Practical and Innovative Applications of IoT and IoT Networks

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What is IoT?

IoT means Internet of Things. In today's scenario, IoT is important in regular life style. IoT is the network of internet-linked devices which is used to communicate with the help of internet to the vehicles, mobile phones and other appliances without intervention of the human being. IoT devices are gather the information from various resources and then send it to the cloud server for responding the services regarding that device.

IoT Devices such as AC (Air Conditioner) remote, Web Camera, smart phones, Laptops, Coffee machines, Refrigerators, Goole home, Smart watches, etc. Any devices of these are connected to IoT it provides the sensing information to the Internet connection.

Often, IoT is mentioned in the same breath as Big Data, since the former generates the kind of massive quantities of information characteristic of the latter. One could say that while all of the information from the Internet of Things is Big Data, not all of Big Data is from the Internet of Things (simplilearn.com).

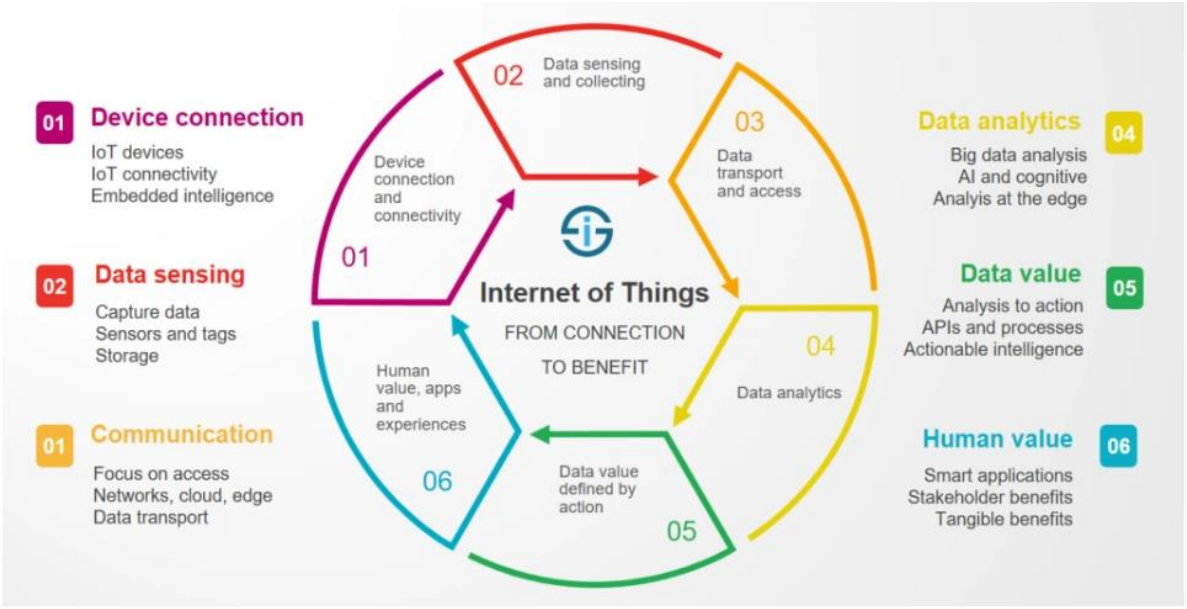

Figure 1: IoT from Connecting devices to Human beings

The basic concept of the IoT is to enable objects of all kinds to have sensing, actuating, and communication capabilities, so that locally-intrinsic or extrinsic data can be collected, processed, transmitted, concentrated, and analysed for either cyber-physical goals at the

collection point (or perhaps along the way), or for process/environment/systems analytics (of a predictive or historical nature) at a processing centre, often "in the cloud". Applications range from infrastructure and critical infrastructure support (for example smart grid, Smart City, smart building, and transportation), to end-user applications such as e-health, crowdsensing, and further along, to a multitude of other applications where only the imagination is the limit. (Daniel Minoli and Benedict Occhiogrosso, 2019). Figure 1 has been taken from umasreeraghunath.blogspot.com.

What are the features of Internet of Things?

The following are major IoT features: (stl.tech)

- **Connectivity:** Establishing a proper connection between all IoT devices and the IoT platform, which could be a server or the cloud.
- **Analysing:** After connecting all of the relevant things, it is time to analyse the data collected in real-time and use it to build effective business intelligence.
- **Integrating:** IoT integrates various models to improve user experience.
- **Artificial Intelligence:** IoT makes things smart and improves people's lives by utilizing data.
- **Sensing in IoT:** In IoT technologies, sensor devices detect and measure environmental changes and report their status.
- **Active Engagement:** IoT allows connected technology, products, or services to engage in active engagement with one another.
- **Endpoint Management:** Endpoint management is critical for all IoT systems; otherwise, the system will fail completely.

What is the Internet of Things Applications?

The Internet of Things is applicable in both public and private sector on daily basis. Through the IoT we can easily track any devices from anywhere or we can also regular monitor the activities doing by any person.

Consumers can use the IoT to help them make restaurant reservations, monitor their exercise progress and overall health, and receive coupons for a store only by virtue of walking by the business in question (simplilearn.com).

Businesses can use IoT to monitor supply chains, track customers' spending habits as well collect their feedback, monitor and maintain inventory levels, and engage in predictive maintenance of their machines and devices (simplilearn.com).

The IoT also proves helpful in ITIL (Information Technology Infrastructure Library), which is a set of IT (Information Technology) service management, an important detail, since IT departments are called on to do more and more in a world that's getting increasingly digital, with more reliance on wireless networks (simplilearn.com).

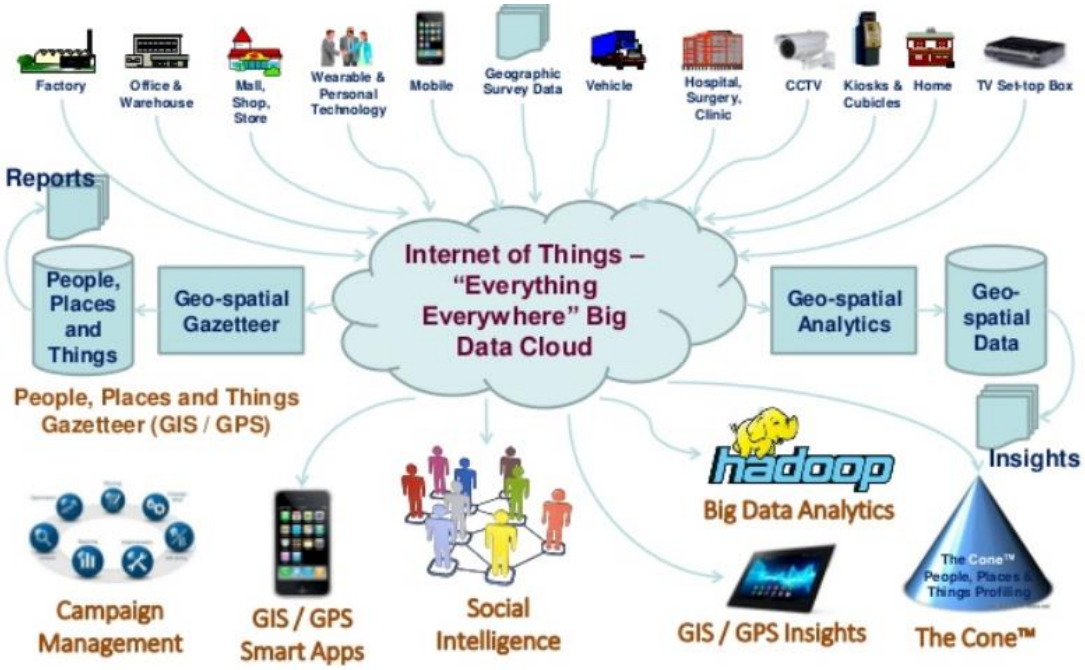

Figure 2: Internet of Things Applications

Blockchain, which is being increasingly used as a more efficient and secure method of transaction and data processing, is a natural beneficiary of IoT technology. We can expect to see IoT and Blockchain coming together more often in the future (simplilearn.com).

