PUCIT

INTRODUCTION TO INTERNET OF THINGS

Subject Code: STIES

Total Hours: 45 Credits: 4

Course Learning Objectives (CLO)

The objective of this course is to make students learn basic understanding of Electronics Circuit Design and fundamentals of Embedded systems and how to use these techniques to build real-world IoT applications. These will be accomplished through course activities on the following Units:

UNIT 1: Introduction to Internet of Things [4 hours]

The hype?, Desktop vs Embedded vs IoT,

Hardware, Firmware & Software, Node, Hub, Edge, Cloud,Analytics, IoT network topologies, Network Interfaces (WiFi, Cellular, LoRaWAN, etc), Topologies,(Standalone, Mesh, Hybrid)

UNIT 2: C Programming Basics [12 hours]

Introduction to C language, Constants, variables, Identifier, Data Type, Basic structure, Difference between Top-Down,Bottom-up approach

Control Statements (Branching, looping, jumping)

Function (Introduction,Categories of function), Call by value/reference, Object Notation

Storage Classes (Automatic, Register, Static, External, Volatile Qualifier)

Idea behind the recursion and implementation

Pointer, Pointer arithmetic, Array and Pointer, Character and Pointer

UNIT 3: Foundation of Electronics [10 hours]

Introduction on electronic component and Passive component

Active Component

Hands on active and passive components

Integrated Circuit

Hands on integrated circuit

UNIT 4: Introduction to Embedded System Design & Hands On [20 hours]

Introduction to Microcontroller, Microprocessor vs Microcontroller (What to use When?), IDE and Toolchain. Hardware options (ESP, Pi, Photon,Arduino Ble, MKR, Nordic, STM, etc), how to choose a hardware, IoT Coach, microcontroller and on-board sensors

Hands on IDE setup and Initial Kit boot up

Logic Levels. TTL vs CMOS, Level shifters, DIO Port modes (Input and Output),Debouncing problem, Pullup and Pulldown, AI and AO

Hands on Twilight Switch

Sensor & Actuators types and configuration, Introduction to interface buses, Buses[UART]

Buses [I2C, SPI], Addressable vs Non-Addressable

Hands on Weather Station

Interrupts, Hardware vs Software, IRQ

Timers, PWM, RTC, Square Wave, Pulse WidthModulation

Hands on Touch less dispenser

Course Outcomes: On completion of this course, students will be able to:

- Mastered key concepts and gained the practical knowledge of how to quickly and powerfully apply the Internet of Things to challenging real-world problems.
- Interact with different sensor technologies which will enable build custom embedded devices using different sensor modules.
- Deal with different Interface Buses which will enable the device to interact with the external world.

SKILL BASED EXERCISE (SBE):

Note: - These Projects/activities are only indicative; the faculty member can innovate

Mini Projects on: -

Build a project from the given list below:

- **Distance Meter :** Use the ultrasonic sensor to measure distance and display the reading on the OLED display ,use a buzzer then its distance is less than 4 cm and all addressable LEDs glow in red color.
- **Plant Watering System :** Use the moisture sensor to monitor the soil moisture level and use the relay to turn on the water pump to water the plants when needed and display it on the OLED display.
- **Smart Door Lock :** Use the relay to control the locking and unlocking of a door based on the presence of a person detected by the Ultrasonic Sensor. Also use a

buzzer when the door is opened and display it on the OLED displays text "Door Open" or "Door Close".

- **Smart Window Blinds :** Use the relay to control the opening/closing of window blinds based on the ambient light levels detected by the LDR. if it is dark then Addressable LEDs start glowing in white color.
- **Pet Feeder :** Use the ultrasonic sensor to detect the presence of a pet and use the relay to dispense food and water to the pet.
- **Smart Thermostat :** Use the BME280 sensor to measure temperature and humidity and use the relay to control the heating/cooling system to maintain a comfortable temperature and also display Temperature on the OLED . When the temperature rises above 100 ° C , the load will disconnect from the power source.
- **Artificial Vision Torch :** Using an ultrasonic sensor in front of the torch detects the presence of any person, object, or thing . when it detects the buzzer should turn on .
- **Smart Glove for Patient :** Using a different GPIO pin of ESP32 attached with the fingertips of Glove. When a patient wants to say something , then they simply join their fingertips with the thumb and data will display on the OLED and the buzzer will turn on for a bit to notify that patient wants to say something.
- **Smart Fan** : Use the BME280 sensor to measure temperature and humidity and use the relay to turn on the fan when the temperature and humidity levels exceed a certain threshold.
- **Smart Dustbin** : Use the ultrasonic sensor to detect the presence of a person and use the relay to open the flap of the dustbin.
- **Moon lightning :** Use the LDR sensor to detect the ambient light levels and when it detects the dark outside then addressable LEDs start glowing in a rainbow manner and with help of touch sensor modes of LEDs will be able to change modes like fading , different colors, rainbow etc.

References:

- Let us C - by Yashavant Kanetkar
- Basic Electronics(Solid State) - by B L Theraja
- Embedded Systems: Introduction to ARM Cortex-M Microcontrollers - by Jonathan Valvano
- Programming and Customizing The AVR Microcontroller - by Dhanajay V. Gadre