Mobile & Wireless Technology

CT090-3-2 & Version VD01

IoT and Wireless Sensor Networks

ASIA PACIFIC UNIVERSITY
OF TECHNOLOGY & INNOVATION
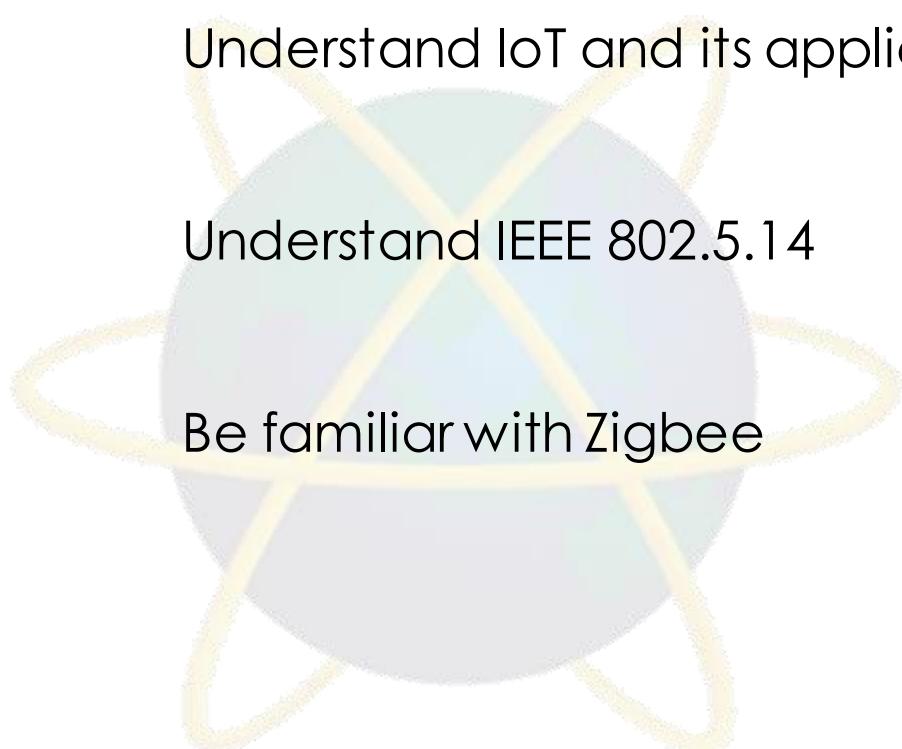
Topic & Structure of The Lesson

- Internet of Things – Applications
  - Smart Cities
  - Manufacturing
  - Home Automation
  - VANETS
  - Body Area Networks
- IEEE 802.5.14
- Zigbee

Learning Outcomes

- **At the end of this topic, You should be able to**

   Understand IoT and its applications
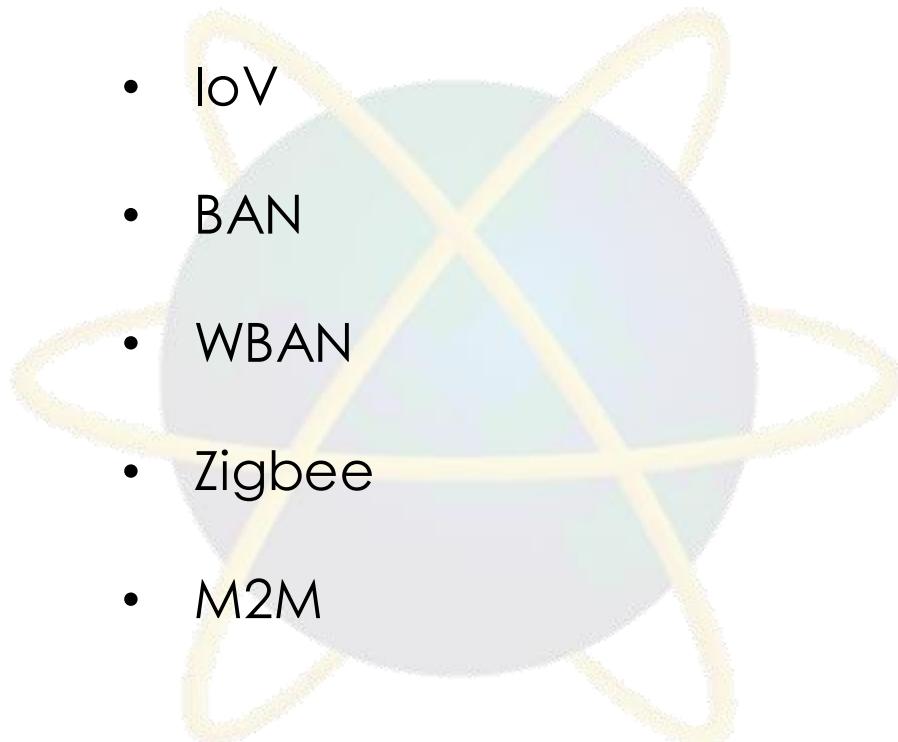
   Understand IEEE 802.5.14