Applications of Internet of Things (IOT)

The ubiquity of the Internet of Things is a fact of life thanks to its adoption by a wide range of industries. IoT's versatility makes it an attractive option for so many businesses, organizations, and government branches, that it doesn't make sense to ignore it. Figure 2 has been taken from Let us learn about IoT applications across industries below:

1. **Smart Agriculture**

For indoor planting, IoT makes monitoring and management of micro-climate conditions a reality, which in turn increases production. For outside planting, devices using IoT technology can sense soil moisture and nutrients, in conjunction with weather data, better control smart irrigation and fertilizer systems. If the sprinkler systems dispense water only when needed, for example, this prevents wasting a precious resource. (simplilearn.com). Figure 3 has been taken from (mdpi.com/2076-3417/12/7/3396)

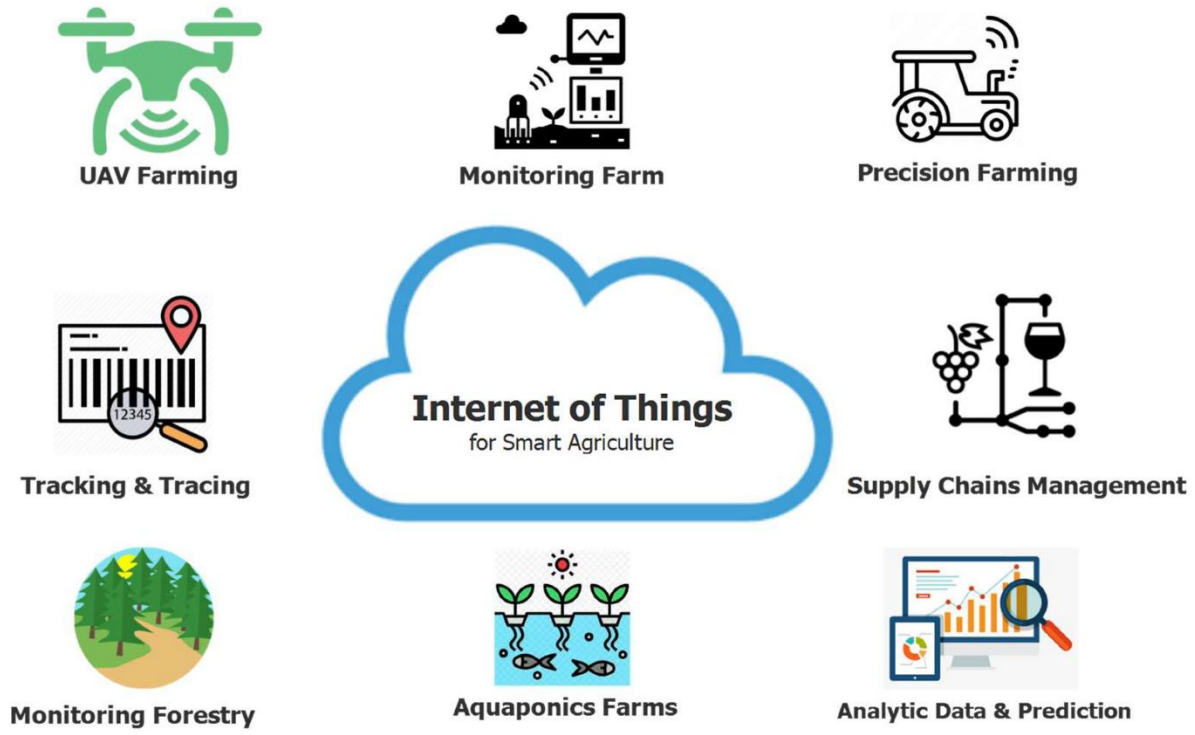

Figure 3: Applications of IOT in Smart Agriculture

Agriculture, as an industry, could massively benefit from the Internet of Things. The world's human population is estimated to grow to around 10 billion by 2050. As such, governments are prioritizing the scaling up of agricultural systems. This, combined with climate change, has farmers marrying technology to cultivation. (spiceworks.com)

- Sensors are used to provide details of **soil chemistry and fertilizer profiles**. CO2 levels, moisture, temperature, level of acidity, and the presence of appropriate nutrients all contribute to how good a harvest turns out to be. (spiceworks.com)
- **Smart irrigation** is an IoT application to regulate and efficiently use water for farming. The IoT system only initiates the water flow when the soil reaches a certain dryness level. It also stops the supply once a certain level of moisture is reached. This reduces wastage caused by human errors. (spiceworks.com)
- **Livestock tracking** involves the use of RFID chips to keep track of an animal's vitals, vaccination details, and location. (spiceworks.com)
- A **smart greenhouse** uses microclimate to raise crops instead of relying on changing weather patterns. Sensors monitor and control all parameters and have automated systems for light and water. (spiceworks.com)
- **Predication farming** is the practice of using information collected over time to hone and implement agricultural practices. The data provided by these sensors allow farmers to decide on the ideal growth parameters and suitable fertilizers. (spiceworks.com)

Cainthus, a Dublin-based vision company, uses predictive imaging to monitor livestock. It tracks key data such as food and water intake, behaviour patterns, and heat detection. Farmers can use this information to decide milk output, reproduction management, and overall animal health. It even boasts proprietary software to recognize animals based on hide patterns and facial recognition. (spiceworks.com)

Food is an integral part of life without which we cannot survive. However, it is an unfortunate fact that a lot of food is wasted in developed countries like America while people starve in poorer countries like Chad, Sudan, etc. One way to feed everyone is better agricultural practices which can be enhanced using IoT. This can be done by first collecting data for a farm such as soil quality, sunlight levels, seed type, rainfall density from various sources like farm sensors, satellites, local weather stations, etc. and then using this data with Machine Learning and IoT to create custom recommendations for each farm that will optimize the planting procedure, irrigation levels required, fertilizer amount, etc. All this will result in better yield or crops with a focus on reducing world hunger in the future. This is done very efficiently by Sun Culture, which is an initiative by Microsoft AI for Earth. (geeksforgeeks.org)

2. Smart Transportation or Smart Vehicle

By this time, most people have heard about the progress being made with self-driving cars. But that's just one bit of the vast potential in the field of transportation. The GPS, which, if you think of it, is another example of IoT, is being utilized to help transportation companies plot faster and more efficient routes for trucks hauling freight, thereby speeding up delivery times.

There's already significant progress made in navigation, once again alluding to a phone or car's GPS. But city planners can also use that data to help determine traffic patterns, parking space demand, and road construction and maintenance. There's even a possibility that apps can be made that can prevent a car from starting if the driver is inebriated! (simplilearn.com)

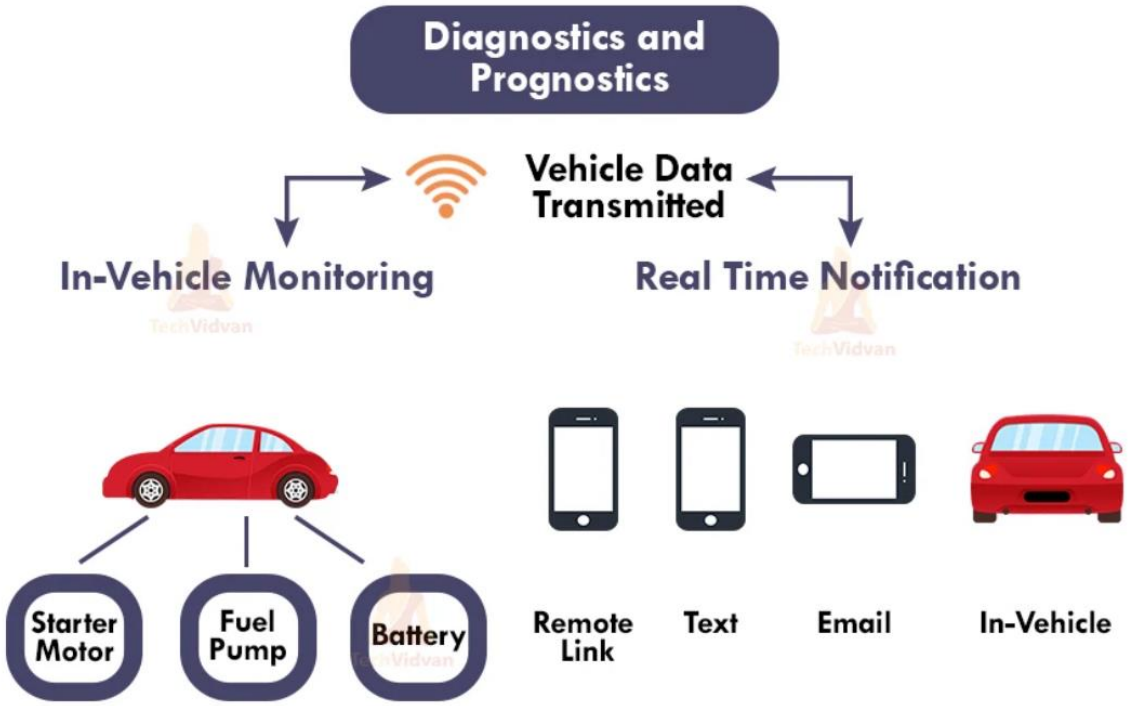

Figure 4: Applications of IoT in Smart Transportation

Smart vehicles or self-driving cars as they can be called are pretty dependent on IoT. These cars have a lot of features that are integrated with each other and need to communicate such as the sensors that handle navigation, various antennas, controls for speeding or slowing down, etc. Here the Internet of Things technology is critical especially in the sense that self-driving cars need to be extremely accurate and all the parts need to communicate with each other in milliseconds on the road. Tesla Cars are quite popular and working on their self-driving cars. Tesla Motors' cars use the latest advancements in Artificial Intelligence and the Internet of Things. And they are quite popular as well!!! Tesla Model 3 was the most sold plug-in electric car in the U.S. in 2018 with a total yearly sale of around 140,000 cars. (geeksforgeeks.org). Figure 4 has been taken from techvidvan.com.

Finally, coming to the applications of **Internet of Things** in transport. These are:

- **Intelligent Traffic**
- **Smart Cars**
- **Automobile Industry**
- **Commercial transportation**

a) Intelligent Traffic

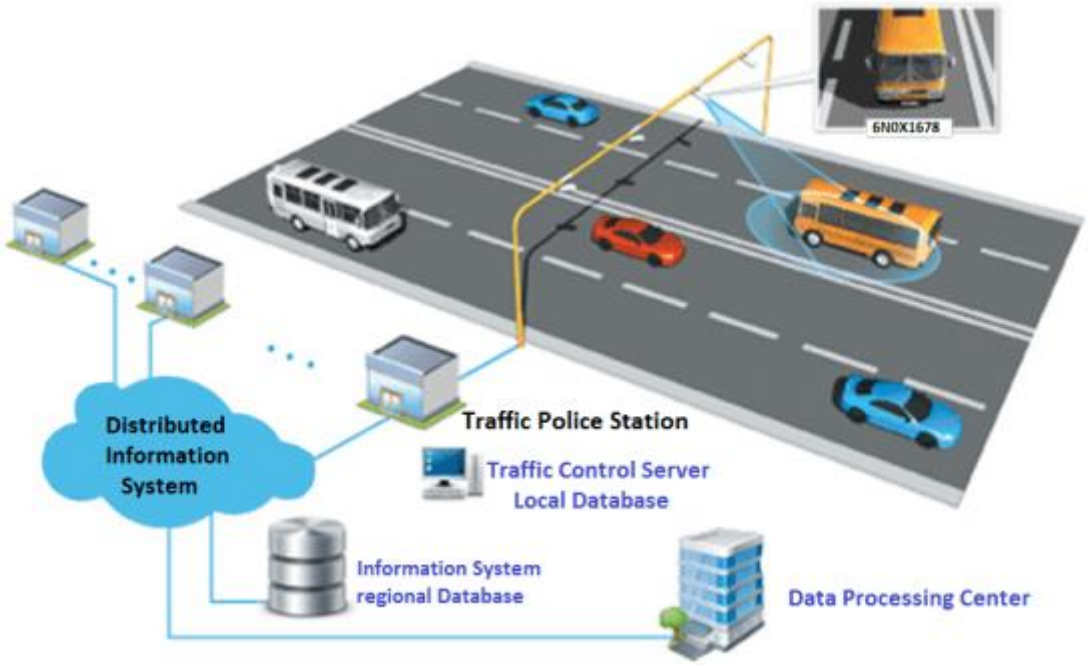

Figure 5: IoT in Intelligent Traffic

Since the traditional traffic control system is not being able to solve the real-time problem. So, the need of the intelligent traffic system comes. Here also, IoT plays an important role. As a result, this smart system helps cities to control traffic more efficiently. However, the backbone of this system is the **5G, 4G** wireless connectivity. Therefore, road traffic, infrastructure, vehicles, street lights, pedestrians are well managed. The technologies applied in intelligent traffic system are: (iot4beginners.com)

Figure 5 has been taken from iot4beginners.com.

<u>Communication</u>

Firstly, in the field of **short-range communication**, the radio frequencies **UHF** and **VHF** are mostly used. Similarly, Global system for communication using mobile phones is GSM or 3G. (iot4beginners.com)

Video-vehicle detection system

Secondly, Videos from cameras are fed into processors that identify the changing characteristics of the video image as the vehicle pass. For this reason, Cameras are situated on the poles, critical zones or adjacency roads. (iot4beginners.com)

As a result, the information can be read from the monitored sites. Similarly, decrypts and allows the operator to process. Finally, the outputs are the vehicle speed, lane occupancy, wrong-way vehicle alarm, headway, detection etc. (iot4beginners.com)

Sensing System

Inductive loops are placed in the roadbed. As a result, the passing vehicles can be detected from the magnetic loops. Likewise, some sophisticated sensors measure the speed, length and class of the vehicles and distance from each. (iot4beginners.com)

Moreover, these sensors work on both high speed and low-speed vehicles. Also, vehicle magnetic sensor detection technologies can reveal the name-plate of the vehicle even at a high speed. Therefore, the crime detection is also become easy. (iot4beginners.com)

GPS Monitoring

So, we can track the traffic speed, density on a particular road using **GPS**, smartphones and sensors. (iot4beginners.com)

Dynamic Traffic Light

RFID sensors are used to maintain the dynamic traffic light sequences. In addition, a proper algorithm, the database can make the work of **RFID** easier to detect the real-time data from each lane, road. (iot4beginners.com)

b) Smart Cars

The future modern transport is smart, integrated and connected cars. Firstly, the increasing number of private cars is the reason behind traffic congestion and pollution. So, to reduce this severe environmental hazard smart car started leaving its importance. Figure 6 has been taken from iot4beginners.com. Here are some features of smart cars:

Communication

How's it if your car can talk? Cool right? Meanwhile, it will give you goosebumps if you know that the smart cars can communicate with each other. Therefore, it will give notification to avoid accidents. Moreover, it can reduce fuel consumption by creating road-train. (iot4beginners.com).

