IOT IN THE REAL WORLD

Session 2

OBJECTIVES

In this session, you will learn to:

► Explain the concept of IoT in real world

► List down the features of IoT in smart world

► Explain the role of IoT in the growth of diverse sectors

INTRODUCTION

- ▶ IoT allows its devices to transmit and co-ordinate data in real time

- ▶ The word 'smart' is added before each application: smart cars, smart watches, and so on

- ▶ Embedded communication and built-in networking abilities are used for interconnecting smart objects

HOME AUTOMATION 1/10

All devices are connected to a central hub and controlled by Internet through mobile phones
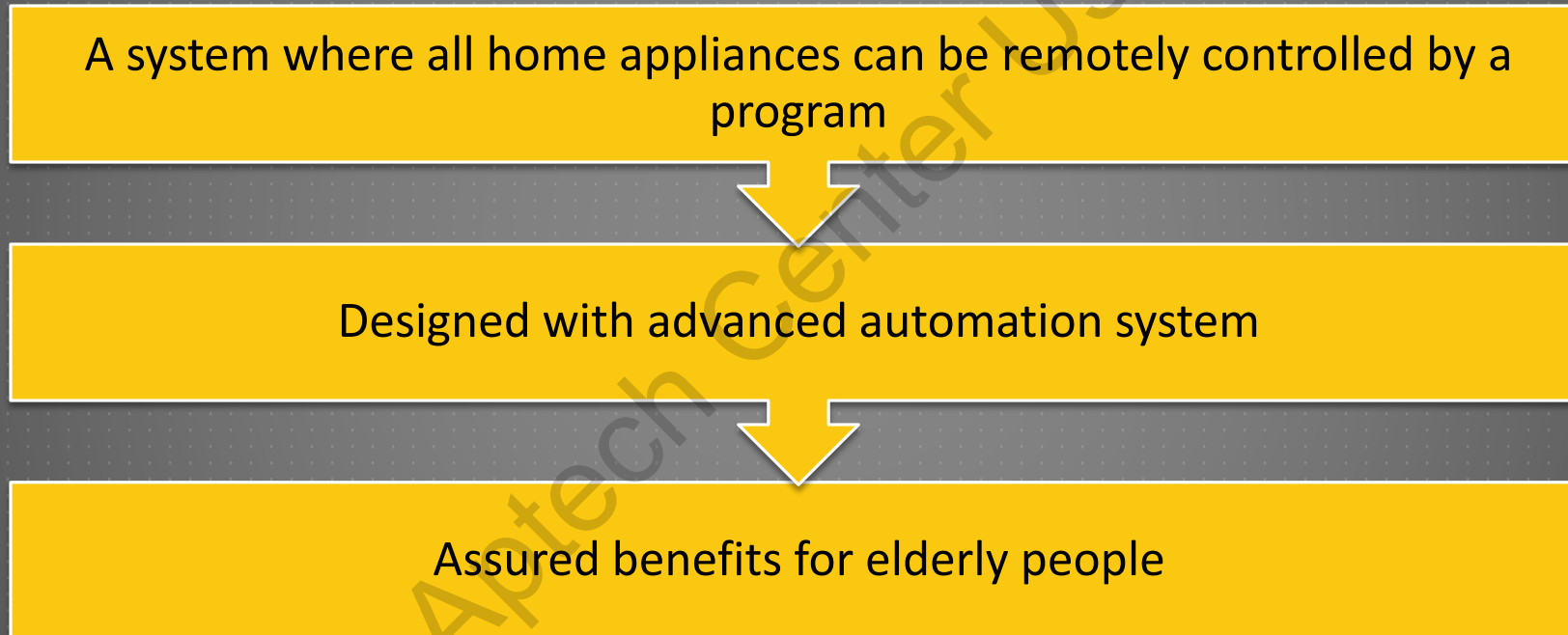
It depends on open source home automation platforms

It uses sensors to manage, access, and retrieve information through smart devices

Smart Home

A system where all home appliances can be remotely controlled by a program

Designed with advanced automation system

Assured benefits for elderly people

► **Some Examples of Smart Home**

Alerts for any harmful gases, user's medication, and so on

Surveillance and security systems inside the house

Alerts the other members when elderly people are in need of any physical assistance

