INTERNET OF THINGS
(Common to CSE & IT)

Course Code: 19CT1114

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2	0	2	3

Course Outcomes: At the end of the Course, the Student will be able to:
CO1: Describe the concepts of IoT along with its applications.
CO2: Build a prototype using Arduino Uno.
CO3: Identify different types of sensors, actuators and communication Protocols.
CO4: Build a prototype using Raspberry pi.
CO5: Design an IoT application to interact with Django.

UNIT-I **(6 Lectures)**

INTRODUCTION TO IoT: Microprocessor, Microcontroller, Embedded System, Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT levels & Deployment Templates, IoT Applications. (Text Book 1,3)

Learning Outcomes: At the end of the unit, the student will be able to

1. differentiate Microprocessor, Microcontroller, Embedded System.(L2)
2. explain the Characteristics of IoT (L2)
3. explain the physical design and logical design of IoT (L2)
4. describe various applications of IoT (L2)

UNIT-II **(6 Lectures)**

IOT WITH ARDUINO: Introduction to the Arduino, Creating an Arduino programming Environment, Using the Arduino IDE, Creating an Arduino program, Using Libraries,Working with Digital Interfaces, Interfacing with Analog devices, Adding Interrupts, Communicating with devices,Using sensors,Working with Motors,Using an LCD. (Text Book -2)

Learning Outcomes: At the end of the unit, the student will be able to

1. show Arduino IDE installation. (L3)
2. apply three (write, upload, and execute) operations on basic Arduino programs.(L3)
3. demonstrate the prototypes using Arduino with external devices.(L2)

UNIT-III **(6 Lectures)**

SENSORS AND ACTUATORS: Introduction,Sensor,Types of Sensors,Actuators,classification of Actuators.

TECHNOLOGIES USED IN IoT: Bluetooth, Bluetooth Low Energy (BLE), WiFi, LiFi, Cellular Networks, Z-Wave,X-10,Sig fox, ZigBee, LoRaWAN, 6LowPAN, 5-G, LPWAN, RFID and NFC,WSN.
COMMUNICATION PROTOCOLS: CoAP, MQTT, XMPP, DDS,AMQP, REST,HTTP (Text Book- 3)

Learning Outcomes: At the end of the unit, the student will be able to

1. classify different sensors and Actuators.(L2)
2. explain different Communication technologies. (L2)
3. understand the basics of communication protocols. (L2)

UNIT-IV **(6 Lectures)**

IoT WITH RASPBERRY PI : IoT PHYSICAL DEVICES & ENDPOINTS: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Controlling LED

with Raspberry Pi, Interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi. (Text Book -1)

Learning Outcomes: At the end of the unit, the student will be able to

1. use Raspberry Pi hardware. (L3)
2. develop programs using Raspberry Pi. (L3)
3. develop an interface between sensors and Raspberry Pi. (L3)

UNIT-V **(6 Lectures)**

IoT PHYSICAL SERVERS & CLOUD OFFERINGS: Python Packages for IoT, WAMP - AutoBahn for IoT, Python Web Application Framework – Django,Amazon Web Services for IoT,SkyNet IoT messaging platform (Text book- 1)

Learning Outcomes: At the end of the unit, the student will be able to

1. describe the structure of WAMP. (L2)
2. identify python packages to interface Amazon web services. (L3)
3. build a web application using Django. (L3)

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, *Internet of Things (A Hands-on-Approach)*, 1st Edition, VPT, 2016.
2. Richard Blum,*Arduino Programming in 24 Hours*, Sams Teach Yourself,Pearson Education,2017.
3. Jain, Prof. Satish, Singh, Shashi, *Internet of Things and its Applications*, 1st Edition, BPB, 2020.

REFERENCES:

1. Donald Norris, *Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black*,1st Edition, McGraw-Hill,2015.
2. Adeal Javed Lake Zurich, Illinois, *Building Arduino Projects for the Internet: Experiments with Real-World Applications*, 1st Edition,USA, A press,2016.
3. Yashavant Kanetkar, Shrirang Korde, *21 IOT Experiments*, 1st Edition, BPB Publications, 2018.
4. Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta, Navjot Rathour, Mahendra Swain, Bhupendra Singh, *IoT based Projects Realization with Raspberry Pi, NodeMCU and Arduino*, 1st Edition, BPB Publications, 2020.

WEB REFERENCES:

1. https://www.arduino.cc/reference/en
2. https://create.arduino.cc/projecthub
3. https://maker.pro/raspberry-pi/tutorial
4. https://projects.raspberrypi.org/en/projects
5. https://www.digikey.com/en/maker/blogs/2019/how-to-use-mqtt-with-the-raspberry-pi

LIST OF EXPERIMENTS:

1. Install IDE of Arduino and write a program using Arduino IDE to blink LED.
2. Interface LED and buzzer with Arduino to buzz for a period of time.
3. Interface RGB LED with Aurdino to obtain different colours and brightness using PWM.
4. a) Control a servo motor using Arduino with an input given through a push button (e.g: When the push button is pressed the servo motor has to rotate by 15 degrees).

   b) Rotate Stepper motor either clockwise or anti clockwise at ‘n’ number of steps using Arduino.

5. Write a program to read the data from the RFID tag and display the information on the display board using Arduino and control LED (e.g: if it is a valid card then the LED should be ON otherwise OFF).
6. Control any two actuators connected to the Arduino using Bluetooth/Wifi.
7. Interface analog/digital sensors with Arduino and analyse the corresponding readings. (Sensors like temperature, alcohol, humidity, pressure, gas, sound pollution, level, weight, flow, proximity, LDR, PIR, pulse, vibration, sound etc..)
8. Demonstration of setup & working of Raspberry Pi. (Students have to prepare the report for the same).
9. Interface RGB LED with Raspberry Pi to obtain different colours and brightness using PWM.
10. a) Interface an ultrasonic sensor with Raspberry pi to print distance readings on the monitor when the sensor changes its position.

    b) Reading the data from an analog sensor with Raspberry using Arduino serial port or ADC MCP3208 using SPI.

11. Post/read the data to/from the cloud via MQTT broker with a Raspberry Pi.
12. Send real-time sensor data to a smartphone using Raspberry Pi onboard Bluetooth.
13. Interface Picamera module using Raspberry Pi to perform operations of PiCamera-API or OpenCV library.
14. Implement an intruder alert system that alerts through email
15. Implement remote monitoring of smoke alarm systems using Raspberry Pi.
16. Create a user interface using Tkinter to control the API's in Raspberry Pi.

DOMAIN-SPECIFIC USE CASES:

CHEMICAL ENGINEERING:

1. Monitoring a safe liquid level in a tank through IoT.

2. Sensing the concentrations of pollutants in air through IoT (CO_2 gas)

3. Measuring the presence of undesired material in an Industry effluent through IoT

COMPUTER SCIENCE AND ENGINEERING/ INFORMATION TECHNOLOGY:

1. Face Recognition System

2. Gesture Recognition System

3. Smart Farming System.

4. Health care system

ELECTRONICS AND COMMUNICATION ENGINEERING:

1. Automatic Traffic light system

2. Room automation system

3. Line follower robots