Figure 6: IoT in Smart Cars

Solar & Electric Roadways

This is to say, some roadways have already been implemented in some of the countries like **Sweden** and **South Korea.** To clarify, a network of electronically powered roads for electric vehicles is made using the open-source project **TEV(Tracked Electric Vehicle System)**. (iot4beginners.com)

Self-operating

Now, the driving problem is solved. For example, the smart cars are the **self-driving cars**.

c) Automobile Industry

Firstly, coming to some importance of IoT in automobile industry:

Autonomous vehicle

Today, the hot-topic of the automobile makers is to make a vehicle autonomous. Even though developers have been made in this area, a fully autonomous vehicle still needs to be developed. However, **semi-autonomous** vehicles are there. Therefore, it can assist drivers with driving, parking, braking, road changing, congestion of roads, infrastructure of roads and many more. (iot4beginners.com)

Automotive Maintenance

The sensors from which data can be collected, shared to a platform and then processed by an algorithm. As a result, predictive analysis can be done. Similarly, alerts are sent to the dashboard of the driver regarding probable malfunctions. (iot4beginners.com)

Due to this, drivers can take cost-effective and time-saving steps in anticipation. In conclusion, the driver can confirm of its vehicle condition and repair the parts before they break. Figure 7 has been taken from iot4begginers.com.

Figure 7: IoT in Automobile Industry

Fleet Management

Here are some of the features which an IoT based fleet management system offers to the manager:

- **Real-time location monitoring of the fleet**
- **Volume tracking of cargo**
- **Fuel and mileage statistics**
- **Road-train**
- **Tracking traffic**
- **Time and driver management**

Connected Vehicles

- Firstly, the connected vehicles are using an IoT network called **CV2X (Cellular Vehicle to Everything)** which connects vehicles and smart transport system with each other. In addition, based on the vehicle connection with different objects **CV2X** is again divided in following categories. (iot4beginners.com)
- **Vehicle to vehicle(V2V):** This connection allows to share data of each other. For example, the data are related to speed, location etc. As a result, it helps to prevent accidents. Due to this, the emergency vehicles get access to easily move. (iot4beginners.com)
- **Vehicle to Infrastructure(V2I)**: This infrastructure contains traffic, lights, lane marking etc. Moreover, it facilitates smooth traffic flows and avoid queues at petrol pumps. (iot4beginners.com)
- **Vehicle to Pedestrian(V2P):** A pedestrian can connect to CV2X by using mobile applications. It locates nearby taxis and monitor estimated time to arrival. Likewise, it can also check the pedestrian walking system and change the traffic signal to cross the road. (iot4beginners.com)

d) Commercial transportation

Commercial transports are used to transport goods whether for paying or not. Now coming to the point what makes a commercial transport smart. Figure 8 has been taken from iot4beginners.com.

Figure 8: IOT in Commercial Transportation

Firstly, sensors monitor and communicate real-time status of fuels to operators or the drivers. Similarly, service intervals and saving of money can avoid pulling filters based on industrial recommendation. Likewise, it reduces the breakdown, two bills. In addition, it also monitors the health status of the driver and avoid accidents. Here are some examples of vehicles where smart commercial transportation have been imported. (iot4beginners.com)

3. Smart Healthcare

There are many applications of IoT in the Healthcare Industry where doctors can monitor patients remotely through a web of interconnected devices and machines without needing to be in direct contact with them. (geeksforgeeks.org) This is very useful if the patients don't have any serious problems or if they have any infectious diseases like COVID-19 these days. One of the most common uses of IoT in healthcare is using robots. These include surgical robots that can help doctors in performing surgeries more efficiently with higher precision and control. (geeksforgeeks.org) There are also disinfectant robots that can clean surfaces quickly and thoroughly using high-intensity ultraviolet light (which is pretty useful these days!) Other types of robots also include nursing robots that can handle the monotonous tasks that nurses have to perform for many patients' day in and day out where there is little risk to the patients. (geeksforgeeks.org). Figure 9 has been taken from conceptsall.com.

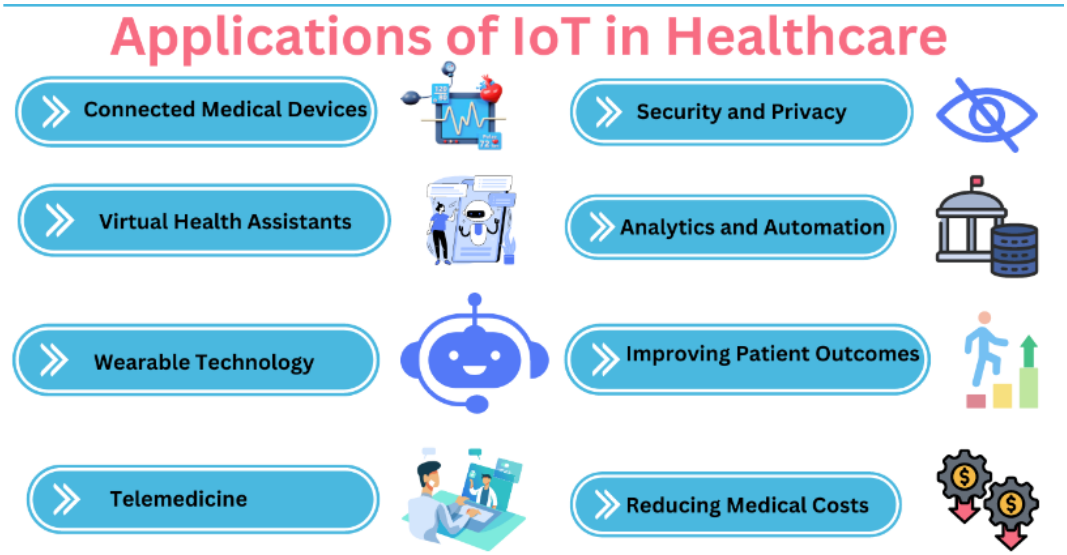

Figure 8: IoT in Healthcare

Smart Hospitality

Interesting improvements to the service quality have found their way with the application of the IoT to the hotel industry. The hassle-free automation of various interactions, such as electronic keys sent directly to each guest's mobile devices, has brought about a transformation. It provides easy check-out processes, immediate information on the availability of rooms, and quicker assignment of housekeeping tasks while disabling the operation of doors. (simplilearn.com)

The guests' location, sending offers on activities of interest, the realization of orders to the room, the automatic charge of accounts to the room, and more can easily be handled via integrated applications using IoT technology. (simplilearn.com)

4. **Smart Insurance**

Even the insurance industry can benefit from the IoT revolution. Insurance companies can offer their policyholders discounts for IoT wearables such as Fitbit. (simplilearn.com)

Figure 9: IoT in Smart Insurance Industry

By employing fitness tracking, the insurer can offer customized policies and encourage healthier habits, which in the long run, benefits everyone, insurer, and customer alike. (simplilearn.com). Figure 9 by Tracy Gardner.

5. **Smart Manufacturing (simplilearn.com)**

The world of manufacturing and industrial automation is another big winner in the IoT sweepstakes. RFID and GPS technology can help a manufacturer track a product from its start on the factory floor to its placement in the destination store, the whole supply chain from start to finish. These sensors can gather information on travel time, product condition, and environmental conditions that the product was subjected to. (simplilearn.com)

Sensors attached to factory equipment can help identify bottlenecks in the production line, thereby reducing lost time and waste. Other sensors mounted on those same machines can also track the performance of the machine, predicting when the unit will require maintenance, thereby preventing costly breakdowns. (simplilearn.com)

1. IoT recognize manufacturing delays and helps to identify the underlying causes.
2. Production units benefit majorly with automation of various processes in the manufacturing industry. This allows the maximum utilization of raw material and manufacturing components. (techvidvan.com)
3. IoT leads to better allocation of resources. It allows users to shift their focus on clients and profits rather than worrying about tedious and time-consuming tasks.

