IoT Concepts and Applications

Course Learning Objectives	• Understand the basic knowledge of IoT that paves a platform to understand physical and logical design of IOT • Analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms. • Learn the technologies behind Internet of Things(IoT). • Code for an IoT application using Arduino/Raspberry Pi open platform. • Apply the concept of Internet of Things in a real world scenario.
Course Outcomes	• Exhibit the learnings on the concept of IoT. • Analyse the communication models and various protocols for IoT. • Design portable IoT using Arduino/Raspberry Pi /open platform • Apply data analytics and use cloud offerings related to IoT. • Analyze applications of IoT in real time scenario.

Course Duration: 45 Hours

UNIT I: INTRODUCTION TO INTERNET OF THINGS

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT

Lab Component & Outcome

• Interfacing sensors

UNIT II: COMPONENTS IN INTERNET OF THINGS

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

Lab Component & Outcome

● Interfacing to Zigbee module

● Interfacing to GSM module

● Interfacing to Bluetooth Module

UNIT III: PROTOCOLS AND TECHNOLOGIES BEHIND IOT

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing, Embedded Systems.

Lab Component & Outcome

● Setup a cloud platform to log the data

● Log Data using Raspberry PI and upload to the cloud platform

● Communicate between Arduino and Raspberry PI using any wireless medium

●

UNIT IV: OPEN PLATFORMS AND PROGRAMMING

IOT deployment for various platforms -Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

Lab Component & Outcome

● IoT platform and programming

UNIT V: IOT APPLICATIONS

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

Lab Component & Outcome

● Design an IOT based system

Test Projects:

Use Cases:

1. **Street Light Management**

Task 1: Implement smart streetlights with IoT capabilities.

Task 2: Integrate light sensors for adaptive brightness.

Task 3: Set up a centralized control system for remote monitoring.

Task 4: Implement power management to optimize energy usage.

Task 5: Use communication modules for real-time status updates.

2. **Fire Detection System:**

Task 1: Deploy fire detection sensors in strategic locations.

Task 2: Integrate smoke detectors for early warning.

Task 3: Establish a communication system for alerts (Wifi, GSM).

Task 4: Connect sensors to a centralized monitoring system.

Task 5: Implement interfaces for emergency alerts to relevant authorities.

3. **Smart Shirt for Health Monitoring:**

Task 1: Develop a smart shirt with embedded health sensors.

Task 2: Integrate sensors for continuous health monitoring.

Task 3: Implement Bluetooth for data transmission to a mobile app.

Task 4: Design a user-friendly app for real-time health data.

Task 5: Connect to a cloud platform for historical data analysis.

4. Waste Management System

Task 1: Install smart bins with fill level sensors.

Task 2: Implement a route optimization system for waste collection.

Task 3: Set up alerts for bins reaching capacity.

Task 4: Integrate with city infrastructure for efficient collection.

Task 5: Develop a citizen reporting system for waste issues.

5. Smart Parking System

Task 1: Deploy sensors to detect parking space occupancy.

Task 2: Implement a mobile app for real-time parking availability.

Task 3: Set up automated payment systems.

Task 4: Integrate with navigation apps for parking guidance.

Task 5: Develop a system for reporting abandoned vehicles**.**

6. Air Quality Monitoring:

Task 1: Deploy air quality sensors in urban areas.

Task 2: Implement a real-time air quality index.

Task 3: Set up alerts for high pollution levels.

Task 4: Integrate with city infrastructure for traffic control.

Task 5: Develop a public-facing app for air quality information.

7. Smart Home Automation:

Task 1: Identify and select IoT-enabled devices for home automation.

Task 2: Set up a centralized control system.

Task 3: Implement voice control using a virtual assistant.

Task 4: Create automation routines for energy efficiency.

Task 5: Enable remote monitoring and control.

8. Agricultural Crop Monitoring

Task 1: Deploy soil moisture sensors.

Task 2: Implement a weather station for environmental data.

Task 3: Develop a crop health monitoring system.

Task 4: Set up automated irrigation based on sensor data.

Task 5: Provide a mobile app for farmers to monitor remotely.

9. Smart Energy Management

Task 1: Install smart meters for energy consumption.

Task 2: Implement a system for real-time energy monitoring.

Task 3: Set up automated energy usage patterns.

Task 4: Integrate with renewable energy sources.

Task 5: Provide user-friendly interfaces for energy control.

10. Traffic Management System

Task 1: Deploy smart sensors for traffic flow monitoring.

Task 2: Implement a centralized traffic control system.

Task 3: Develop predictive algorithms for congestion.

Task 4: Set up dynamic traffic signal control.

Task 5: Provide a mobile app for real-time traffic updates.

11. Disaster Early Warning System:

Task 1: Deploy environmental sensors for weather monitoring.

Task 2: Integrate seismic activity detectors for earthquake detection.

Task 3: Implement communication modules for real-time alerts.

Task 4: Connect to a centralized system for disaster monitoring.

Task 5: Develop public alert interfaces for timely warnings.

12. Smart City Safety - Emergency Response:

Task 1: Install emergency buttons in key public areas.

Task 2: Integrate location sensors for precise information.

Task 3: Connect surveillance cameras to monitor emergency situations.

Task 4: Implement communication modules for real-time alerts.

Task 5: Develop a centralized system for emergency response.

Student Assessment Plan:

Each of the above-mentioned test projects will be divided into tasks by the training partner for each specific institution. Such tasks will be jointly evaluated by the faculty and the training partner and the following weightage is to be followed.

- 70% weightage to the external practical assessment.
- 30% weightage to the internal assessment.

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 70%

Details	**Marks**
Task: 1	20
Task: 2	20
Task: 3	20
Task: 4	20
Task: 5	20

Employment Potential:

This course shall enable mechanical, electrical and allied domain Engineers to get employment in sectors like Manufacturing, Assembly, Logistics, Warehouse, Packaging, Finance and etc .