Curriculum

The IoT Academy
Connecting The Unconnected

Embedded Systems
and
Internet of Things(IoT)

Course by

The IoT Academy

Duration - 6 months

About Us

We are a fast emerging company imparting quality and affordable programs for colleges and individuals for digital economy skills training, internship and guidance focused on helping people develop the skills they need to thrive in the rapidly growing digital economy.
The IoT Academy has made a niche name for itself providing rigorous online/offline training in Data Science, Machine Learning, AI, Python, Java, Internet of Things (IoT), Embedded Systems, Big Data, Data analytics, Industrial IoT, Industry 4.0, Digital marketing, Etc. Based in Delhi NCR since 2017 we have helped 150+ professionals, 600+ students and 100+ faculties across the states get trained, acquire certifications, and upskill their employees.

We have an easy and affordable learning solution that is accessible to millions of learners. With our learners spread across countries like the US, India, UK, Canada, Singapore, Australia, Middle East, Brazil, and many others, we have built a community of over 1 million learners across the globe.

Vision

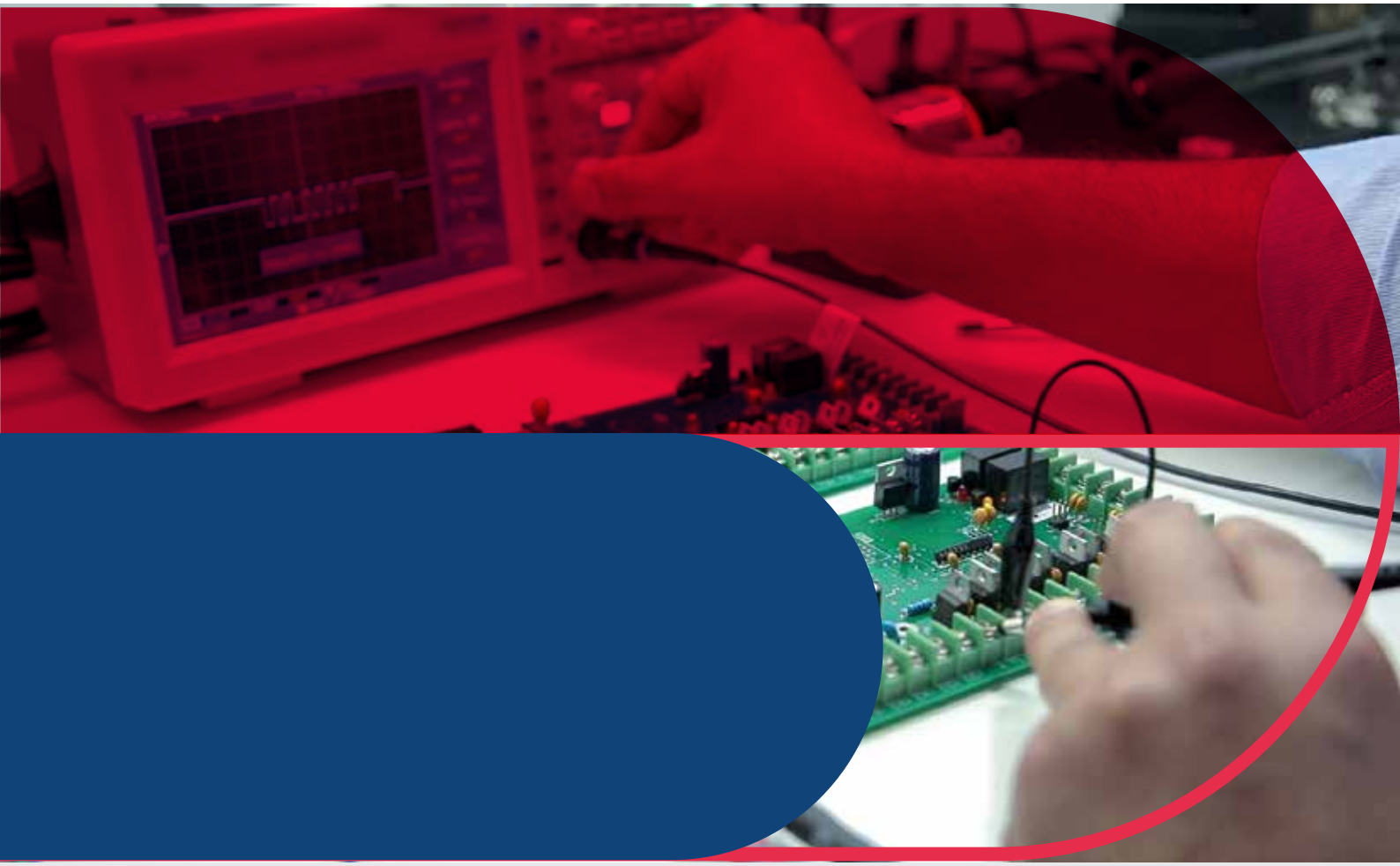
We aspire to provide learners an edge over the career they choose to stand out amongst today's competitive world through support in training and various academic and industrial collaborations.