6. **Smart Retail**

IoT technology has a lot to offer the world of retail. Online and in-store shopping sales figures can control warehouse automation and robotics, information gleaned from IoT sensors. Much of this relies on RFIDs, which are already in heavy use worldwide. (simplilearn.com)

Mall locations are iffy things; business tends to fluctuate, and the advent of online shopping has driven down the demand for brick-and-mortar establishments. However, IoT can help analyse mall traffic so that stores located in malls can make the necessary adjustments that enhance the customer's shopping experience while reducing overhead. (simplelearn.com)

Speaking of customer engagement, IoT helps retailers target customers based on past purchases. Equipped with the information provided through IoT, a retailer could craft a personalized promotion for their loyal customers, thereby eliminating the need for costly mass-marketing promotions that don't stand as much of a chance of success. Much of these promotions can be conducted through the customers' smartphones, especially if they have an app for the appropriate store. (simplilearn.com). Figure 10 (rishabhsoft.com) shows how to use IOT in retail industry.

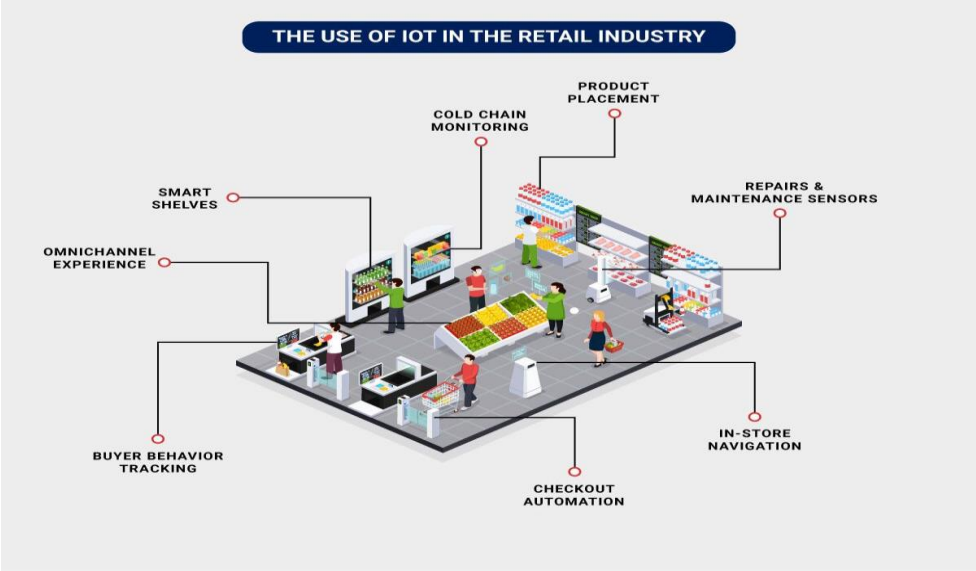

Figure 10: IOT in Retail Industry

7. Smart Utilities/Energy

IoT sensors can be employed to monitor environmental conditions such as humidity, temperature, and lighting. The information provided by IoT sensors can aid in the creation of algorithms that regulate energy usage and make the appropriate adjustments, eliminating the human equation. (simplilearn.com)

With IoT-driven environmental control, businesses and private residences can experience significant energy savings, which in the long run, benefits everyone, including the environment! (simplilearn.com)

On a larger scale, data gathered by the Internet of Things can be used to help run municipal power grids more efficiently, analysing factors such as usage. Also, the sensors can help pinpoint outages faster, thereby increasing the response time of repair crews and decreasing blackout times. (simplilearn.com). Figure 11 (infoholicresearch.com) sows IoT in Utility market.

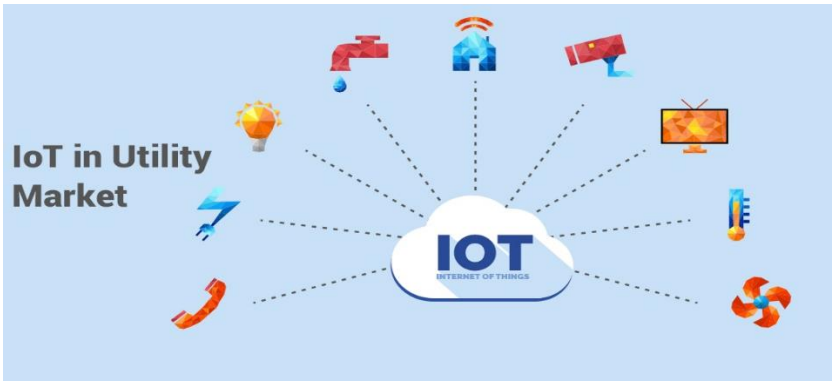

Figure 11: IOT in Utility market

8. Smart Wearables

From medical to fitness to GPS tracking, wearables serve a wide range of purposes. These IoT have more than doubled in the last three years. (simplilearn.com)

The fitness bands monitor calorie expenditure, meters of distance covered, heartbeats per minute, blood oxygen level, and more. These IoT mostly come in the form of wristbands/watches. However, they can also appear as earbuds, clip-on devices, or smart fabric. (simplilearn.com)

Other wearables include virtual glasses and GPS tracking belts. These small and energy-efficient devices equipped with sensors and software collect and organize data about users. Top companies like Apple, Google, Fitbit, and Samsung, are behind the introduction of the Internet of Things. (simplilearn.com). Figure 12 (embeddedcomputing.com) shows how wearables things works with IOT.

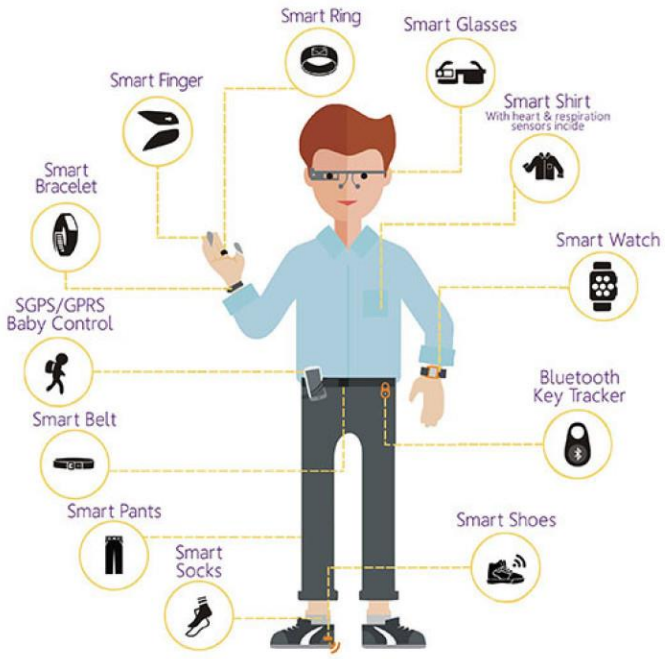

Figure 12: IOT in Wearables Devices

9. Smart Traffic Monitoring

A major contributor to the concept of smart cities, the Internet of Things is beneficial in vehicular traffic management in large cities. Using mobile phones as sensors to collect and share data from our vehicles via applications like Google Maps or Waze is an example of using IoT. It informs about the traffic conditions of the different routes, estimated arrival time, and the distance from the destination while contributing to traffic monitoring. (simplilearn.com)

Traffic pattern analysis gives commuters a perfect idea of what might happen during peak hours. Thus, they will be better prepared to avoid traffic by being aware of possible alternatives. (simplilearn.com) Figure 13 (Mohammed Sharrab, Supriya Pulparambil and Medhat Awadalla, 2020, sciencedirect.com)