   Be familiar with Zigbee

Key Terms You Must Be Able To Use
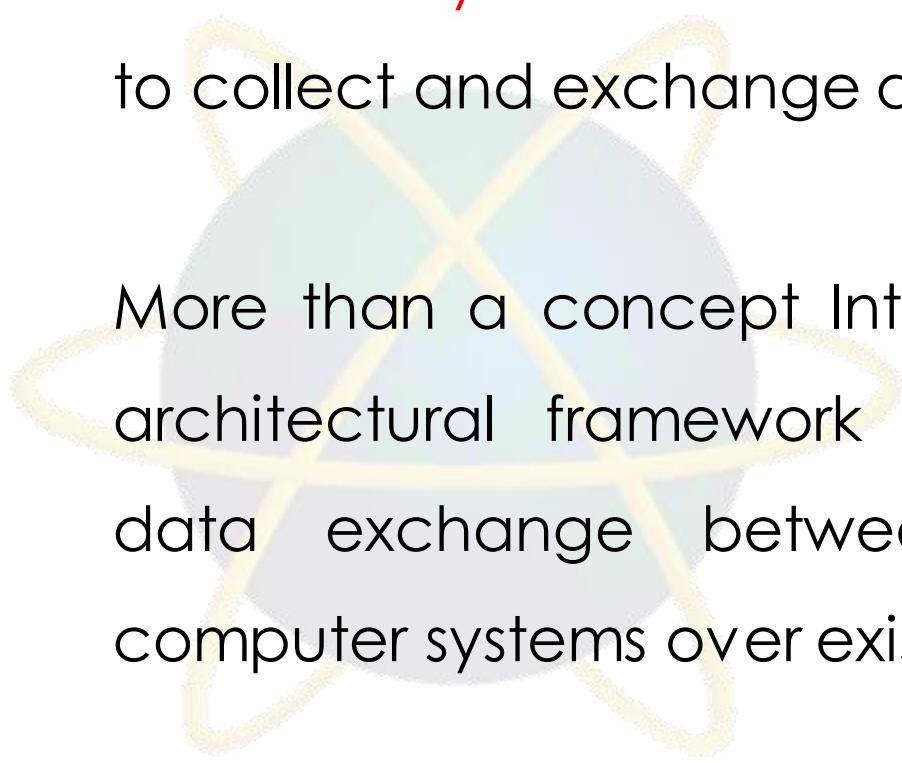
If you have mastered this topic, **you should be able to use the following terms correctly in your assignments and exams**:

- VANET

- IoV

- BAN

- WBAN

- Zigbee

- M2M

IoT – Internet of Things

IoT is simply the network of interconnected things/devices which are embedded with sensors, software, network connectivity and necessary electronics that enables them to collect and exchange data making them responsive.

