CSEN2101	INTERNET OF THINGS	L	T	P	S	J	C
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Pre-requisite	**CSEN1021-Programming with Python**						
Co-requisite	**None**						
Preferable exposure	**None**						

Course Description:

The Internet of Things (IoT) is a network of a wide variety of devices like vehicles, humans, soil etc. These devices gather data using sensors, which can be used for monitoring or control. This course is an introduction to the embedded devices, communication protocols and APIs used in the IoT.

Course Educational Objectives:

- Introduce the fundamental concepts of IoT and its characteristics
- Expose the student to sensors used for sensing different physical quantities
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with different application program interfaces for accessing Cloud services.
- Enable students to create simple IoT applications.

UNIT 1 Introduction to Internet of Things (IoT) 5 hours

Introduction to Internet of Things, Examples of IoT Devices, Evolution of IoT: M2M, WSN, CPS, Application Areas of IoT, Characteristics of IoT, Things in IoT, IoT Stack, Enabling Technologies, IoT Challenges, IoT Levels.

UNIT 2 Introduction to Sensors, Microcontrollers, and their Interfacing 6 hours

Sensors and Actuators, Single Board Microcontrollers and Computers, Arduino Platform, Board, Arduino IDE, Programming for Arduino, Raspberry Pi Platform, Raspberry Pi Processor, Raspberry Pi vs. Arduino

UNIT 3 Connectivity for IoT 6 hours

Why is networking required? WAN Structure, Network types, Addressing, TCP/IP basics, **Messaging and Transport Protocol**s: Messaging Protocols (CoAP, MQTT), **Addressing and**

Identification: Internet Protocol Version 4 (IPv4), Internet Protocol Version 6 (IPv6), Uniform Resource Identifier (URI)

UNIT 4 **Cloud for IoT** **5 hours**

IoT with Cloud, Challenges, Selection of Cloud Service Provider for IoT Applications, Introduction to Fog Computing, Cloud Computing: Security Aspects, Case Study: *Streaming IoT Data to AWS/Google Cloud*

UNIT 5 **IoT Data Analytics and Application Development** **8 hours**

Data Analytics – Visualizing the Power of Data from IoT, Data Analysis, Machine Learning, Types of Machine Learning Models, Model Building Process, Modelling Algorithms, Model Performance. **Application Building with IoT:** healthcare IoT, Agricultural IoT, Vehicular IoT

Suggested list of experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from the sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to the same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to the cloud.
7. Control an actuator through the cloud.
8. Access the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it (Mini Project).

Textbook(s):

1. Misra, S., Mukherjee, A. and Roy, A., Introduction to IoT. Cambridge University Press, 2021.
2. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, Internet of Things, Wiley India, 2019

References:

1. Simon Monk, Programming Arduino: Getting Started with Sketches, Mc Graw Hill Publications, 2011
2. Simon Monk, Programming the Raspberry Pi, Getting Started with Python, Mc Graw Hill Publications, 2015
3. Simon Monk, Hacking Electronics: Learning Electronics with Arduino and Raspberry Pi, Mc Graw Hill Publications, 2017
4. Manoj R. Thakur, NodeMCU ESP8266 Communication Methods and Protocols: Programming with Arduino IDE Amazon Media, 2018.

Course Outcomes:

After completion of this course, the student will be able to:

- choose the sensors and actuators for an IoT application (L4)
- select protocols for a specific IoT application (L2)
- utilize the cloud platform and APIs for IoT application (L3)
- experiment with embedded boards for creating IoT prototypes(L5)
- design a solution for a given IoT application (L6)

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1										3	3		1
CO2	1	1		1					2			2	3		2
CO3	1	2										2	3	3	
CO4	3	3	3		3							2	3	3	
CO5	3	3	3	3		2	2		2	3	3	3	3	3	3

Note: 1 - Low Correlation 2 - Medium Correlation 3 - High Correlation

APPROVED IN:

BOS: 06-09-2021 **ACADEMIC COUNCIL: 01-04-2022**

SDG No. & Statement:

SDG Justification: