

Assignment 1

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List out 20 use cases of the Internet of Things.

Smart Factories

Enterprise Asset management

Enterprise asset management involves: work management, asset maintenance, planning and scheduling, supply chain management and environmental, health and safety (EHS) initiatives. Businesses collect real-time data from an asset with IoT sensors.

Businesses are rapidly adopting smart asset management systems into their businesses. Due to their asset-intensive environments, we mostly encounter with IoT asset monitoring in industries such as logistics, retail, and manufacturing.

IoT-powered asset management increases real-time visibility of assets and helps businesses optimize their resource while providing benefits such as:

- Increased operational efficiency
- Better control over the sales lifecycle
- More efficient safety and compliance checks
- More responsive smart environment.

Predictive maintenance

Maintenance is conducted to prevent predicted problems. So over the lifetime of a machine, some components may never be checked if they are not predicted to cause problems.

For example, Fanuc is a robotics company that is working on reducing the downtime of machines with IoT technology. Fanuc uses sensors to predict when the failure of the component will happen.

Industrial process automation/optimization

Organizations can keep a real-time record of the metrics of all the machines inside a plant using IoT and IP networks. Manufacturers can use this data to automate workflows and to optimize production systems. Automation and optimization support industrial companies to reduce costs and increase the quality and volume of output.

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 is an IoT platform that provides IoT applications including energy management to optimize the energy consumption of businesses.

Smart Cities

Kay Sharpington from Gartner, states “The COVID-19 pandemic is slowing down spending, however, governments across the globe continue to use IoT technologies and solutions to improve citizen safety. At the same time, the falling endpoint and connectivity costs make smart city initiatives more viable”. Gartner estimates that global government Internet of Things (IoT) endpoint electronics and communications market will total \$15 billion in 2020, an increase of 6% from 2019.

Outdoor surveillance

When IoT CCTV cameras combined with artificial intelligence and 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.

Smart lighting

According to the 2018 Gartner 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.

Electronic Road Toll Collection and Traffic Management

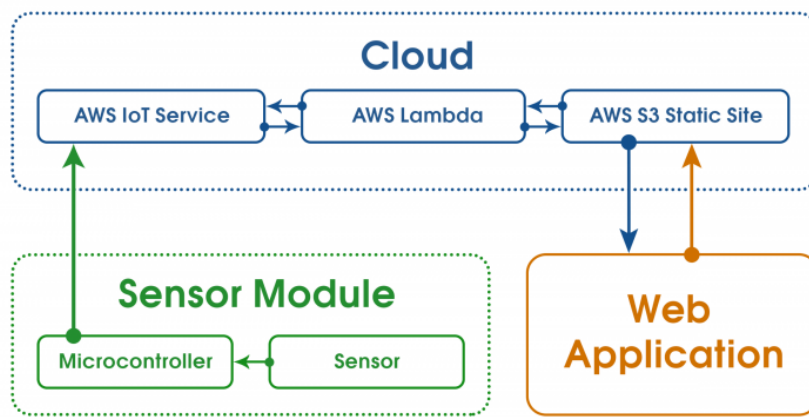
Traffic engineers augmented by smart systems at a central traffic management center (TMC) can analyze data from IoT sensors then optimize timing of traffic lights throughout the day. This can help divide the traffic more evenly over roads as traffic volume fluctuates.

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.



mobidev

Source: Modidev

Noise Monitoring

In smart cities, sound monitoring systems can monitor noise levels and warn companies that violate limits and help manage noise levels.

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.

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.

Machine learning methods can also be implemented in IoT sensors (i.e. edge analytics) so that sensors can predict the fill levels of containers by learning from historical data.

Below the video, you can find how Proximus, an IoT solutions vendor, using IoT to manage waste:

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:

Water conservation

Sensors detect the water level in tanks and alerts when the water level is lower than the threshold. Well™, a smart home water conservation system developed by Mindtribe, uses IoT sensors to monitor water usage.

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 offers an IoT solution that measures how much water the tree needs and provides that amount of water.

Leakage Management

IoT sensors can detect temperature changes, water leakage, chemical leakage, and pressure level in water tanks.

