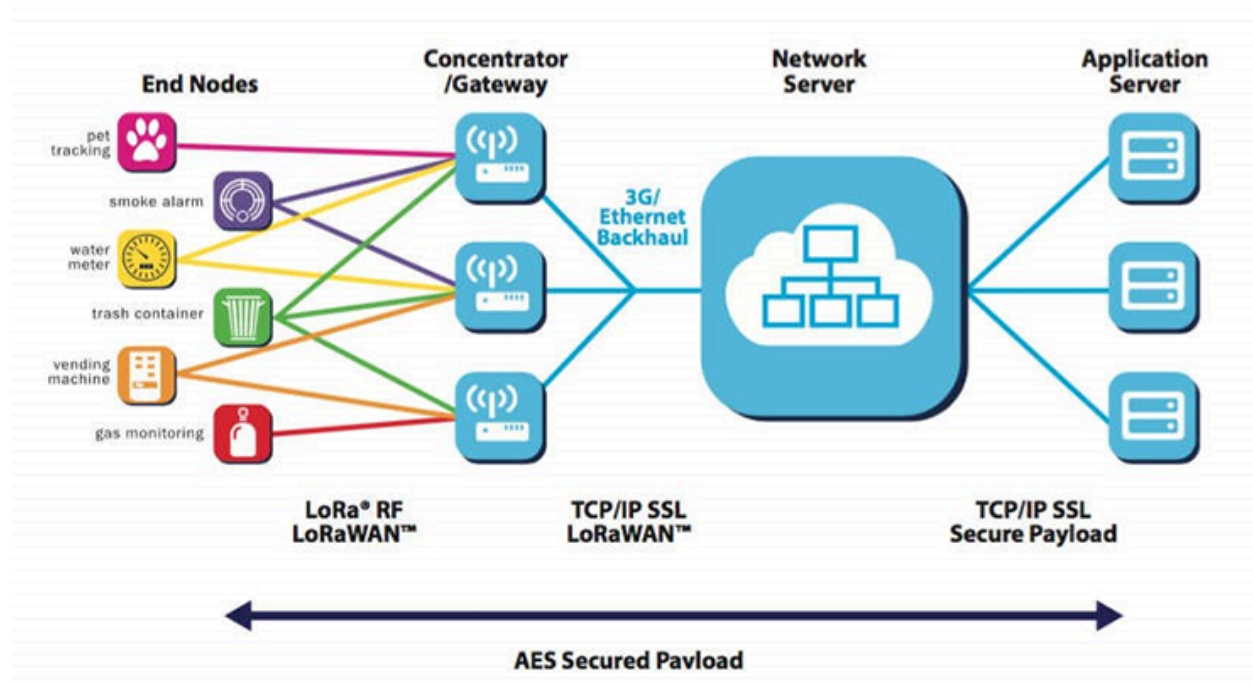# Practical - 3

Aim -

Study of Various IoT Protocol Libraries (Wi-Fi, Bluetooth, ZigBee, LoRa)

Theory -

IoT devices require communication protocols that match their specific needs—whether it's short-range data transfer or long-range sensor communication. This practical focuses on the libraries and frameworks available for commonly used protocols such as **Wi-Fi, Bluetooth, ZigBee, and LoRa**. Each protocol has distinct advantages and limitations, and understanding them helps students choose the right technology for their application.