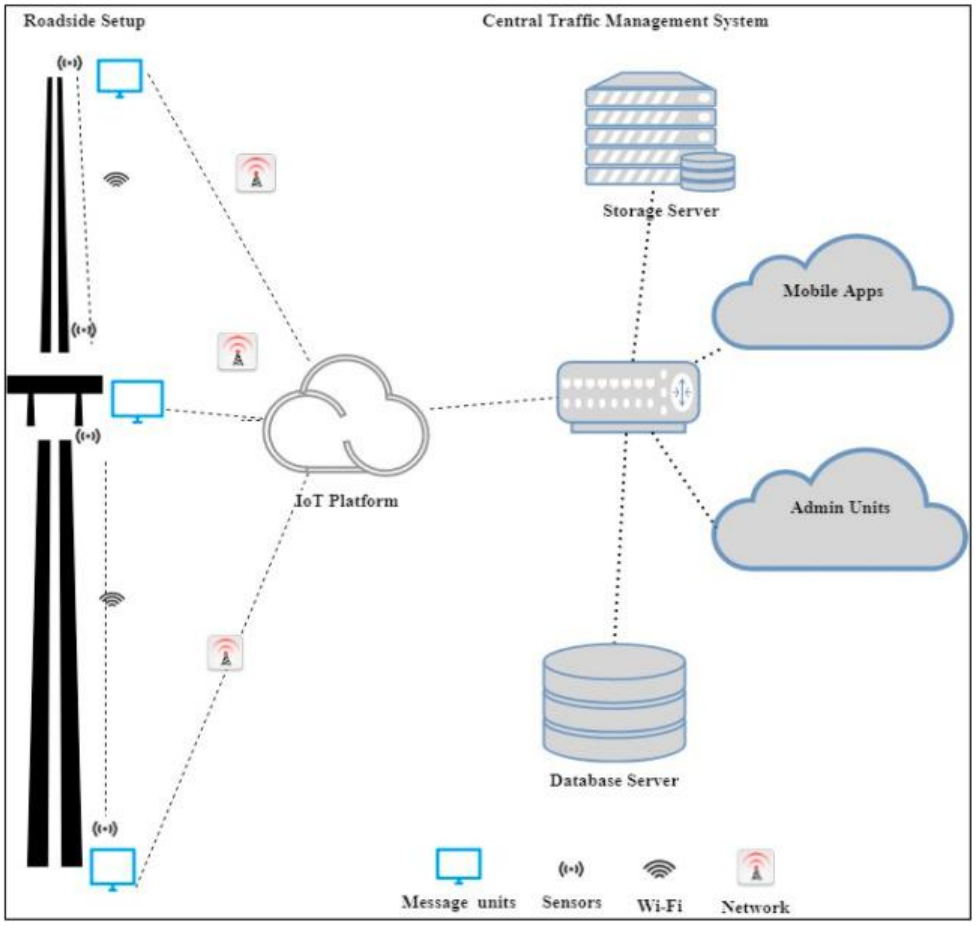

Figure 13: IOT in Traffic Monitoring

10. Smart Consumer use

For the private citizen, IoT devices in the form of wearables and smart homes make life easier. Wearables cover accessories such as Fitbit, smartphones, Apple watches, health monitors, to name a few. These devices improve entertainment, network connectivity, health, and fitness. (simplilearn.com)

Smart homes take care of things like activating environmental controls so that your house is at peak comfort when you come home. Dinner that requires either an oven or a crockpot can be started remotely, so the food is ready when you arrive. Security is made more accessible as well, with the consumer having the ability to control appliances and lights remotely, as well as activating a smart lock to allow the appropriate people to enter the house even if they don't have a key. (simplilearn.com)

11. Smart Grid and Energy Saving

From intelligent energy meters to the installation of sensors at strategic places from the production plants to the distribution points, IoT technology is behind better monitoring and effective control of the electrical network. (simplilearn.com)

A smart grid is a holistic solution employing Information Technology to reduce electricity waste and cost, improving electricity efficiency, economics, and reliability. (simplilearn.com)

The establishment of bidirectional communication between the end user and the service provider allows substantial value to fault detection, decision making, and repair thereof. It also helps users monitor their consumption patterns and adopt the best ways to reduce energy expenditure. (simplilearn.com). Figure 14 (Hossein Shahinzadeh) shows IOT in smart grid.

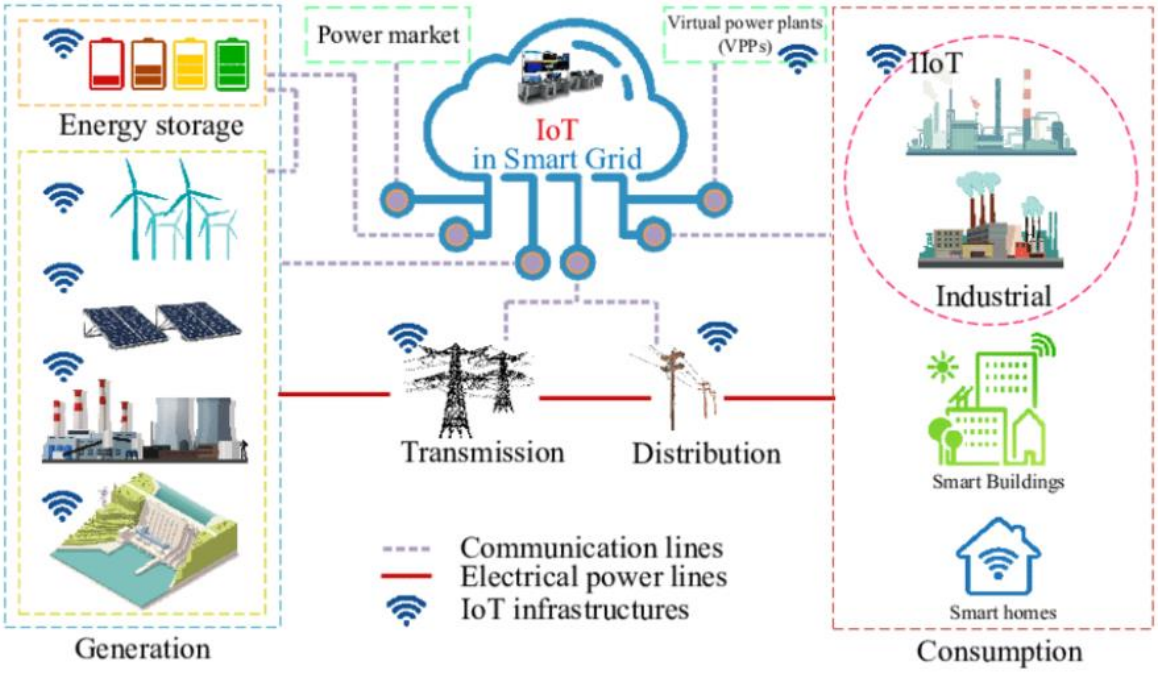

Figure 14: IOT in Smart Grid

12. Smart Water Supply

When incorporated externally into water meters, a sensor connected to the Internet accompanied by software helps in the seamless collection, processing, and analysis of data, allowing a better understanding of consumer patterns, fault detection in the supply service, and result reporting. (simplilearn.com)

Simultaneously, they offer end users to track their consumption information via app or web page in real-time. Automatic alerts that detect consumption out of the average range record, indicating the presence of a leak, have immensely contributed to water saving. (simplilearn.com). Figure 15 (ritewater.in) shows how to supply water using IOT.