▶ **Smart Lighting**

Aims energy efficiency by automated control system

Factors: Occupancy and availability of daylight

It can be controlled wirelessly from anywhere and anytime

HOME AUTOMATION 5/10

▶ **Smart Appliances**

Functions simpler, faster, and energy efficient

A central automation system makes them work efficiently

Power and energy usage are reduced

HOME AUTOMATION 6/10

▶ **Smart Appliances**

▶ **Home Intrusion Detection System**

Detects, senses, and identifies intrusion

Passive Infrared (PIR) sensors , motion sensors, and door sensors are used

PIR senses sudden changes in temperatures

▶ **Home Intrusion Detection System**

Information is recorded in case of any intrusion

Alarms with both audio and video offer evidences

▶ **Smart Smoke and Gas Detectors**

Detects the presence of fire and harmful gases at home

They control and monitor battery status, receive alerts, or warnings of smoke detection through mobile devices

▶ **Smart Smoke and Gas Detectors**

Voice alerts are programmed to warn users

Alerts by SMS or E-mail to warn users

SMART CITY 1/9

Smart city integrates IT and Communication networks for managing infrastructure

Information and Communication Technology (**ICT**) improves quality, interactivity, and performances

Information gathered are processed and analyzed

SMART CITY 2/9

Following are day-to-day Smart activities:

▶ Smart Parking

▶ Smart Lighting for Roads

▶ Smart Roads

▶ Structural Health Monitoring

▶ Surveillance

▶ Emergency Response

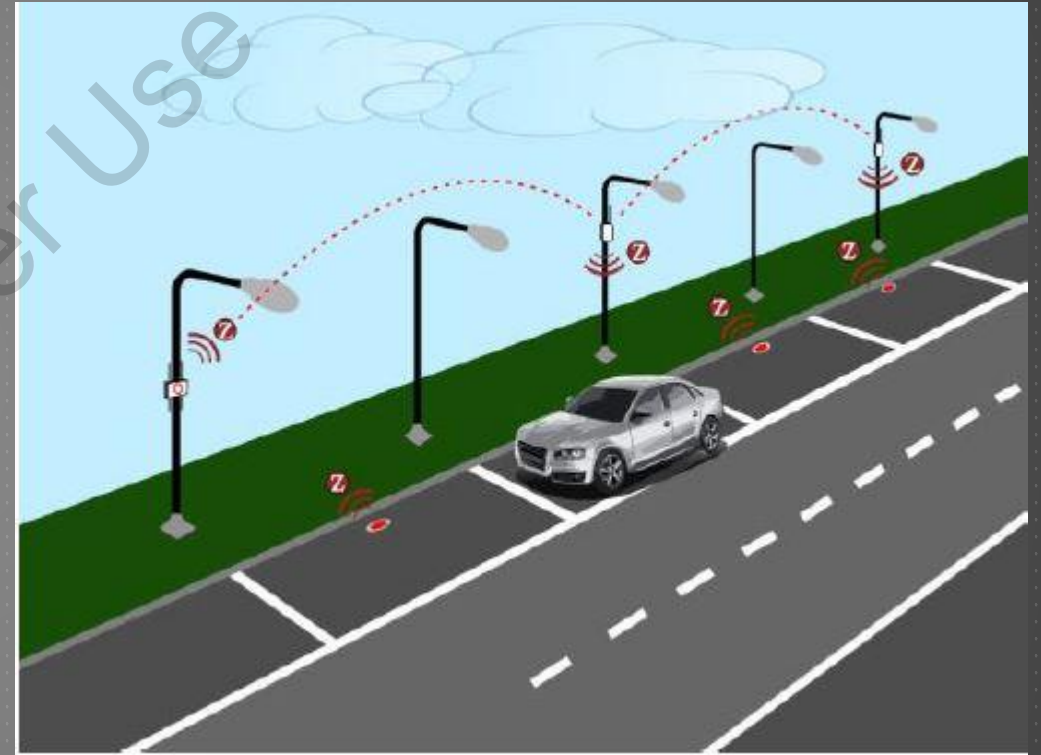▶ **Smart Parking**

Traffic congestion and difficulties in finding parking space

Uses wireless sensors that are installed in each parking slot and detects the available vacant parking spaces

The information is sent to central Web-server using Wi-Fi networks in real-time
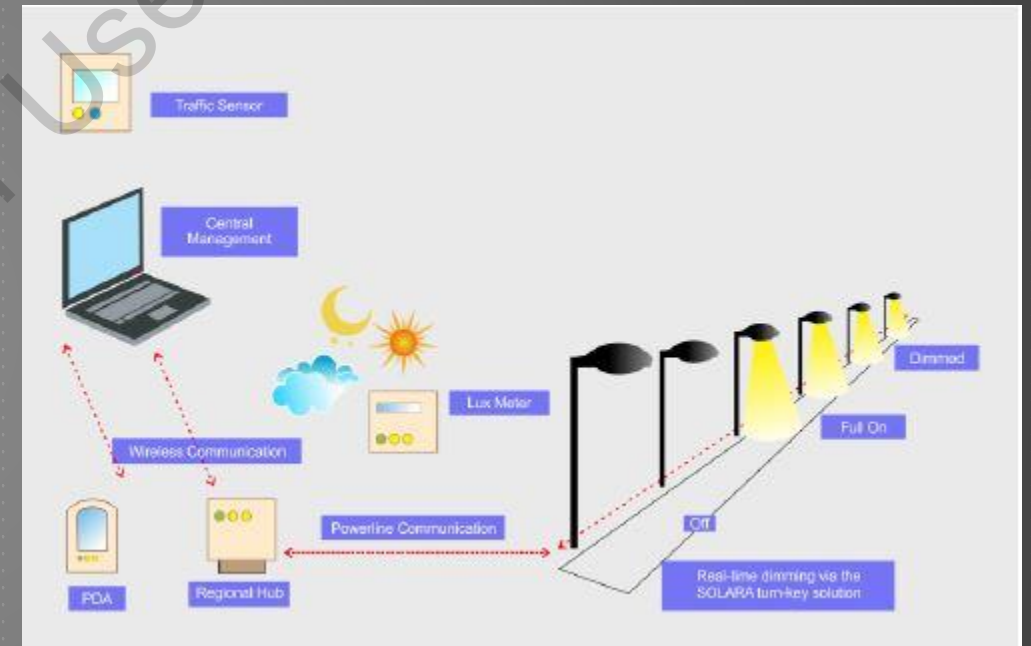
▶ **Smart Lighting for Roads**

Smart lighting systems for roads, buildings, and parks saves energy

Smart lighting controls lighting dynamically and adapts to ambient conditions

It uses wireless sensors that work in unison with other lightings connected to the same network

▶ **Smart Roads**

Help drivers by providing information on condition and potholes of road surfaces and weather conditions

↓

Sensors and smart applications for monitoring weather, measures humidity, temperature, and so on

↓

Provides driver with a consistent view of the road situation

SMART CITY 6/9

▶ **Structural Health Monitoring (SHM)**

The process of implementing a damage detection and categorization plan for engineering structures

⬇

The sensors provide vibration levels and damage-sensitive information for statistical analysis

⬇

SHM enables instantaneous screening of the building conditions during natural calamities

SMART CITY 7/9

▶ Structural Health Monitoring (SHM)

The information helps to:

▶ Detect the existence of damages on the engineering structures

▶ Locate the damages

▶ Identifies the types of damages

▶ Quantify the severity of the damages

▶ Calculates the remaining life span of the structure

SMART CITY 8/9

▶ **Surveillance**

Smart cities monitor public through sensors placed in various places around the city

⬇

Data gathered are analyzed by local authorities and governments

⬇

Smart city surveillance technology is effective for efficient enforcement of law, order, and prevention of crime

SMART CITY 9/9

▶ **Emergency Response**

Monitors essential infrastructure in cities, such as buildings, gas and water pipelines, and public transport

Damage in city's gas and water pipelines are alerted to the concerned public works department

Emergency response alerts such as redirecting of traffic, evacuations of affected areas are sent to public