More than a concept Internet of Things is essentially an architectural framework which allows integration and data exchange between the physical world and computer systems over existing network infrastructure.

IoT – Internet of Things – Applications: Smart Cities

Smart surveillance, safer and automated transportation, smarter energy management systems and environmental monitoring all are examples of internet of things applications for smart cities.

Smart cities are the real substantial solutions for the troubles people usually face due to population outburst, pollution, poor infrastructure and shortage of energy supplies.

IoT – Internet of Things – Applications: Smart Cities

Bigbelly smart waste and recycling system is a smart waste management system for smart cities. A completely modular system, Bigbelly gives historical as well as real-time and data collection capability via cloud-based service.

It helps with smart trash picking, avoid overflows and generate notifications making waste management truly smart.

IoT – Internet of Things – Applications: Manufacturing

Technologies based on the Internet of Things have the potential to radically improve visibility in manufacturing to the point where each unit of production can be "seen" at each step in the production process.

Batch-level visibility is being replaced by unit-level visibility. This is the dawn of smart manufacturing.

IoT – Internet of Things – Applications: Manufacturing

Smart manufacturing is a decision-making environment. Very importantly, smart manufacturing includes proactive and autonomic analytics capabilities, making smart manufacturing an intelligent and self-healing environment.

With smart manufacturing organizations can predictively meet business needs through intelligent and automated actions driven by previously inaccessible insights from the physical world.

IoT – Internet of Things – Applications: Manufacturing
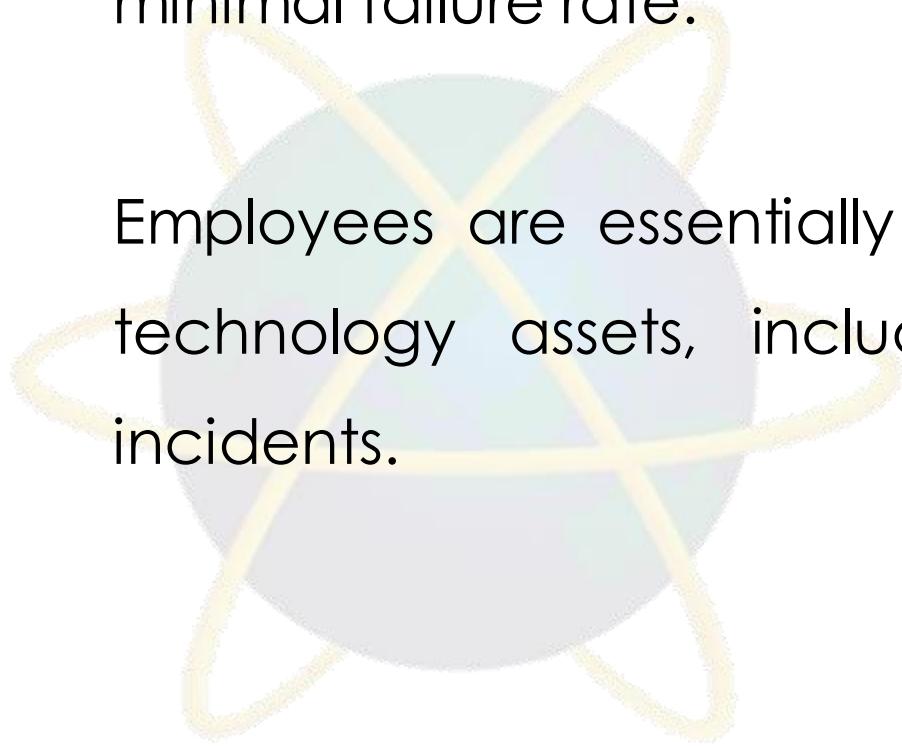
Example-

Siemens. At Siemens' electronics manufacturing plant in Amberg, Germany, machines and computers handle 75% of the value chain autonomously, with some 1,000 automation controllers in operation from one end of the production line to the other.

