Report Name: Introduction to Embedded Systems & IoT

Object:

The objective of this lab is to introduce students to the fundamental components and concepts of embedded systems and the Internet of Things (IoT). This includes understanding sensors, microcontroller units (MCUs) such as Arduino, ESP32, STM32, IoT devices like Wi-Fi modules and NodeMCU, electronic switches including BJTs and MOSFETs, power supply units, and relay/actuator mechanisms.

Introduction:

Embedded systems are specialized computing systems designed to perform dedicated tasks within larger systems. They are the core of modern smart devices and IoT applications. IoT (Internet of Things) connects these embedded devices to the internet, enabling remote monitoring, data sharing, and control.

In this lab, students will explore sensors for detecting real-world conditions, work with popular microcontrollers, understand IoT modules for wireless communication, study how electronic switches operate, learn about powering embedded systems, and see how relays and actuators implement actions in automated systems.

Discussion:

1. Sensors

Sensors detect physical phenomena and convert them into electrical signals for the MCU to process.
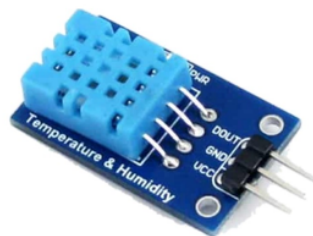

Fig-1: DHT11 Temperature and Humidity Sensor.

2. Microcontroller Units (MCUs)

Sensors detect physical phenomena and convert them into electrical signals for the MCU to process.

- Arduino: An easy-to-use open-source microcontroller for beginners and prototyping.
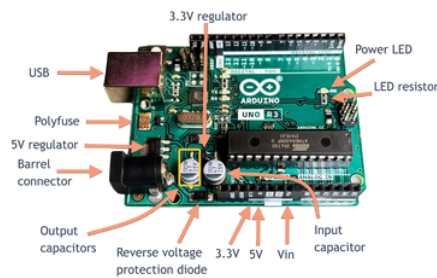

Fig-2: Arduino Board

- ESP32: A powerful microcontroller with integrated Wi-Fi and Bluetooth for IoT applications.

Fig-3: ESP32 Board

- STM32: A family of high-performance 32-bit MCUs suitable for more complex embedded projects.
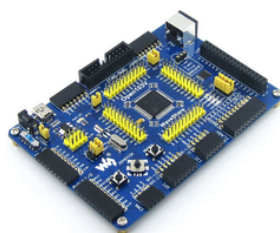

Fig-4: STM32 Board

3. IoT Devices

- Wi-Fi Module: Allows microcontrollers to connect to wireless networks (e.g., ESP8266).

Fig-5: Wi-Fi Module

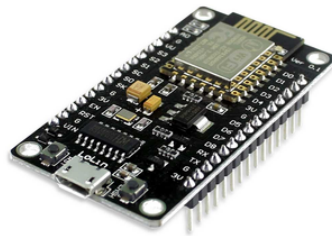- NodeMCU: A development board with a built-in Wi-Fi module (ESP8266/ESP32) for IoT solutions.

Fig-6:NodeMCU Board

4. Electronic Switches

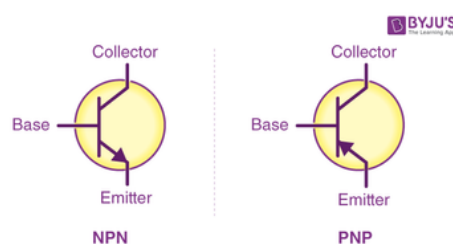- BJTs (Bipolar Junction Transistors): Used for switching and amplifying signals in circuits.

Fig-7: BJT Transistor

- MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors): Efficient switches for controlling power in embedded circuits.
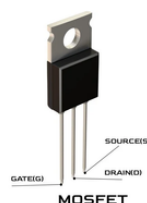

Fig-8: MOSFET

5. Power Supply

- Supplies necessary electrical power to embedded systems; sources can include batteries, USB, or adapters.

Fig-9: Power Supply

6. Relays / Actuators

Relays allow low-power signals to control high-power devices, while actuators convert electrical signals into physical action.

Fig-10: Relay Module   Fig-11: Motor Actuator

Conclusion:

This lab familiarized students with core elements of embedded systems and IoT, including sensors for input, microcontrollers for processing, IoT devices for wireless communication, switches for circuit control, reliable power sources, and relays/actuators for performing actions. Understanding these building blocks prepares students to develop practical IoT applications and smart embedded solutions for real-life challenges.