SMART ENVIRONMENT 1/6

Demands placed on the environment can be met to enable the people to live healthy, now and in the future
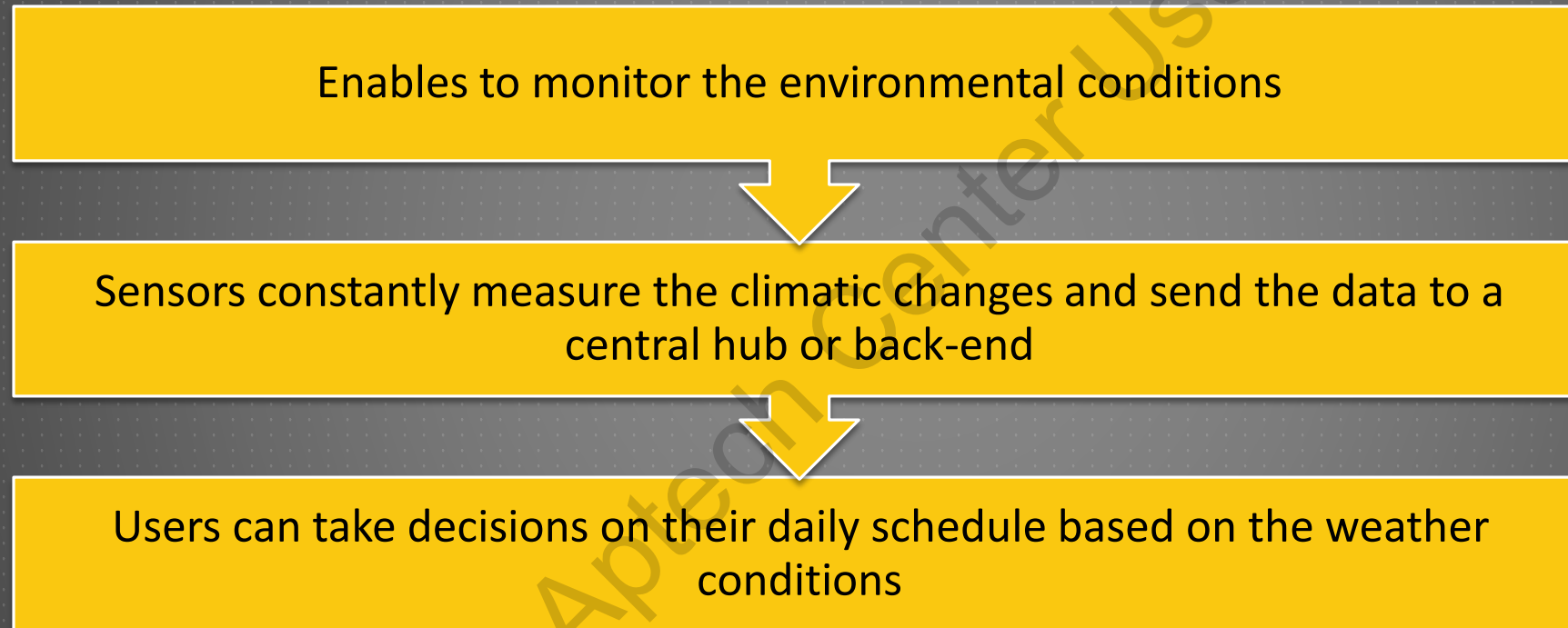
Renewable energy, sanitation, water, and waste water management

Air pollution can have physiological effects on people

▶ **Weather Environment**

Enables to monitor the environmental conditions

Sensors constantly measure the climatic changes and send the data to a central hub or back-end

Users can take decisions on their daily schedule based on the weather conditions

SMART ENVIRONMENT 3/6

▶ **Air Pollution Monitoring**

Increased number of vehicles and industrial development have led to air pollution

Monitors the quality of air emitted from harmful gases, such as CO_2, NO_2, CO, NO, and so on

Particle pollution is the term for a mixture of solid particles and liquid droplets found in the air

▶ **Air Pollution Monitoring**

Urban development has led to increase in noise levels in metropolitan cities

An individual noise sensor is used to detect the Sound Pressure Level (**SPL**)

It is a logarithmic measure of the effective pressure of a sound, measured in decibels (**dB**) droplets found in the air

SMART ENVIRONMENT 5/6

▶ **Forest Fire Detection**

Sensors collect data on surrounding conditions including temperature, humidity, and intensity levels

Types of sensors detector:
Infrared Rays, Video-cameras, Imaging cameras, and Light Detection and Ranging Systems (LIDAR)
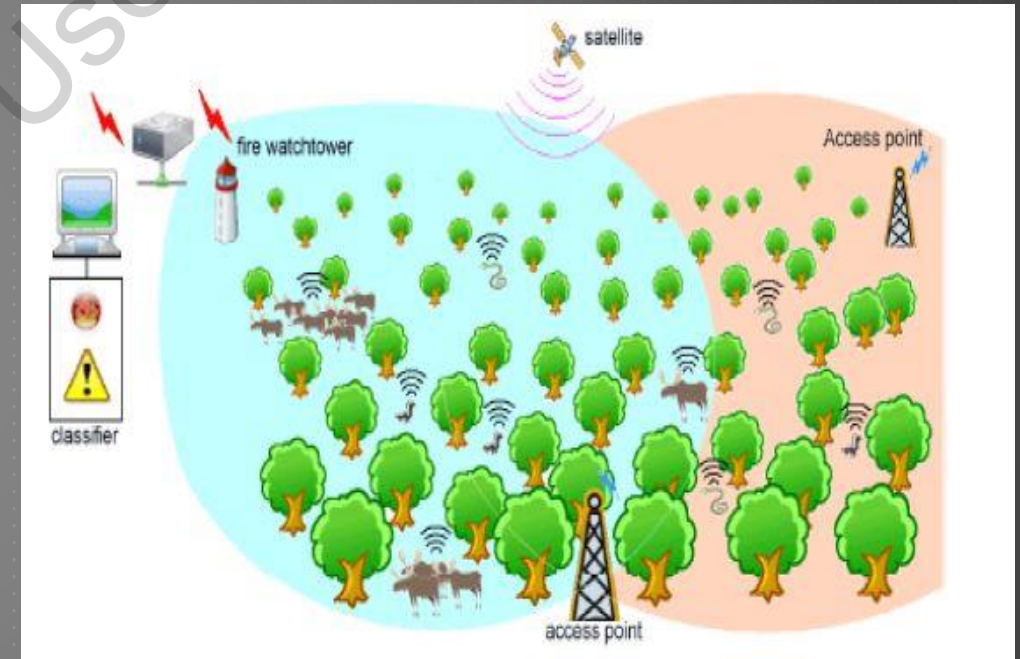
▶ **Flood Detection**

An in-advance system of flood monitoring can avert risks and damages caused by floods

⬇

Sensors can provide prompt warnings and alerts for public evacuation in endangered areas

⬇

Developing proper urban planning policy

ENERGY 1/4

Cost Effective, viable, and reliable energy

Intelligent integration of decentralized renewable energy sources

Power consumption that helps to form the future energy ecosystem

ENERGY 2/4

▶ **Smart Grid**

Interconnected network for delivering electricity from energy suppliers

Improves ability to detect fault faster and automatically rectifies the fault

Smart meter is an automatic device that logs consumption of 'electric energy in interims of an hour or less'

Supports two-way interaction between the meter and the energy provider

ENERGY 3/4

▶ **Renewable Energy Systems**

Renewable sources, such as sun and wind are not always available

Integrating solar and wind power into the grid enables more efficient use of energy and also saves cost

Transmission and distribution of infrastructure will manage bi-direction energy flows better

ENERGY 4/4

▶ **Prognostics**

For energy systems to function efficiently, energy systems must be in good working condition

Electrical grids collects real time information using specialized electrical sensors known as Phasor Measurement Units (**PMU**)

RETAIL 1/5

- **Retail Industry**

Retail industries are substituted with sensors and RFID technology

Helps retailers by offering superior product choice and improved customization

RETAIL 2/5

▶ **Inventory Management**

RFID readers are attached to the retail store shelves and warehouses to enable easy tracking of data

When items are constantly monitored, RFID technology prevents inventory shrinkages including misplacements and thefts of items

RETAIL 3/5

▶ **Smart Payments**

Contact-less payments, which uses RFID technologies

Helps to remotely access these devices from a distant location

Debit cards, credit cards, smart cards, key fobs, smartphones and other mobile devices are various contactless payment systems