Water Quality Management

IoT sensors determine what kind of chemicals are in the water. They also identify metrics such as total dissolved solids (TDS), bacteria, chlorine, electrical conductivity, etc.

Digital Health

Ultraviolet Radiation Monitoring

Sunlight consists of three major components:

- Visible light: Wavelengths between 0.4 and 0.8 micrometers,
- Ultraviolet light: Wavelengths shorter than 0.4 micrometers,
- Infrared light: Wavelengths longer than 0.8 micrometers.

Ultraviolet (UV) rays are electromagnetic waves that account for about 10% of solar light. When overexposed, UV rays have harmful effects 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.

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.

Below video is an example of how fall detection systems work from a vendor called Walabot:

Companion Robots

A companion robot is a robot that is designed to create companionship mostly for elderly and single children. IoT sensors are essential for robotics and it is the same for companion robots as well. Sensors detect objects that surround the robot and enable the robot to move.

Researchers claim that people have become more receptive to companion robots during the pandemic. Since social isolation may lead people to loneliness, anxiety and frustration, especially for the elderly.

Medical Fridges

Medical fridges monitor the temperature of vaccines, medicines and organic elements for clinics and health centers. Medical fridges provide an opportunity to follow all safety standards and national regulations of the pharmaceutical market using IoT sensors. They prevent medicines and vaccines from spoiling.

Efento is an IoT sensor and IoT platform vendor that has a variety of temperature measurement products along with wireless monitoring of temperature in medical refrigerators.

Patient Surveillance/Remote Patient Monitoring

20% of patients who had surgery are readmitted to the hospital within just 30 days. Remote patient monitoring (RPM) systems use wearables to monitor the condition of patients who are resting at home after surgery. RPM enables real-time data collection about patients' body temperature which is the main indicator of infections. With RPM, doctors can observe patients' data and provide early diagnoses without requiring patients to be physically present at the hospital.

Telit is an IoT solution vendor and offers its customers a remote patient monitoring (RPM) solution that enhances patient monitoring capabilities and patient satisfaction. Telit's offering can reduce:

- patients hospital stay duration thanks to early diagnosis of complications
- hospital readmissions

Smart Retail

Supply Chain Control

IoT devices have transformed supply chain management. Sensors, which are attached to storage containers or to products themselves,

- show the location of goods using GPS,
- track the speed of movement providing an accurate estimated time of arrival (ETA) for goods,

- monitor warehouse conditions such as temperature, humidity, light intensity, and other environmental factors

Near Field Communication (NFC) Payment

NFC enables contactless payments. POS vendors include NFC support in their systems, and customers are adopting contactless payments via their smartphones.

Layout Optimization

Sensors in the store collect data like voice, image or video to better understand customer habits and preferences. Retailers can get insights to redesign the layout of their stores. The optimized layout can enhance sales.

Smart Product Management

IoT sensors enable retailers to control the rotation of products on shelves and warehouses to automate merchandising decisions. We have already written about [retail analytics use cases](#), feel free to check it out if you want to learn more.

Smart Workplace

Sociometric badges

Sociometric sensors are wearable IoT devices that measure the amount of face-to-face interaction, conversational time, physical proximity to other people, and physical activity levels using social signals derived from vocal features, body motion, and relative location.

For example, [Humanyze](#) is a vendor that uses sociometric sensors to perform people analytics. The company helps organizations understand how their teams interact to increase performance.

Smart Homes

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.

Home Intrusion Detection Systems:

IoT based home security applications give users capabilities such as smart locks and security cameras that detect motions and send alerts to their smartphones so that they can monitor the safety conditions of their home from anywhere.

Smart locks

Eyelock is a security provider vendor that offers its clients an iris-based authentication solution.

Motion detection

Manything is another vendor in IoT based home security market. It streams homes/office videos and lets users receive alerts when it detects any activity.

Smart Logistics

Fleet Tracking

IoT fleet tracking systems improve security and provide precise and complete reports that give the fleet managers full transparency towards the fleet's activities. Through GPS monitoring and geo-location tools, companies can track the location of their trucks, optimize routes and monitor their fleet utilization in detail.