Parts being produced communicate with machines by means of a product code, which tells the machines their production requirements and which steps need to be taken next.

IoT – Internet of Things – Applications: Manufacturing

All processes are optimized for IT control, resulting in a minimal failure rate.

Employees are essentially supervising production and technology assets, including handling unexpected incidents.

IoT – Internet of Things – Applications: Home Automation

We can adjust the thermostat from the office, check the security cameras from the movie theater, or turn the lights off or close the garage door from just about anywhere—whether user are next door or across the world.

Home automation steps in to deliver on the promise of simplifying your life. With a single app from user's smartphone, user can control everything. And the real magic happens when user program these devices to perform a function based on the actions or location of another device.

IoT – Internet of Things – Applications: Home Automation

Simply getting out of bed in the morning can trigger user music to begin playing and user coffee maker to brew coffee. Closing the garage door on user way to work can arm user security system and make sure all the lights and TV's are off in the house.

And returning home at night can turn on the lights, unlock the door and turn to user favorite TV channel right as user walk in the door.

IoT – Internet of Things – Applications: VANET

The new era of Internet of Things (IoT) is driving the evolution of conventional Vehicle Ad hoc Networks (VANET) into the Internet of Vehicles (IoV) paradigm.

According to recent predictions, 25 billion of "things" will be connected to the Internet by 2020 among which vehicles will constitute a significant portion. The difference of the vehicle concept in VANET and IoV makes these two scenarios essentially different in the device, communications, networking, and services aspects.

In VANET, a vehicle is mainly considered as a node to disseminate messages among vehicles.

IoT – Internet of Things – Applications: VANET

In the IoV paradigm, each vehicle is considered as a smart object equipped with a powerful multi-sensor platform, communications technologies, computation units, IP-based connectivity to the Internet and to other vehicles either directly or indirectly.

In addition, a vehicle in IoV is envisioned as a multi-communication model, enabling the interactions between intra-vehicle components, vehicles and vehicles, vehicles and road, and vehicles and people.

IoT – Internet of Things – Applications: Body Area Network

The Human Body as part of an Internet of Things.

Sensors may be worn on the body forming a wireless body area network (WBAN).

Each sensor is in range of a mobile data hub on a human, typically a smart phone that can acquire the data and transmit it in real-time or off-line to a remote database.

Example : Smart Shoes

IEEE 802.15.4 - ZIGBEE

The IEEE supports many working groups to develop and maintain wireless and wired communications standards.

For example, 802.3 is wired Ethernet and 802.11 is for wireless LANs (WLANs), also known as Wi-Fi. The 802.15 group of standards specifies a variety of wireless personal area networks (WPANs) for different applications.

For instance, 802.15.1 is Bluetooth, 802.15.3 is a high-data-rate category for ultra-wideband (UWB) technologies, and 802.15.6 is for body area networks (BAN). There are several others.

IEEE 802.15.4 - ZIGBEE

The 802.15.4 category is probably the largest standard for low-data-rate WPANs. It has many subcategories. The 802.15.4 category was developed for low-data-rate monitor and control applications and extended-life low-power-consumption uses.

The basic standard with the most recent updates and enhancements is 802.15.4a/b, with 802.15.4c for China, 802.15.4d for Japan.

802.15.4e for industrial applications, 802.15.4f for active (battery powered) radio-frequency identification (RFID) uses, and 802.15.4g for smart utility networks (SUNs) for monitoring the Smart Grid.

All of these special versions use the same base radio technology and protocol as defined in 802.15.4a/b.