Mission

At IoT Academy We believe that the future Converged reflected is about Unified and technologies as in our mission statement. Every aspect of life will eventually lead in bringing forth a unified world of immense possibilities

About the Program

This comprehensive course on Embedded Systems and Internet of Things (IoT) provides students with a deep understanding of the principles, design methodologies, and practical applications of embedded systems and IoT technologies.The course delves into the exciting realm of IoT, exploring the architecture and components that enable devices to connect and communicate over the internet. You will study wireless communication protocols, cloud computing, data analytics, and security mechanisms relevant to IoT applications. Practical projects will guide students in developing IoT-enabled devices, implementing data collection and analysis, and ensuring robust security measures



Advance Embedded & IoT System (6 months)

Recap of Embedded C

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

PYTHON

- Data types and type conversion
- Variables and basic operations
- Flow control
- Loops
- Lists, Set and Tuple
- Dictionary
- Functions
- File Handling
- Class and Objects
- Error/ Exception Handling

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

SIGNAL AND ACQUISITION

- Analog and Digital
- Industrial Terminology

INTRODUCTION TO IOT

- A What is IoT
- IoT application in different domains
- Trends in IoT Market
- Smart things
- Gateways
- Middleware
- Edge vs Cloud functional partitioning

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

LIVE USE CASES

- Claims to cold chain
  (Haldiram Chain: Customers complaining about not getting right temperature of food items)
- Automation of irrigation
- H/W Components
  Client, Device, Rule, Alarm, Device Data, Event
  Sensor data being sent to Cloud platform
  Actuation through BLE
  Visualization through real time dashboard
  How the problem gets solved through big data and visualization

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

RPI

- Introduction to Raspberry pi
- Setup and installation
- Raspberry pi OS walkthrough
- Network setup
- Code execution and data generation
- Sending data to cloud

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

EMBEDDED LINUX

LINUX INTERNALS

- Linux internals
- Linux introduction and installation.
- Linux Shell Commands
- Shell Scripting
- C Programming in Linux
- Make Files
- Process Management
- File Operation
- Signals in Linux
- Linux Scheduler & Memory Management
- Linux Multi-Threading Programming
- Inter Process Communication (Pipes, Semaphores, Queues, Shared Memory)
- Network Programming in Linux

SOCKETS

- Socket connection
- Socket Attributes
- Creating a Socket
- Socket Addresses
- Naming a Socket
- Creating a Socket Queue
- Accepting Connections
- Requesting Connections
- Closing a Socket
- Socket Communications Processes and Signals
- What is process?
- Process Structure
- The Process Table
- Viewing Processes
- System Processes

MODULE-II: ELINUX PORTING

- Introduction, Setup & Hardware
- Toolchain & Hardware Practical's
- Bootloader U-Boot
- U-Boot Porting
- Customizing Bootloader
- Linux Kernel
- Kernel Porting & Compilation
- Kernel Modification
- Root File System
- Embedded Application Development

MODULE-III: LINUX - DEVICE DRIVERS

- Introduction and Arch of Linux Device Drivers
- Kernel Module Programming
- Character Device Drivers
- Interrupts in Device Driver
- Interrupt Handling & Bottom Half
- Process creation calls (fork,vfork,execv)
- LDDM (Linux Device Driver Model)
- Writing and testing of Board File
- Device Tree
- Advance Device Drivers
- Debugging Techniques using GDB & valgrind other tools.

INTER-PROCESS COMMUNICATION

- Pipes
- Semaphores, message queues and shared memory
- Shared Memory
- Message Queues

MODULE-IV: YOCTO

- Yocto Architecture
- Recipes defines everything in Yocto
- Layers makes Yocto Modular & Structured
- Adding new Hardware support using BSP Layers
- Custom Distribution & Images
- Creating SDK using Yocto for Application Development

IOT PROTOCOLS

- Yocto HTTP/REST, MQTT, COAP, AMQP, WEBSOCKETS, 6LoWPAN

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/ SageMaker
- Greengrass
- 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

- Introduction to Industry 4.0
- 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

USECASES

- Automobile
- Electrical Vehicle

Certifications:

Upon successfully completing this program, you'll Learn **Internet of Things Certification Course (IoT)**

This certificate will testify to your skills as an expert in **Internet of Things (IoT)**

THANK YOU

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By The IoT Academy

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