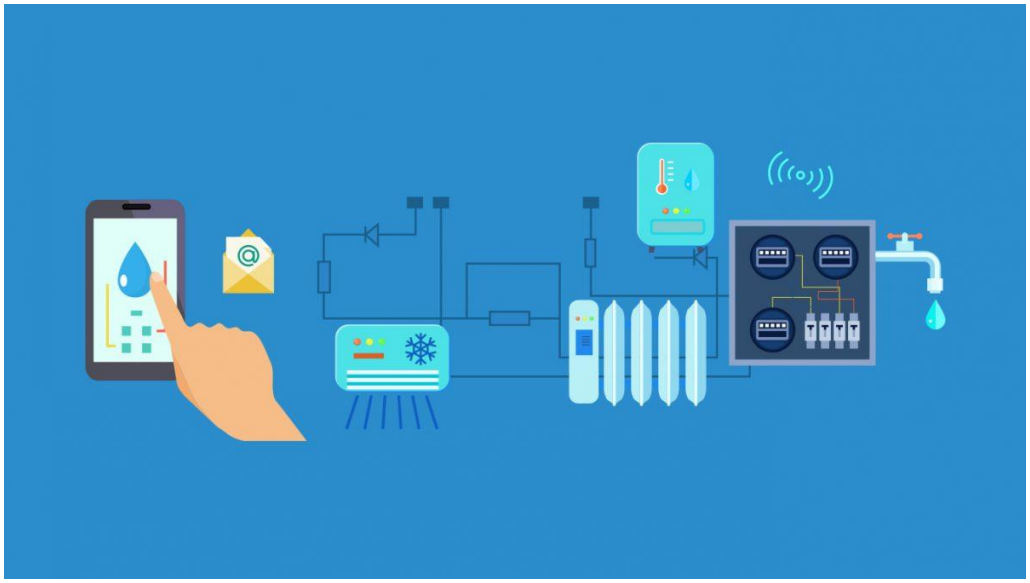

Figure 15: IOT in Smart Water supply

13. Smart Home

It is predicted that by 2023, 309M homes worldwide will have smart systems installed. Their popularity is on the rise as they provide the complete freedom to personalize a home. (simplilearn.com) Figure 16 (Heetae Yang, Wonji Lee and Hwansoo Lee in 2018) shows the IoT in smart home.

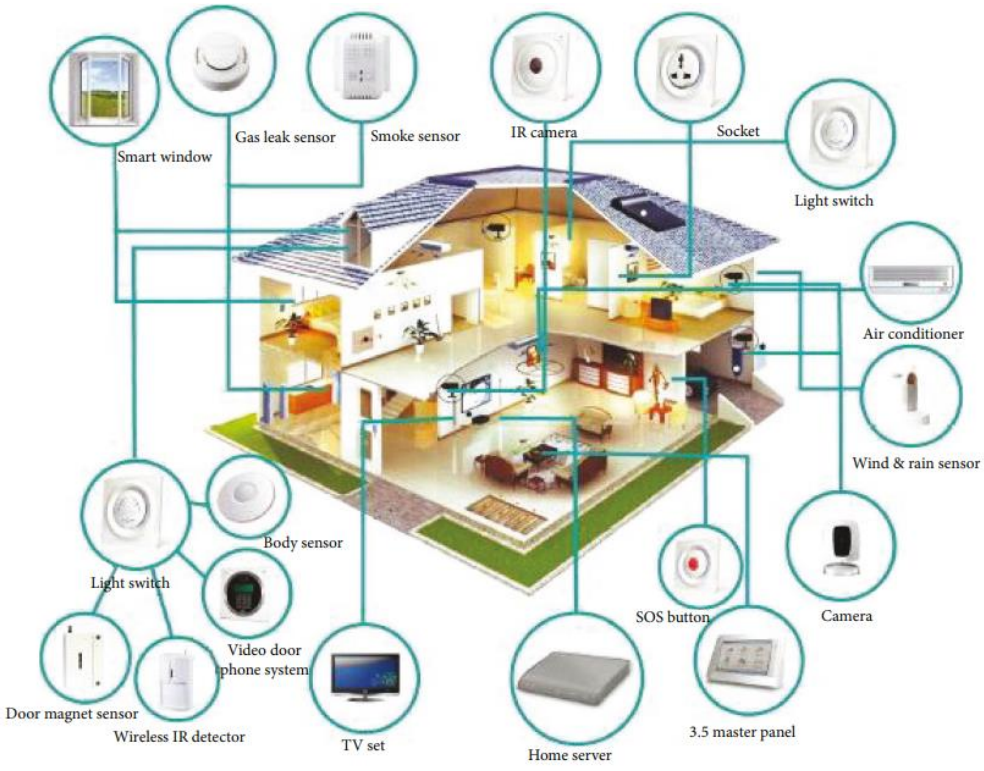

Figure 16: IOT in Smart Home

Maybe the most famous application of IoT is in Smart Homes. (geeksforgeeks.com) After all, who hasn't heard about connecting all the home applications like lighting, air conditioners, locks, thermostat, etc. into a single system that can be controlled from your smartphone! (geeksforgeeks.com) These IoT devices are becoming more and more popular these days because they allow you complete freedom to personalize your home as you want. In fact, these IoT devices are so popular that every second there are 127 new devices connected to the internet. (geeksforgeeks.com) Some popular ones that you might have heard have, or even have in your home, include Google Home, Amazon Echo Plus, Philips Hue Lighting System, etc. (geeksforgeeks.com) There are also all sorts of other inventions that you can install in your home including Nest Smoke Alarm and Thermostat, Foobot Air Quality Monitor, August Smart Lock, etc. (geeksforgeeks.com)

14. Smart Pollution Control

IoT has helped address the major issue of pollution. It enables controlling the pollution levels to more breathable standards. (simplilearn.com) Data related to city pollution such as vehicular emissions, pollen levels, weather, airflow direction, traffic levels, and more are collected using sensors in combination with IoT. (simplilearn.com) This data is then used with Machine Learning algorithms to forecast pollution in various areas and inform city officials of the potential problems beforehand. Green Horizons project by IBM's China Research Lab is an example of an IoT application for pollution control. (simplilearn.com)

An example of this is the Green Horizons project created by IBM's China Research Lab. (geeksforgeeks.com) Figure 17 (Ayaskanta Mishra in 2018)