RETAIL 4/5

▶ **Smart Payments**

   ❑ **Near Field Communication**

> NFC is a form of mobile contactless payment

> NFC comprises an initiator and a target

> NFC initiates pairing of devices to establish a Bluetooth connection

> NFC is a one-step payment method that works anywhere the users want to make a purchase

RETAIL 5/5

▶ **Smart Vending Machines**

> Allow users to transfer money from the bank

> Give users the history of their past purchase

> Automatically gives users an alternative offer as desired

LOGISTICS 1/5

Important role is to network people

Optimization of models integrating with Web-based systems

Dynamically structured supply chain network

LOGISTICS 2/5

▶ **Route Generation and Scheduling**

Enables optimization of multiple route generation

More number of routes require route generation and scheduling

Optimizing transportation schedules and planning fixed routes

LOGISTICS 3/5

▶ **Fleet Tracking**

> Used by fleet operators for fleet management

> Provides a wide range diagnostics and maintenance reports on vehicle faults

> GPS technology identifies the next fleet nearest to the break down vehicle

LOGISTICS 4/5

▶ **Shipment Monitoring**

Enables manufacturers and shippers to track shipments

If packages are tampered with and send E-mail alerts to concerned authorities

Cargo container fitted with GPS and RFID effectively tracks units or pallets

LOGISTICS 5/5

▶ **Remote Vehicle Diagnostics**

Detect faults in the vehicles or warns of impending faults

Enables remote diagnostics in a vehicle by providing in-vehicle data on vehicle operation

AGRICULTURE 1/3

Controlling and monitoring the agricultural industry

Detect, crop growth, soil moisture, and cattle feed levels

Monitors irrigation equipment and harvesters

AGRICULTURE 2/3

▶ **Smart Irrigation**

To determine the amount of moisture in the soil

To release the flow of water through the irrigation pipes

To gather moisture levels on a server or in the cloud

AGRICULTURE 3/3

▶ **Green House Control**

Measures various factors such as temperature, humidity, light, and soil moisture

Enhances productivity

Correlates the productivity with different control strategies

INDUSTRY AND MANUFACTURING 1/3

Transforms industries

Positive impact on the operational efficiency

Increases revenue

Develop technologies

INDUSTRY AND MANUFACTURING 2/3

▶ **Machine Diagnosis and Prognosis**

Anticipates the performance of a machine

Determines the reason for a machine's fault

Monitors machines

INDUSTRY AND MANUFACTURING 3/3

▶ **Indoor Air Quality Monitoring**

Identifies the hazardous zones for poor ventilation

Effective control

HEALTH AND LIFESTYLE 1/2

Periodical capturing of information

Assists collection and analysis of the information

Change the way in which healthcare will be provided

HEALTH AND LIFESTYLE 2/2

▶ **Health and Fitness Monitoring**

Enable uninterrupted health and fitness monitoring

Monitor patient's physiological conditions

Transfers the tasks of regular monitoring

SUMMARY 1/2

▶ Growth of Wi-Fi's role in home automation has mainly increased due to the integrated nature of installed electronics, where electronic devices (TVs and AV receivers, mobile devices and so on) have started to play a vital role in the home IP network.

▶ Present homes have different types of modern appliances, such as, air-conditioner, music systems, washer/dryers, refrigerators, TVs, and so on. Handling and governing these appliances can be arduous, as each appliance is designed with unique controls or remotes.

▶ Smart parking is driven by IoT systems which perceive the number of vacant parking spaces and send the information through the Internet to smart parking application back-ends.

SUMMARY 2/2

▶ IoT systems for fire detection, gas, and water leakage detection can help in generating alerts and minimizing their effects on the vital infrastructure.

▶ IoT based weather monitoring systems can collect data from a number of sensor attached, such as, temperature, humidity, pressure, and so on. It can also send the data to cloud-based applications and storage back-ends.

▶ IoT systems using Radio Frequency Identification (RFID) tags can help in inventory management and maintaining the right inventory levels.

▶ Wearable IoT devices that allow non-invasive and continuous monitoring of physiological parameters that can help in continuous health and fitness monitoring. These wearable devices can be in various forms such as belts and wrist-bands.