Internet of Things

Code	Credit Hours
CS 335	3+0

Course Description

This course focuses on the fundamentals of the Internet of Things (IoT) and its technology stack. As of today, IoT is one of the fastest-growing technologies worldwide and increasingly becoming pervasive in enhancing various verticals ranging from civilian to defense sectors. These domains include agriculture, environment, healthcare, education, manufacturing, livestock, water, etc. which are presently transforming their traditional infrastructure to support IoT. The unprecedented advancement in technology has made it possible to envisage persistent connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. Therefore, it is very important to learn the fundamentals of this emerging technology. The learning outcomes of this course include an understanding of the significance of the Internet of Things, its architecture, and communication protocols. In addition, it will help the students to explore the relationship between IoT, cloud computing and big data, and business benefits of an IoT solution

Text Book:

1. Internet of Things (IoT): Principles, Paradigms and Applications of IoT by Kamlesh Lakhwani, Hemant Kumar Gianey, Joseph Kofi Wireko, Kamal Kant Hiran, 2020
2. The Internet of Things" by Samuel Greengard, MIT press, 2015

Reference Book:

1. Internet of Things: Architectures, Protocols and Standards, by Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri, 1st edition, Wiley,2019
2. A Reference Guide to the Internet of Things, Bridgera LLC, RIoT, 2017

Prerequisites

Computer Networks

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Project	10%
Mid Terms	30%
ESE	40%

Teaching Plan

Week No	Topics	Learning Outcomes
1-4	Introduction Sensing Actuation Embedded Systems	Introduction to IoT, why is IoT important?
		Trends in the Adoption of IoT, Applications
		IoT Architecture and Technology Stack
		Sensors, Characteristics of Sensors
		Classes of sensors, Types of Sensors
		Specifications, Application Specific Sensors
		Actuators, Types of Actuators
		Operation and key characteristics
		Internet connectivity
		Typical costs, computing energy budget
		Energy management and sleep states
		Microcontrollers, Peripherals
		Operating systems and multiprogramming
5-8	Network Technologies Arduino Raspberry Pi	Networking standards and technologies
		Physical Layer IoT Network Technologies
		Internet Layer IoT Network Technologies
		Application Layer IoT Network Technologies
		Wireless Sensor Networks
		Embedded system programming (Arduino)
		Introduction to Raspberry Pi
		Implementation of IoT with Raspberry Pi
		Introduction to Nvidia Nano Jetson (optional)
9	**Mid Term**	
10-14	Computing paradigms Role of ML in IOT Modern IOT Applications & Case Studies	Cloud / Fog / Edge Computing
		Big Data Analytics and the IoT
		Machine Learning in IoT, Types
		IoT Market Trends, Benefits and success Stories
		On-device inferences
		IoT Verticals (Smart cities)
		IoT Verticals (Healthcare and Agriculture)
		IoT Verticals (Industrial IoT)
		IoT in Agriculture (Case Study)
		Urban Air Quality Monitoring using IoT (case study)
		Indoor Air Quality Monitoring using IoT (case study)
		IoMT in Healthcare Introduction, Architecture
		Basics of Wearable Health Monitoring System (WHMS)

	IoT in Healthcare Cardiovascular system in Detailed study	Need for Wearable IoMT Systems
		Pilot case study introduction
		Role of IoT for Cardiovascular Patient Monitoring
		Traditional vs Smart Systems for Monitoring Cardiovascular Patients
		Hardware requirements for a Digital Cardiovascular system
		Sensor Interfaces
		ECG, EEG, PPG, Pulse Oximeter, Temperature Sensors, and Pressure Sensors
		Wireless Body Area Network (WBAN)
		WBAN Architecture and Topology
		Comparison of multiple communication topologies for the case study
15-17	Data Analysis & Types of Computing Data Privacy Concerns Term project	Data Handling and Analysis
		Data Visualization
		Edge/fog/ cloud computing
		Data Security
		Challenges of IoT
		Project Presentations, Demo, Viva,
		Report Submission
18	**ESE**	