IEEE 802.15.4 - ZIGBEE
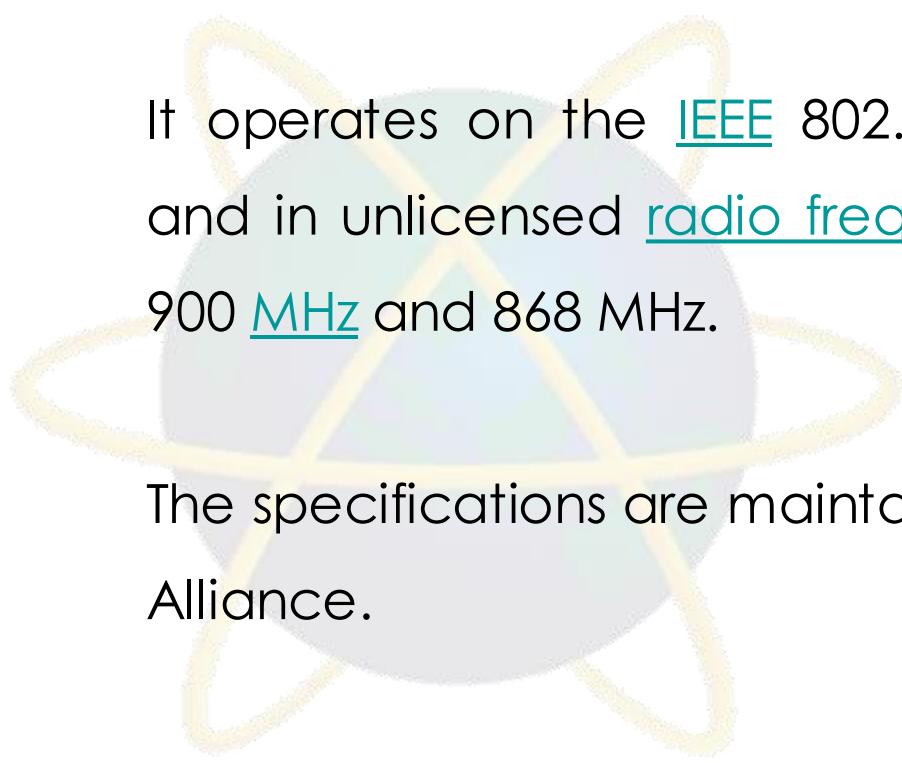
The most widely deployed enhancement to the 802.15.4 standard is ZigBee, which is a standard of the ZigBee Alliance. The organization maintains, supports, and develops more sophisticated protocols for advanced applications.

ZigBee is a mesh network specification for low-power wireless local area networks (WLANs) that cover a large area. ZigBee was designed to provide high data throughput in applications where the duty cycle is low and low power consumption is an important consideration.

(Many devices that use ZigBee are powered by battery.) Because ZigBee is often used in industrial automation and physical plant operation, it is often associated with machine-to-machine (M2M) communication and the Internet of Things.

IEEE 802.15.4 - ZIGBEE

ZigBee is based on the Institute of Electrical and Electronics Engineers Standards Association's 802.15 specification.

It operates on the IEEE 802.15.4 physical radio specification and in unlicensed radio frequency bands, including 2.4 GHz, 900 MHz and 868 MHz.