This session introduces protocol-specific libraries that allow devices to connect and communicate. Students write simple programs to send and receive messages, discover nearby devices, and test connectivity using available tools and microcontrollers.
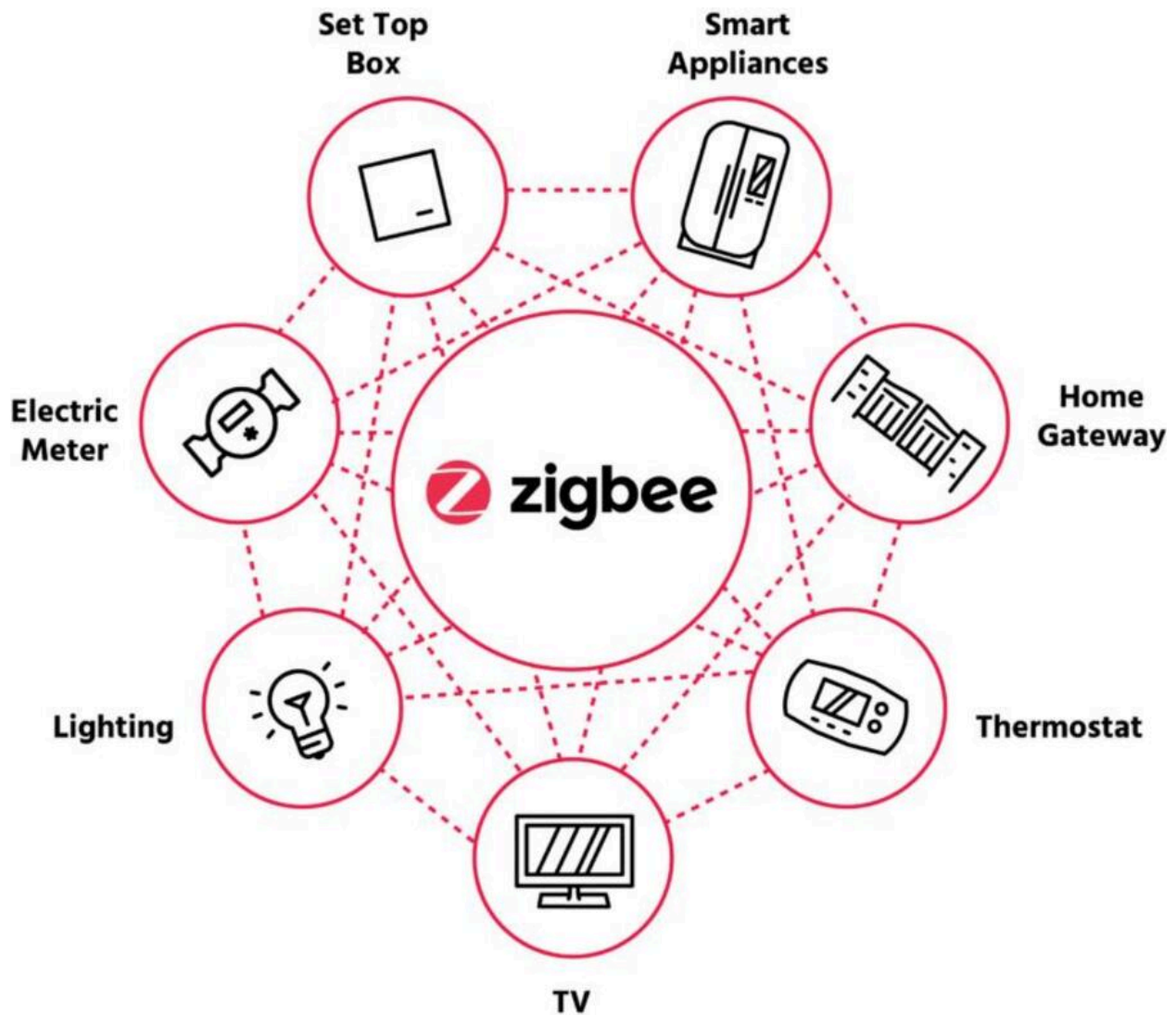
Key Points:

- **Wi-Fi** offers high-speed data transmission and is ideal for home or office IoT environments.

- Students use libraries such as `ESP8266WiFi` or `WiFi.h` (Arduino) for Wi-Fi programming.

- **Bluetooth** enables short-range communication in devices like smartwatches and fitness trackers.

- Python's `pybluez` or Arduino's `BluetoothSerial` is used for Bluetooth integration.

- **ZigBee** is a mesh protocol suited for smart homes and industrial automation.

- **XBee modules** and Digi's **XCTU software** are used for ZigBee configuration.

- **LoRa** provides low-power, long-range communication, ideal for remote sensing.

- Libraries like `LoRa.h` (Arduino) help configure LoRa transceivers for peer-to-peer communication.

- Comparison of protocols in terms of **range, power, data rate**, and **topology**.

- Students learn practical protocol selection for use cases like **agriculture, home automation, health monitoring**, etc.