

## **Level 1 – Fundamentals of Sensors & IoT (Basic Concepts)**

**Goal:** Introduce basic sensors, IoT concepts, and applications.

1. Introduction to IoT
  2. Basic Sensors – Temperature, Light, Pressure
  3. Actuators – Motor, Relay, LED
  4. IoT architecture (Perception, Network, Application Layer)
  5. Applications of IoT – Smart Home, Wearables, Agriculture
  6. Units of measurement, data acquisition basics
  7. Sensor interfaces – Digital vs Analog
  8. Basics of wireless communication (Wi-Fi, Bluetooth)
  9. Microcontroller basics for IoT (Arduino, ESP32)
  10. IoT data flow and simple examples
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## **Level 2 – Sensor Types & Principles**

**Goal:** Understand how different sensors work and interface with systems.

1. Temperature sensors – Thermistor, LM35, DS18B20
  2. Light sensors – LDR, Photodiodes, Phototransistors
  3. Motion sensors – PIR, Accelerometer, Gyroscope
  4. Proximity sensors – Ultrasonic, IR sensors
  5. Pressure & force sensors – Piezoelectric, Force-sensitive resistors
  6. Gas sensors – MQ series
  7. Sensor characteristics – Sensitivity, Accuracy, Resolution, Range
  8. Analog-to-Digital Conversion
  9. Sensor calibration techniques
  10. Basics of sensor interfacing with microcontrollers
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## **Level 3 – Microcontrollers & Communication Protocols**

**Goal:** Learn the hardware & software communication for IoT systems.

1. Microcontrollers & microprocessors for IoT (Arduino, ESP32, Raspberry Pi)
  2. GPIO, ADC, PWM basics
  3. Serial communication – UART, SPI, I2C
  4. Wireless communication protocols – Wi-Fi, Bluetooth, Zigbee, LoRa
  5. MQTT – Publish/Subscribe model
  6. HTTP & REST for IoT devices
  7. Data collection and logging
  8. Sensor network topologies
  9. Basics of real-time monitoring
  10. Edge vs Cloud computing for IoT
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## **Level 4 – IoT System Design & Architecture**

**Goal:** Understand how to design IoT systems for real-world applications.

1. IoT system components – Sensor, Actuator, Gateway, Cloud
  2. IoT system architecture layers – Perception, Network, Middleware, Application
  3. Data acquisition & preprocessing
  4. Embedded programming for IoT devices
  5. Power management and low-power IoT devices
  6. IoT protocols – CoAP, MQTT, HTTP
  7. IoT security basics – Authentication, Encryption
  8. IoT gateways and edge computing
  9. Device addressing & identification (IP, MAC, Unique ID)
  10. Sensor fusion and integration
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## **Level 5 – IoT Data Analytics & Cloud Integration**

**Goal:** Learn to process IoT data and integrate with cloud platforms.

1. IoT data types – Time-series, Event-driven, Streaming data
  2. Cloud platforms – AWS IoT, Azure IoT Hub, Google Cloud IoT
  3. Data storage & database for IoT – SQL, NoSQL, Time-series DB
  4. IoT dashboards – Node-RED, ThingsBoard
  5. Real-time data processing – MQTT brokers, WebSocket
  6. Data visualization – Charts, Graphs, Alerts
  7. IoT analytics – Basic trend analysis, anomaly detection
  8. Remote device monitoring and control
  9. Data logging & cloud storage
  10. IoT REST APIs integration
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## **Level 6 – Advanced IoT & Applications**

**Goal:** Apply IoT concepts to advanced systems and real-world problems.

1. Industrial IoT (IIoT) – Smart factories, SCADA integration
2. Smart agriculture, smart city applications
3. IoT security – Threats, Attacks, Mitigation techniques
4. Machine learning for IoT – Predictive maintenance, Anomaly detection
5. IoT edge computing – On-device intelligence
6. Sensor networks – Wireless sensor networks (WSN), mesh networks
7. Energy harvesting & low-power IoT devices
8. IoT system scalability & reliability
9. Integration with AI, ML, and big data
10. Case studies & real-world IoT projects