For instance, Canadian delivery service Sure Track Courier saved 6-10% per month on fuel costs by optimizing routes using IoT data from trucks.

Platooning

Platooning involves a group of self-driving trucks that follow a lead truck at high speed safely and efficiently. Trucks use IoT sensors so that each truck communicates with the other trucks to adapt its speed and braking accordingly.

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 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 prototype of the semi-autonomous truck is scheduled for release in 2025.

Smart Metering

Smart Grid

With the increasing attention regarding climate change and carbon emissions, utilities focus on reducing energy consumption. For utility companies, IoT enables remote data management and monitoring capabilities to manage better power flows into and out of their grids, and give users the insights needed to understand their energy infrastructure investments.

Digital Twins

A digital twin is a virtual replica of physical entities such as devices, people, processes, or systems that help businesses make model-driven decisions. With the help of IoT sensors, businesses collect data that is needed to create a digital twin.

Digital twins enable businesses to gain a deeper understanding of real-world conditions so that they make necessary adjustments to their products & services.

AR/VR

Whether in gaming, shopping, entertainment, or medical procedures, augmented reality (AR) and virtual reality (VR) are gaining traction to create experiences in an “extended reality.”

AR layers information onto the real world. Whether ani-morphing faces in a video chat or hunting cute little creatures in one’s backyard, your devices are using real-world information, then layering on digital information to change or augment reality. VR places users in a digital world, then uses captured motions (eyes, head turns, etc.) to make them feel immersed in that world.

Smart Watches, Fitness Trackers, Wearables and “Hearables”

Thanks to an influx of new personal devices, the wearables market is thriving. In fact, a **recent report** predicts that this industry is **expected to reach 520.1 million units by 2025**, from 181.5 million units in 2019, representing a CAGR of 19.9 percent over the forecast period (2020-2025). The report also says **over 80 percent of consumers are willing to wear fitness wearables**. This global adoption is due in large part to smart watches, which are

expected to make up over half of all wearables sold in the coming years. Consumers are looking for seamless connection and interaction between their smartphones and smartwatches to track, manage, and secure their data — especially sensitive health data.

But, technological innovation won't just come on the wrist. A new subcategory known as “hearables” could disrupt the wearables industry, using voice-activated, connected headphones and earphones. With more headset makers ditching the headphone jack, these types of devices are expected to become commonplace in the future. Another opportunity is in portable medical devices that monitor blood pressure and heart rate, as well as alert ambulance dispatchers during a medical emergency.

Machine-to-Machine (M2M) Connected Devices

Today's factories are using IoT-enabled machines to work smarter, not harder. By equipping machines with sensors, factory managers can more accurately map machine workloads, inputs, and outputs. They can also more closely track machine wear-and-tear, which leads to maintenance that is predictive rather than reactive and improves lifespan. With these features, factories are increasingly becoming automated, thanks to the **wave of Industry 4.0**. Machine-to-machine (M2M) devices typically use embedded and removable flash solutions to aggregate data into a single stream at the edge. This is used to monitor and react to changing conditions on the factory floor. At the same time, some data is passed on to the central cloud or data center for further processing.

Companion Robots

An IoT use case that has emerged in tandem with this year's pandemic is companion robots. For those who have been shut in at home during the shelter-in-place, companion robots have become a welcome friend. They have names, some can converse, and one day may even be able to take vitals and administer medicine to elders living alone.

Drones on the Rise

For cinematographers and photographers, drones have helped record stunning landscapes previously unavailable to visual artists. But these flying devices aren't just used for this purpose. Oil rig workers are using drones to complete **full rig inspections** quicker, without sacrificing worker safety or production downtime. E-commerce companies are beginning to use delivery robots and drones to deliver buyers' goods from pizza to packages to their front doorstep. Even nonprofits are making use of drones to monitor deforestation in environmentally-fragile communities.

Outside of commercial uses, drones are also serving the public good in search and rescue missions. These machines are helping **search and rescue** teams locate victims more quickly, evaluate the status of victims, and map the right path for rescue missions. In dangerous mountain rescues, successful drone operations require high performance and high capacity data storage. This recent **blog** shows how reliable storage makes a difference in life-threatening emergencies.