Arduino Essentials for IoT Applications

Course Description

This course is designed to introduce students to the world of IoT hardware and programming. Students will learn the basics of hardware design and wiring, as well as how to interface with sensors and actuators. The course also covers the use of software libraries with an Arduino sketch and the use of shields to extend the capabilities of an Arduino-based system.

Audience

This course is suitable for beginners who are interested in learning about IoT hardware and programming. No prior experience with electronics or programming is required

Hardware Requirements

Students will need access to an Arduino board, a breadboard, basic electronic components (resistors, capacitors, LEDs, etc.), and sensors/actuators (e.g. temperature sensor, light sensor, servo motor, etc.).

Pre-requisite Knowledge/Skills

No prior knowledge of electronics or programming is required for this course. However, students should have a basic understanding of computer usage and be comfortable with installing software.

Course Objectives

Upon completing this course, students will be able to:

1. Design and implement basic circuits using passive components
2. Interface with sensors and actuators using Arduino
3. Use software libraries to simplify programming of hardware peripherals
4. Extend the capabilities of an Arduino-based system using shields
5. Connect an IoT device to the Internet using Ethernet and WiFi shields

Course Outline

The course comprises of 6 modules. The duration of the course is 16 hours.

Module 1: Introduction to IoT Device Hardware Design

- Electrical Circuits
- Electrical Properties
- Ohm's Law
- Electrical Components

- Diodes
- Switches, Potentiometers
- Wiring
- Wiring Demo, Pushbutton
- Wiring Demo, Potentiometer

Module 2: Sensors and Actuators

- Introduction to Sensors and Actuators
- Resistive Sensors
- Resistive Sensor Demo
- Actuators
- Analog Actuators
- Pulse Width Modulation
- Demo Fade Example
- Making Sounds
- Demo Music System

Module 3: Software Libraries for IoT Devices

- Introduction to Arduino Libraries
- EEPROM (Updated)
- Masking (Updated)
- I2C Communication
- I2C Transactions
- Sending Bits
- Wire Library
- Master Communication
- Slave Operation

Module 4: IoT Device Networking with Shields

- Introduction to Arduino Shields
- Ethernet Shield
- Ethernet Library
- Ethernet Client
- Client Examples
- Ethernet Server
- Ethernet Shield Demo
- WiFi Shield

- WiFi Shield Demo

Module 5: IoT Device Programming with Arduino

- Introduction to Arduino Programming
- Arduino IDE
- Data Types and Variables
- Conditionals and Loops
- Functions
- Arrays
- Strings
- Serial Communication

Module 6: IoT Device Deployment and Security

- Introduction to IoT Device Deployment
- Power Management
- Device Enclosure Design
- Introduction to IoT Device Security
- Cryptography
- Authentication and Authorization
- Secure Communication Protocols