The specifications are maintained and updated by the ZigBee Alliance.
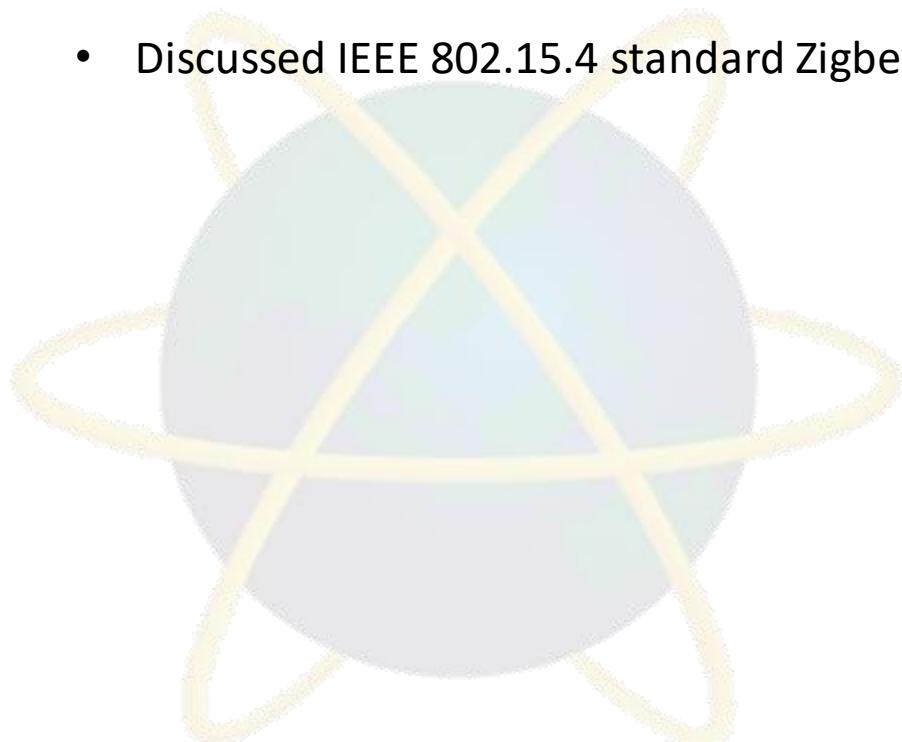
Quick Review Question

- Define IoT.List any three applications of IoT

- Define Zigbee

Summary of Main Teaching Points
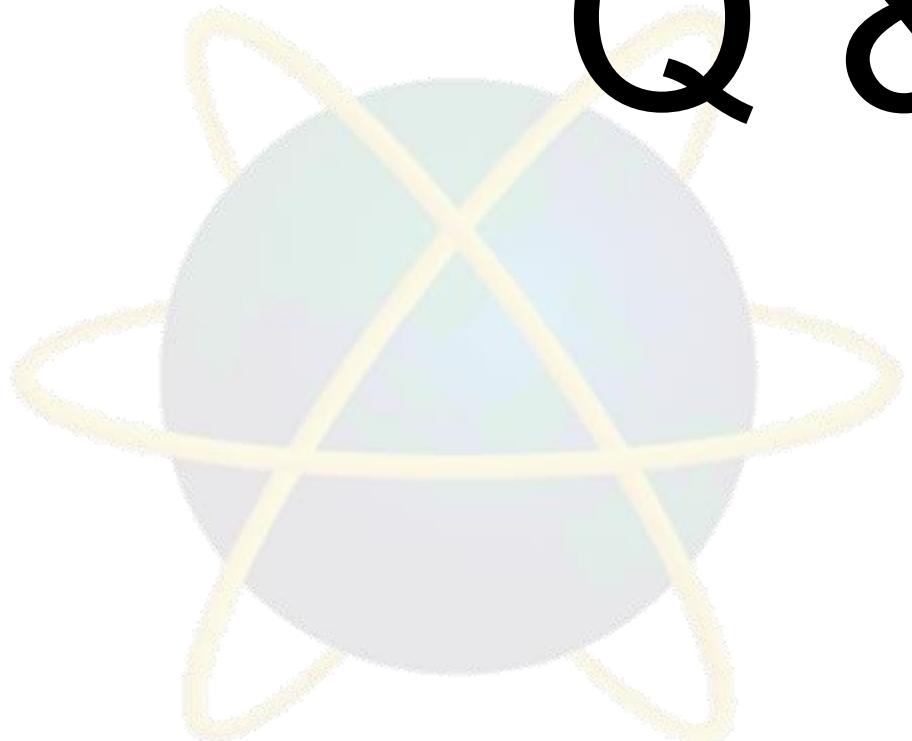
- Discussed IoT and how it is applied in smart cities, manufacturing, VANET and BAN

- Discussed IEEE 802.15.4 standard Zigbee

Question and Answer Session

Q & A

What we will cover next

Module Summary/Exam Revision