FF No. : 654

COURSE CODE: CS2221 COURSE NAME: INTERNET OF THINGS

Course Prerequisites:

Students should have a basic Understanding of the Internet, Cloud, Networking Concepts and Sensors

Course Objectives:

The student will be able to

1. Understand IoT Architecture and framework.
2. Recognize and differentiate between the various use cases of different sensors, actuators, solenoid valve etc
3. Learn about fundamental concepts of networking and protocols.
4. Understand IoT Physical, Data link and Higher layer Protocols.
5. Apply theoretical knowledge for Cloud computing.
6. Implement an IoT solution practically

Credits: 5 **Teaching Scheme Theory: 3** Hours/Week
Tut: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance:

The Internet of Things is transforming our physical world into a complex and dynamic system of connected devices on an unprecedented scale. Internet of Things is a system of interrelated computing and sensing devices and has the ability totransfer data over a network without requiring human-to-human or human-to-computer interaction.

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offersincreasing opportunities to collect, exchange, analyse and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations. In a world which is moving towards an increasingly connected future, Internet of Things (IoT) is the next big thing. Right from our homes to our cars to our cities, everything is being connected and the technology of IoT is right in the middle of it.

SECTION-1
Introduction to IoT Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels & Deployment Templates, IoT and M2M **(6 Hours)** **IOT Platform Design Methodology** IoT Design Methodology Steps, Home Automation Case Study, Smart Cities, Health Care, Agriculture, Manufacturing and Logistics **(7 Hours)** **IoT Devices** IoT System Design Cycle, Sensors - Terminologies, Calibration, Types, Specification, Use, Actuators - Types and Use, Prototype Development Platform - Arduino / Raspberry pi / Node MCU, Interface with Embedded System **(7 Hours)**
SECTION-1I
Introduction to Wireless Sensor Network Sensor Node, Smart Sensor Network, Wireless Sensor Network, RFID - Principles and Components, Node MCU **(5 Hours)** **Connectivity Technologies** Network Configuration in IoT, IoT Stack and Web Stack, IEEE 802.15.4 Standard, Zigbee, Bluetooth, Overview of IoT Protocols, MQTT, Cloud Architecture and Types, Cloud Service Providers **(10 Hours)** **Case Studies (Any Three from following List to be covered☺** Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer, IoT in Manufacturing Industry, IoT in Process Industry, IoT in Quality, Control Applications in Industry, IoT in Material Handling System in Industry, IoT in Automobile Industry, Navigation System, Connected Vehicles, Industry 4.0 **(5 Hours)**

List of Practicals: (Minimum Six)

1. Setting up Arduino / Raspberry Pi/ Node MCU ESP8266 : Basic handling , programming
2. LED Interfacing
3. Sensor interface to Node MCU/Arduino / Raspberry Pi Temperature measurement using LM35
4. Actuator interface to Node MCU /Arduino / Raspberry Pi Traffic Signal Control
5. Node MCU /Arduino / Raspberry Pi wireless communication Raspberry Pi as a web server
6. Node MCU/Arduino / Raspberry Pi Cloud interfacing and programming like Thingspeak Email alert using SMTP protocol
7. Sensor data acquisition on Mobile (Mobile APP) / Developing Application (WEB APP) with Django Text transfer using MQTT protocol
8. Home Automation using Cisco Packet Tracer

List of Course Projects:

1. Smart Agriculture System
2. Weather Reporting System
3. Home Automation System
4. Face Recognition Bot
5. Smart Garage Door
6. Smart Alarm Clock
7. Air Pollution Monitoring System
8. Smart Parking System
9. Smart Traffic Management System
10. Smart Cradle System
11. Smart Gas Leakage Detector Bot
12. Streetlight Monitoring System
13. Smart Anti-Theft System
14. Liquid Level Monitoring System
15. Night Patrol Robot
16. Health Monitoring System
17. Smart Irrigation System
18. Flood Detection System
19. Mining Worker Safety Helmet
20. Smart Energy Grid

List of Course Seminar Topics:

1. IoT Architecture
2. Sensor Characteristics
3. IoT for supply chain management and inventory systems
4. IoT Ethics
5. Security in IoT
6. Cloud Computing Platform
7. IoT Best Practices
8. 5G in IoT
9. Middleware Technology
10. M2M energy efficiency routing protocol
11. IoT based Biometric Implementation
12. Complete IoT solution using AWS
13. A smart patient health monitoring system
14. IoT for intelligent traffic monitoring
15. Home automation of lights and fan using IoT

List of Group Discussion Topics:

1. Role of Internet of Things in development of India .
2. Manufacturing industries should make efforts to limit contribution to IoT.
3. Should countries put a ban on IoT for children?
4. Should IoT pay more attention to security rather than just expanding its horizon to the extremes?
5. IoT is the next big thing in technology.
6. IoT poses a huge risk to privacy, if they your system is hacked.
7. IoT is the next big thing for hackers trying to have access to your intimate data.
8. Pros and cons of over-usage of IoT at homes and offices.
9. IoT at battlefields will make life of soldiers safer and easier.
10. IoT will make way for robots to rule over humans one day.
11. IoT devices are making people lazier and obese.
12. IoT needs to be regulated before it goes out of limits and poses serious threat.

List of Home Assignments:

Design:

1. Smart City
2. Smart Transportation
3. Smart Healthcare
4. Smart Industry using IoT
5. Design of IoT framework

Case Study:

1. Open Source in IoT
2. IoT solutions for automobile
3. Cloud Computing
4. AWS
5. Microsoft Azure

Blog:

1. Network Selection for IoT
2. Need of secure protocols
3. Future of IoT
4. IIoT
5. IoT and Industry 4.0

Surveys:

1. Autonomous Vehicles
2. List of Indian companies which offer IoT solutions for agriculture and farming. Describe the problem they are addressing and their solution.
3. Make a list of Indian companies which offer IoT solutions for healthcare. Describe the problem they are addressing and their solution.
4. Make an exhaustive list of everything inside, just outside (immediate surroundings) and on the auto body which must be "observed" for safe and comfortable driving using autonomous vehicles.
5. Compare different Cloud Service providers in the market.

Text Books: ***(As per IEEE format)***

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", (Universities Press)
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)

Reference Books:

1. Adrian McEwen, Hakim Cassimally "Designing the Internet of Things", Wiley
2. Ovidiu Vermesan & Peter Friess "Internet of Things Applications - From Research andInnovation to Market Deployment", ISBN:987-87-93102-94-1, River Publishers
3. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron

MOOCs Links and additional reading material:

1. https://proed.stanford.edu/course/view.php?id=191
2. https://nptel.ac.in/courses/106/105/106105166/
3. https://create.arduino.cc/projecthub/electropeak/getting-started-w-nodemcu-esp8266-on-arduino-ide-28184f

Course Outcomes

1. Demonstrate fundamental concepts of Internet of Things (CO Attainment level: 2)
2. Recognize IoT Design Methodology Steps (CO Attainment level: 3)
3. Select sensors for different IoT applications (CO Attainment level: 3)
4. Analyze fundamentals of networking (CO Attainment level: 4)
5. Apply basic Protocols in IoT (CO Attainment level: 4)
6. Provide IoT solutions practically with the help of case study (CO Attainment level: 5)

Future Courses Mapping:

Other courses that can be taken after completion of this course

1. Ad-Hoc Networks
2. Cyber Security
3. Wireless Networks
4. Industry 4.0
5. Big Data

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positions available as IoT Research Developer, IoT Design Engineer, IoT Product Manager, IoTSoftware Developer, IoT Solution Architect, IoT Service Manager and many more.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks