***Assignment #1***

20 uses of ***INTERNET OF THINGS*** in daily life

**Case #1: SOIL MONITORING**

Soil Monitoring with IoT uses technology to empower farmers and producers to maximise yield, reduce disease and optimise resources. IoT sensors can measure soil temperature, NPK, volumetric water content, photosynthetic radiation, soil water potential and soil oxygen levels. Data from the IoT sensors are then transmitted back to a central point (or the cloud) for analysis, visualisation and trend analysis.

### CASE #2:- Energy Management

### Energy can be a costly input for industrial businesses. With fluctuating energy costs and strict government requirements of efficiency, managing energy distribution becomes important.IoT devices can help manufacturers manage energy consumption based on real-time data collected from devices. Intelligent energy management systems reduce energy bills, operational expenditures and carbon footprint of the factory while increasing energy efficiency. [WebNMS](https://www.webnms.com/iot/energy-management.html) is an [IoT platform](https://research.aimultiple.com/iot-platform/) that provides IoT applications including energy management to optimize the energy consumption of businesses.

### CASE #3:-Outdoor surveillance

### When IoT CCTV cameras combined with [artificial intelligence](https://research.aimultiple.com/ai/) and [machine vision](https://research.aimultiple.com/machine-vision/), governments can automate surveillance of streets through cameras. As IoT enables connectivity of machines, they are able to record and analyse video data in real time, and they can provide police officers with insights instead of single pieces of images.

### However, outdoor surveillance processes personal information and there is potential for abuse in use of such technologies. Therefore appropriate checks and balances need to be implemented in such systems to ensure that personal information is not abused while risk of crime is minimized.

### CASE #4:- Smart lighting

According to the 2018 [Gartner](https://www.gartner.com/doc/3883066/hype-cycle-internet-things-) IoT hype cycle report, smart lighting is the fourth-most mature IoT tech application. Smart lighting aims to optimize energy management.

Smart lighting is made up of street lighting with IoT sensors. Sensors collect data about the condition of traffic and pedestrians. With that data, street lights provide optimum lighting so that street lighting systems can save up to 80% of the energy.

Smart lighting can also be applied to factories or homes.

### CASE #5:- Smart parking

In cities like San Francisco, parking is a big problem. With IoT sensors, parking problems in a city can be minimized.

Working principle of smart parking is:

* Sensors are attached to parking lots to detect parked cars
* Measurements are periodically sent to the cloud by microcontrollers
* Mobile Apps use cloud data to identify empty parking spaces,
* Drivers check mobile apps to identify vacant parking spaces close to the location they aim to go to.

### CASE #6:- Waste Management

Traditional waste collections are complicated and costly since a fleet of trucks drives along busy streets using inefficient routes. Fill levels of garbage containers differ for each container: ranging from overflowing, partially filled and empty. IoT sensors can monitor fill levels for conventional bins and send the data to the relevant department of the city hall. With that information, the garbage truck routes can be optimized for trash collection.

### CASE #7:- Smart Irrigation

IoT sensors determine the weather condition and the soil moisture, which will help in getting the appropriate amount of water that soil needs. [Bosch](https://www.bosch.com/stories/iot-based-smart-irrigation-system/) offers an IoT solution that measures how much water the tree needs and provides that amount of water.

### CASE #8:- Fall Detection

Falling into the ground and not being able to get up or request help can be a scary experience for senior citizens. IoT sensors can detect falls using geolocation data and summon help so that it reduces the time the elderly remain on the floor after a fall which could lead to lethal consequences.

### CASE #9:- Remote Control Appliances

IoT powered home appliances let residents remotely switch on and off devices using smartphone apps to avoid incidents and save energy. Additionally, these devices can make autonomous decisions based on sensor inputs such as preparing fresh coffee when a resident is identified to wake up. Other examples of autonomous or remote controlled actions include:

* turning on lights,
* starting the coffee maker,
* setting temperature,
* open up a music playlist,
* Locking doors.

### CASE #10:- Connected Vehicles

Sensors are enhancing vehicles along with AI and analytical capabilities. These sensors provide communication with the driver to supply useful information about other cars on the road and roadside infrastructure to the driver to help the driver make safer or more informed decisions. For example, these vehicles provide GPS enabled location detection feature that helps them detect traffic congestions.

[Autonomous vehicles](https://research.aimultiple.com/aut/) are also an application of IoT devices. Though it is not commonly used in logistics yet, we will witness this approach soon. For instance, [Mercedes-Benz](https://www.mercedes-benz.com/en/innovation/autonomous/the-long-haul-truck-of-the-future/) prototype of the semi-autonomous truck is scheduled for release in 2025.

### CASE #11:- Ultraviolet Radiation Monitoring

Sunlight consists of three major components:

* Visible light: Wavelengths between 0.4 and 0.8 micrometres,
* Ultraviolet light: Wavelengths shorter than 0.4 micrometres,
* Infrared light: Wavelengths longer than 0.8 micrometres.

Ultraviolet (UV) rays are electromagnetic waves that account for about [10](https://ag.tennessee.edu/solar/Pages/What%20Is%20Solar%20Energy/Sunlight.aspx)% of solar light. When overexposed, UV rays have harmful [effects](https://www.epa.gov/sunsafety/health-effects-uv-radiation) such as skin cancer, premature aging, cataracts, and immune system suppression. IoT sensors measure UV sun rays to warn people not to be exposed in certain hours.

## **CASE #12:- Water Management**

Due to the drastic increase in urbanization levels and the importance of water quality in human health, water management is a key topic for cities. A water management system is based on real-time data collected from sensors. Water management can provide the following applications:

**CASE #13:- Structural Health Monitoring**

IoT allows remote collection of architectural data to monitor events such as vibrations and changes in material conditions, predict structural damage, and prepare action plans for structures such as bridges, buildings, stadiums, ships, airplanes, etc.

### CASE #14:- Smart Greenhouses

[Greenhouse farming](https://www.agrifarming.in/greenhouse-farming-information/) increases crop yield by controlling environmental parameters like light, temperature, air pressure, and humidity. IoT helps by adding remote-controlled sensors and actuators that allow farmers to remotely monitor their greenhouse’s conditions and update its behavior. When combined with artificial intelligence, IoT technology can even complete the necessary tasks itself (turn on lights, control a heater, open a window, etc.).

### CASE #15 :-Agricultural Drones

Drones are unmanned aerial vehicles that can access the airspace above growing fields with an ease previously impossible or prohibitively expensive. These [agricultural drones](https://en.wikipedia.org/wiki/Agricultural_drone) can help farmers monitor fields by [taking pictures of the crops](https://agribotix.com/whitepapers/farmers-need-know-agricultural-drones/) and [delivering important payloads](https://www.coptrz.com/understanding-drone-payloads/) like seeds, water, and crop sprays.

Aerial pictures [can reveal patterns](https://www.technologyreview.com/s/601935/six-ways-drones-are-revolutionizing-agriculture/) not apparent at eye level, such as soil variation, irrigation issues, and even pest/fungal infestations. These images [can even be taken in infrared](http://www.thedrive.com/tech/18456/drones-in-agriculture-how-uavs-make-farming-more-efficient), which can show valuable information invisible to the naked eye. This data can provide [important insights](https://medium.com/sciforce/smart-farming-or-the-future-of-agriculture-359f0089df69) on plant health, plant height, plant counting, and yield prediction.

### CASE #16 :-Livestock Monitoring

IoT allows farmers to [attach sensors to their animals](https://www.sigfox.com/en/solutions/smart-livestock-collars-let-ranchers-track-monitor-and-manage-herds-never) that track location, well-being, and even animal health. The farmer can then monitor their herd in real-time and receive alerts for important situations.

Smart livestock implementations have been shown to:

* [Lower labour costs](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5474773/).
* [Increase herd health](https://www.sciencedirect.com/science/article/pii/S2214180416301350) through methods like [disease identification](https://www.telit.com/industries-solutions/agriculture/crop-livestock-monitoring/) and [oestrous detection](https://www.cowlar.com/).
* [Increase yield](https://www.precisionag.com/systems-management/using-iot-to-increase-efficiency-productivity-for-livestock/) for meat and dairy through improved animal feeding and nutrition monitoring.

## **CASE #17:-Smart Retail**

[Smart shelves](https://www.datexcorp.com/smart-shelf-technology-reshaping-retail-industry/) include IoT sensors built into retail shelves. These sensors can gather data from tags on items or their packaging and communicate it to the store or directly to shoppers.

Smart Shelves have been shown to:

* Improve sales and [marketing](https://www.usatoday.com/story/money/nation-now/2015/10/04/kroger-tests-smart-shelf-technology/73320236/) efforts.
* Help [identify and track](https://www.digitalistmag.com/iot/2018/02/28/smart-shelves-will-help-stock-supermarkets-of-future-05922036) merchandise that’s been misplaced or stolen).
* Decrease labour requirements (such as through [instantaneous price re-labeling](https://www.forbes.com/sites/lanabandoim/2018/12/23/how-smart-shelf-technology-will-change-your-supermarket/#5c87eb3c114c)).
* Gather [information on customer behavior](https://www.mdgadvertising.com/marketing-insights/new-smart-shelves-with-sensors-and-analytics-decode-the-impulse-buy/).
* [Decrease the time](https://www.amberengine.com/blog-content/2018/8/21/smart-shelves-outsmart-your-stock) that items are out-of-stock.

### CASE #18:-Robot Employees

Robotics specializes in replacing repetitive tasks, a categorization that applies to [half of all retail jobs](https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet/de-de). By connecting these robots to other IoT devices and the Internet, retail establishments can train machines to join the workforce.

* [Nestlé](https://www.nestle.com/media/news/nestle-humanoid-robot-nescafe-japan) has used a humanoid, language-understanding robot to sell coffee makers in Japanese department stores.
* [Walmart has implemented robots](https://www.forbes.com/sites/jenniferjohnson/2018/06/29/this-shelf-scanning-robot-could-be-coming-to-a-store-near-you/) that note problems with shelf labels and report them to human team members.
* Lowes’ LoweBot can [help shoppers locate items](https://www.roboticsbusinessreview.com/resources/robots-retail-remains-fellow-robotics-focus/).
* A New York City Best Buy uses a robot called Chloe to [retrieve merchandise for its customers 24/7](https://www.twice.com/retailing/meet-chloe-best-buy-s-one-armed-checkout-gal-58761), thus extending the store’s operating hours.
* Target has conducted [a trial run of its robotic shelf-checker](http://fortune.com/2016/04/28/target-testing-robot-inventory-simbe/) to keep tabs on which products are running low.
* Amazon uses robotic assistance to [retrieve items from its warehouses](http://www.businessinsider.com/kiva-robots-save-money-for-amazon-2016-6).
* Customers in need of a sweet treat can purchase ice cream [directly from a Robofusion kiosk](http://robofusion.com/), no humans needed.

### CASE #19 :-IoT in Poultry and Farming

Livestock monitoring is about animal husbandry and cost saving. Using IoT applications to gather data about the health and well being of the cattle, ranchers knowing early about the sick animal can pull out and help prevent large number of sick cattle.

**CASE #20:- IoT Tracking and Monitoring System**

A lot of businesses are using IoT systems for asset tracking. IoT asset tracking devices use GPS or radio frequency (RF) to track and monitor properties. The smart devices can be used for long-range identification and verification of assets.