters
- Keyword Parameters
- Introducing Lambdas
- Exception Handling

Advance IoT Training & Certification Program Course Content

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Advance IoT training & Certification Program

Topics covered in the training

Learning outcome/Objective:

Participants will have:

- Expert level knowledge of IoT technology, tools, and trends.
- Sound understanding of core concepts, background technologies and sub-domains of IoT.
- Knowledge and skills of sensors, microcontrollers, and communication interfaces to design and build IoT devices.
- Knowledge and skills to design and build network based on client-server and publish-subscribe to connect, collect data, monitor and manage assets.
- Knowledge and skill to write device, gateway and server side scripts and apps to aggregate and analyze sensor data.
- Knowledge and skills to select application layer protocols and web services architectures for seamless integration of various components of an IoT ecosystem.
- Knowledge of standard development initiatives and reference architectures.
- Understanding of deploying various types of analytics on machine data to define context, find faults, ensure quality, and extract actionable insights.
- Understanding of cloud infrastructure, services, APIs, and architectures of commercial and industrial cloud platforms.
- Understanding of prevalent computing architectures – distributed, centralized, edge and Fog.

Content

- Introduction to Internet of Things
    - Concept and definitions
        a. Embedded Systems, Computer Networks, M2M (Machine to Machine Communication), Internet of Everything (IoE), Machine Learning, Distributed Computing, Artificial Intelligence, Industrial automation
        b. Interoperability, Identification, localization, Communication, Software Defined Assets
    - Understanding IT and OT convergence: Evolution of IIoT & Industrie 4.0
    - IoT Adoption
        a. Market statistics, Early adopters, Roadmap
    - Business opportunities: Product + Service model
        a. Development, deployment and monetization of applications as service
    - Use cases

- Concept of Data, Information, Knowledge and Wisdom
    - Knowledge discovery process
    - DIKW pyramid and relevance with IoT
    - Microcontrollers: cost, performance, and power consumption
        a. Commercial microcontroller based development boards
        b. Selection criteria and tradeoffs

    Industrial networks, M2M networks
- Sensor Data Mining and Analytics
    - Transducer: Sensor and Actuator
        a. Sensors – Types of sensors, sampling, analog to digital conversion, selection criteria of sensor and ADC
    - Data acquisition, storage and analytics
    - Signals and systems
        a. Signal processing, systems classification, sampling theorem, ensuring quality and consistency of data
    - Real time analytics
    - Understanding fundamental nuances between IoT and Big data
    - Usage of IoT data in various business domains to gain operational efficiency
- Edge analytics
    - Data Aggregation on Edge gateway

- Wireless Sensor Area Networks (WSAN): Evolution of M2M and IoT networks and technologies

    - Sensor nodes
        a. Sensor node architecture
        b. WSN/M2M communication technologies
        c. Bluetooth, Zigbee and WiFi communication technologies
        d. Cellular communication and LPWAN (LoRa and LoRaWAN) technologies
    - Topologies
    - Applications
- Design and Development of IoT systems
    - IoT reference architectures
        a. Standardization initiatives
        b. Interoperability issues
    - IoT design considerations
        a. Architectures Device, Network and Cloud
        b. Centralized vs distributed architectures
    - Networks, communication technologies and protocols
    - Smart asset management: Connectivity, Visibility, Analytics, Alerts

- Cloud computing and platforms
    - Public, Private and Hybrid cloud platforms and deployment strategy
    - Industrial Gateways
        a. Commercial Gateways solutions from various vendors
        b. Cloud based Gateway solutions
    - IaaS, SaaS, PaaS models
    - Cloud components and services
        a. Device Management, Databases, Visualization, Reporting, Notification/Alarm management, Security management, Cloud resource monitoring and management
    - Example platforms: ThingSpeak, Pubnub, AWS IoT
        - AWS IoT Services
            a. Device Registry
            b. Authentication And Authorization
            c. Device Gateway
            d. Rules Engine
            e. Device Shadow
- IoT security
    - Standards and Best practices
        a. Common vulnerabilities
        b. Attack surfaces
        c. Hardware and Software solutions
        d. Open source initiatives
- Analytics
    - Descriptive, Diagnostic, Predictive and Prescriptive
    - Analytics using Python advance packages: Numpy, Scipy, Matplotlib, Pandas and Sci-kit learn

