**Chapter 7**

**Case Studies using IoT**

## [A] Agriculture:

**1. Smart Irrigation:**

Smart irrigation system uses soil moisture sensors to determine the amount of moisture in the soil and release the flow of water through the irrigation pipes only when the moisture level goes below a predefined threshold.

Data on moisture levels from each region of the farm is collected, stored in cloud and analyzed for plant watering schedules and study on moisture levels in the soil.

## 2. Precision Farming

In this approach of farm management, a key component is the use of IT and various items like sensors, control systems, robotics, autonomous vehicles, automated hardware, adoption of access to high-speed internet, mobile devices, and reliable, low-cost satellites (for imagery and positioning) by the manufacturer are few key technologies characterizing the precision agriculture trend.

The products and services of precision farming are used for water use efficiency, increasing crops productivity etc.

## 3. Agricultural Drones

Drones are being used in agriculture in order to enhance various agricultural practices. The ways ground-based and aerial based drones are being used in agriculture are crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

Real-time data collection and processing, the drone technology will give a high-tech makeover to the agriculture industry. PrecisionHawk is an organization that uses drones for gathering valuable data via a series of sensors that are used for imaging, mapping, and surveying of agricultural land. These drones perform in-flight monitoring and observations. The farmers enter the details of what field to survey, and select an altitude or ground resolution.

From the drone data, we can draw insights regarding plant health indices, plant counting and yield prediction, plant height measurement, canopy cover mapping, field water ponsing mapping, scouting reports, stockpile measuring, chlorophyll measurement, nitrogen content in wheat, drainage mapping, weed pressure mapping, and so on.

## 4. Livestock Monitoring

Large farm owners can utilize wireless IoT applications to collect data regarding the location, well-being, and health of their cattle. This information helps them in identifying animals that are sick so they can be separated from the herd, thereby preventing the spread of disease. It also lowers labor costs as ranchers can locate their cattle with the help of IoT based sensors.

JMB North America is an organization that offers cow monitoring solutions to cattle producers.

## 5. Smart Greenhouses

Greenhouse farming is a methodology that helps in enhancing the yield of vegetables, fruits, crops etc. Greenhouses control the environmental parameters through manual intervention or a proportional control mechanism. As manual intervention results in production loss, energy loss, and labor cost, these methods are less effective. A smart greenhouse can be designed with the help of IoT; this design intelligently monitors as well as controls the climate, eliminating the need for manual intervention.

For controlling the environment in a smart greenhouse, different sensors that measure the environmental parameters according to the plant requirement are used. We can create a cloud server for remotely accessing the system when it is connected using IoT.

**[B] Smart City:**

To accommodate this new demand on cities, municipalities around the globe are turning to the Internet of Things innovation to enhance their services, reduce costs, and improve communication and interaction.

## 1. Efficient water supply

The Internet of Things has the potential to transform the way cities consume water. Smart meters can improve leak detection and data integrity; prevent lost revenue due to inefficiency, and boost productivity by reducing the amount of time spent entering and analyzing data. Also, these meters can be designed to feature customer-facing portals, providing residents with real-time access to information about their consumption and water supply.

## 2. innovative solution to traffic congestion

As more and more people move to cities, traffic congestion – which is already a massive problem – is only going to get worse. Fortunately, the Internet of Things is well positioned to make improvements in this area that can benefit residents immediately. For example, smart traffic signals can adjust their timing to accommodate commutes and holiday traffic and keep cars moving. City officials can collect and aggregate data from traffic cameras, mobile phones, vehicles, and road sensors to monitor traffic incidents in real-time. Drivers can be alerted of accidents and directed to routes that are less congested. The possibilities are endless and the impact will be substantial.

## 3. Energy-efficient buildings

IoT technology is making it easier for buildings with legacy infrastructure to save energy and improve their sustainability. Smart building energy management systems, for instance, use IoT devices to connect disparate, nonstandard heating, cooling,

lighting, and fire-safety systems to a central management application. The energy management application then highlights areas of high use and energy drifts so staff can correct them.

**Smart Parking using IoT, environmental monitoring using IoT, smart metering, street lights**

**[C] Home Automation:**

Home automation is the process of controlling home appliances automatically using various control system techniques. The electrical and electronic appliances in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques.

Components of home automation:

# Home Automation Components

We have talked about them before, but let's clearly separate our components that will finally help you build a realistic model of what major components are involved in building a smart home. The major components can be broken into:

- IoT sensors
- IoT gateways
- IoT protocols
- IoT firmware
- IoT cloud and databases
- IoT middleware (if required)

IoT sensors involved in home automation are in thousands, and there are hundreds of home automation gateways as well. Most of the firmware is either written in C, Python, Node.js, or any other programming language.

# Home Automation Sensors

- Temperature sensors
- Lux sensors
- Water level sensors
- Air composition sensors
- Video cameras for surveillance
- Voice/Sound sensors
- Pressure sensors
- Humidity sensors
- Accelerometers
- Infrared sensors
- Vibrations sensors
- Ultrasonic sensors

https://dzone.com/articles/home-automation-using-iot

**[D] IoT in Healthcare:**

**Simultaneous reporting and monitoring**

Real-time monitoring via connected devices can save lives in event of a medical emergency like heart failure, diabetes, asthma attacks, etc. With real-time monitoring of the condition in place by means of a smart medical device connected to a smartphone app, connected devices can collect medical and other required health data and use the data connection of the smartphone to transfer collected information to a physician.

## End-to-end connectivity and affordability

IoT can automate patient care workflow with the help healthcare mobility solution and other new technologies, and next-gen healthcare facilities. IoT enables interoperability, machine-to-machine communication, information exchange, and data movement that makes healthcare service delivery effective.

Connectivity protocols: Bluetooth LE, Wi-Fi, Z-wave, ZigBee, and other modern protocols, healthcare personnel can change the way they spot illness and ailments in patients and can also innovate revolutionary ways of treatment.

## Data assortment and analysis

Vast amount of data that a healthcare device sends in a very short time owing to their real-time application is hard to store and manage if the access to cloud is unavailable. Even for healthcare providers to acquire data originating from multiple devices and sources and analyze it manually is a tough bet.

IoT devices can collect, report and analyses the data in real-time and cut the need to store the raw data. This all can happen overcloud with the providers only getting access to final reports with graphs.

Moreover, healthcare operations allow organizations to get vital healthcare analytics and data-driven insights which speed up decision-making and is less prone to errors.

## Tracking and alerts

On-time alert is critical in event of life-threatening circumstances. IoT allows devices to gather vital data and transfer that data to doctors for real-time tracking, while dropping notifications to people about critical parts via mobile apps and other linked devices.

Reports and alerts give a firm opinion about a patient's condition, irrespective of place and time. It also helps make well-versed decisions and provide on-time treatment.

Thus, IoT enables real-time alerting, tracking, and monitoring, which permits hands-on treatments, better accuracy, apt intervention by doctors and improve complete patient care delivery results.

## Remote medical assistance

In event of an emergency, patients can contact a doctor who is many kilometers away with a smart mobile apps. With mobility solutions in healthcare, the medics can instantly check the patients and identify the ailments on-the-go.