- Case studies and roadmap
    - Cold chain monitoring
    - Asset tracking using RFID and GPRS/GPS

Hands-on/Practical exercises:

1. Programming microcontrollers (Arduino, NodeMCU)
2. Building HTTP and MQTT based M2M networks
3. Interfacing Analog and Digital sensors with microcontroller to learn real-time data acquisition, storage and analysis on IoT endpoints and edges
4. Interfacing SD card with microcontroller for data logging on IoT end devices using SPI protocol
5. Interfacing Real-time clock module with microcontrollers for time and date stamping using I2C protocol
6. Python exercises to check quality of acquired data
7. developing microcontroller based applications to understand event based real time processing and in- memory computations
8. Setting up Raspberry Pi as Gateway to aggregate data from thin clients
9. Python programming on Raspberry Pi to analyze collected data
10. GPIO programming using Python and remote monitoring /control
11. Pushing collected data to cloud platforms
12. Designing sensor nodes to collect multiple parameters (Temperature, Humidity etc)
13. Uploading data on local gateway as cache
14. Uploading data on cloud platforms
15. Monitoring and controlling devices using android user apps and Bluetooth interfaces
16. Building wireless sensor networks using WiFi
17. Sensor data uploading on cloud using GSM/GPRS
18. Device to device communication using LoRa modules
19. Remote controlling machines using cloud based apps
20. Remote controlling machines using device based apps through cloud as an intermediate node
21. Interfacing Raspberry Pi with AWS IoT Gateway service to exchange messages
22. Interfacing Raspberry Pi with PUBNUB cloud to understand publish/subscribe architecture and MQTT protocol
23. Data cleaning, sub setting and visualization
24. Set of python exercises to demonstrate descriptive and predictive analytics
25. Case study/Use case:
    a. Environment Monitoring
    b. Health monitoring (Wearable)
    c. Asset performance monitoring

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Internet of Things Security

Content

- Introduction to IOT - 30 Min
- IoT Architecture - 30 Min
- Securing the IoT - 30 Min
- IoT Vulnerabilities - 1 hour
- Awareness of Attacks - 2.5 hours
- IoT Security Challenges - 1 hour
- Secure Communications - 2 hours
- Fundamentals of Cryptography - 3 hours
- IoT Authentication and Authorization - 1 hour
- IoT Data Integrity - 1 hour
- IoT Security Standards - 2 hours
- Emerging Technologies for IoT Security - 1 hour
- Possibilities for Hackers on IoT devices - 1 hour
- Protection for the Device - 1 hour
- Protection for Data - 1 hour
- Security Management - 2 hours
- Analyzing the Risks - 1 hour
- Device Firmware Exploitation - 3 hours
- Public key cryptography - 30 min
- Digital Signature - 30 min
- Authentication, Authorization & Integrity - 1 hour
- Implement Technical Countermeasures - 1 hour
- NIST Cybersecurity Framework - 1 hour
- NERC-CIP security standards - 1 hour
- IEEE P1619 encryption of data on fixed and removable storage devices - 1 hour
- IEEE P2600 - 1 hour
- IEEE 802.1ae - 1 hour
- IEEE 802.1x - 1.5 hours
- WiFi Vulnerabilities - 4 hours
- Classic Bluetooth Security - 2 hours
- BR/EDR Security - 2 hours
- BLE Security - 3 hours
- BLE Vulnerabilities - 1 hour
- ZigBee Vulnerabilities - 2 hours