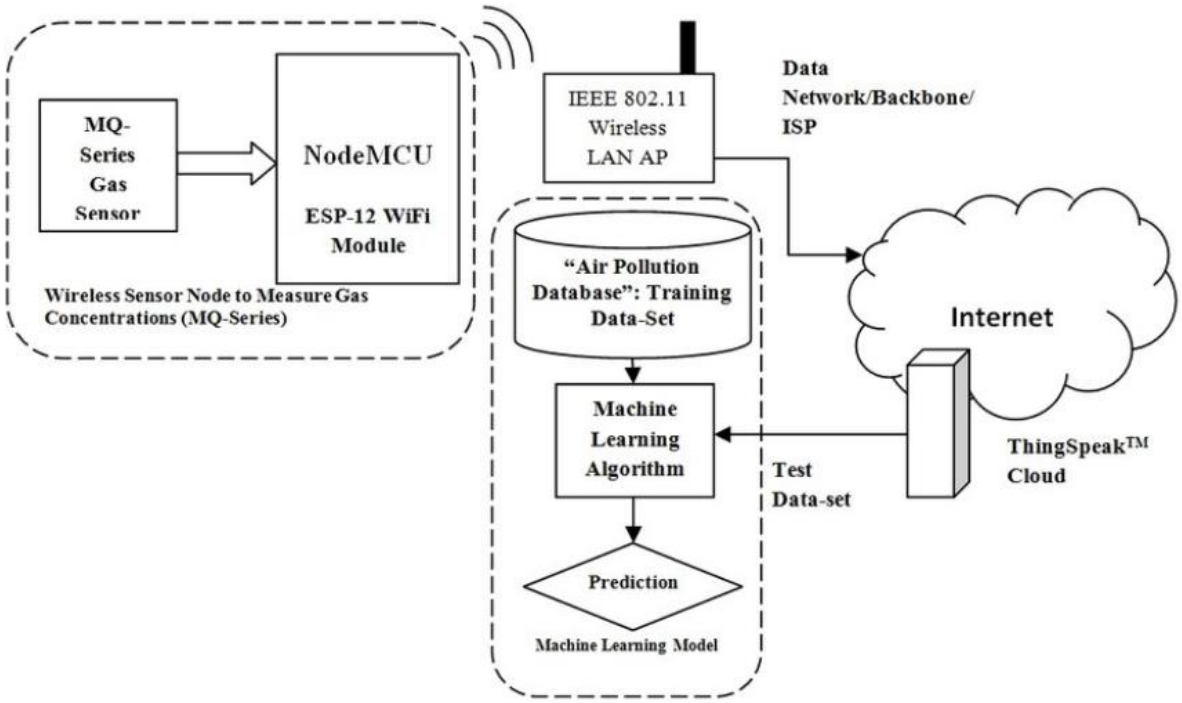

Figure 17: IOT in Air Pollution Control

15. Smart Cities

Cities can be made more efficient so that they require fewer resources and are more energy-efficient. (geeksforgeeks.com) This can be done with a combination of sensors in different capacities all over the city that can be used for various tasks ranging from managing the traffic, controlling handling waste management, creating smart buildings, optimizing streetlights, etc. (geeksforgeeks.com) There are many cities in the world that are working on incorporating IoT and becoming smarter such as Singapore, Geneva, Zurich, Oslo, etc. One example of creating smart cities is the Smart Nation Sensor Platform used by Singapore which is believed to be the smartest city in the world. (geeksforgeeks.com) This platform integrates various facets of transportation, streetlights, public safety, urban planning, etc. using sensors in conjugation with IoT. (geeksforgeeks.com)

Figure 18 (Nikita Godse,2022) shows the importance of IoT in smart cities.

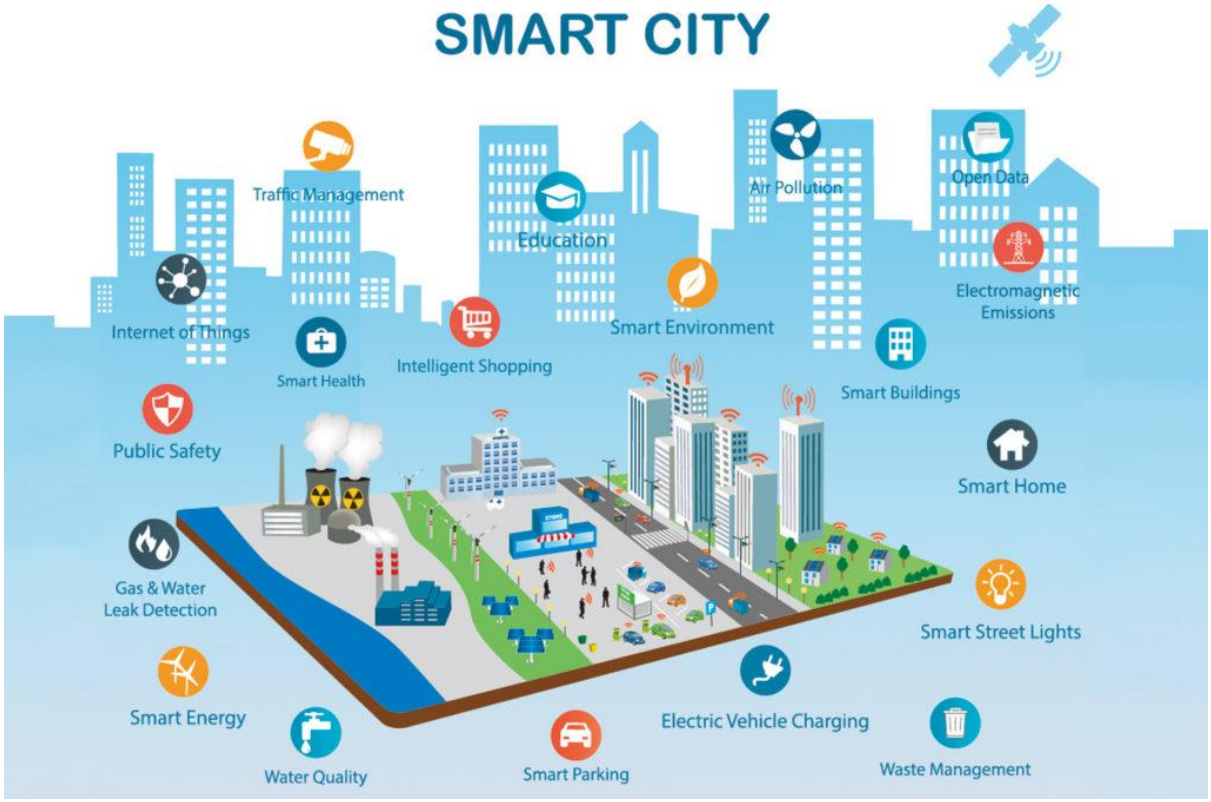

Figure 18: IOT in Smart Cities

16. Smart Water and Waste Management

Water treatment units for water recycling have helped immensely in water management. The use of IoT makes them more efficient as one can see how much wastewater is being produced, the consumption of water in a specific area, and changes in waste production over time. (simplilearn.com)

With a smart waste management system, it gets handy to predict waste quantities in a specific location. Consequently, authorities can plan how to process it, when to clear it, and how to interpret the data for future planning. City upgrade projects will pick up the pace when analytics solutions and data obtained are combined, which would bring about transformations. (simplilearn.com) Figure 19 (Briana Garcia, 2019) shows how IoT use to purify the waste water.

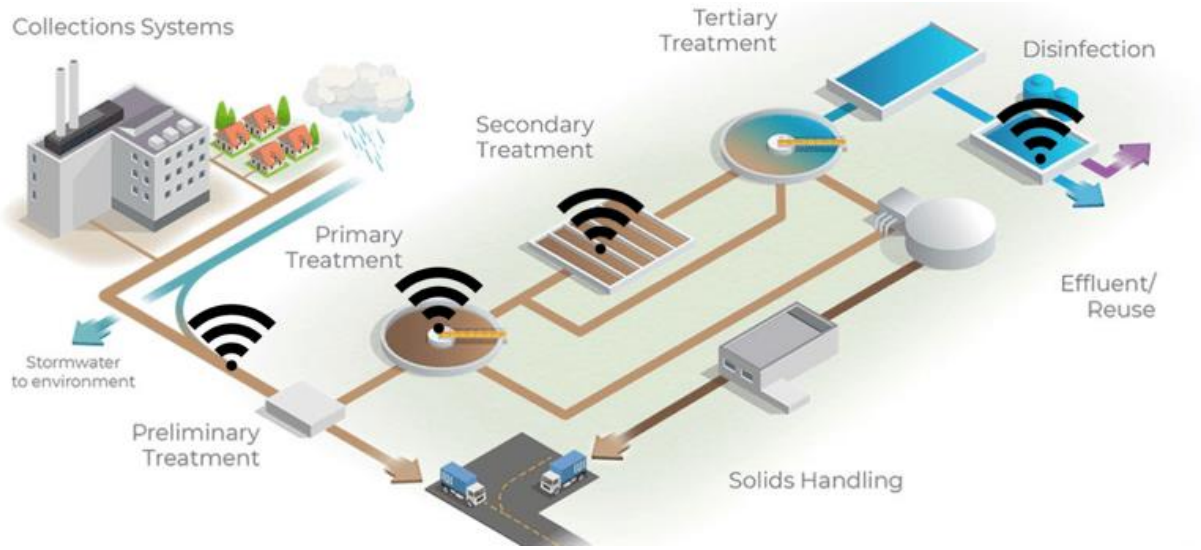

Figure 19: IOT in Smart waste water management

17. Smart Maintenance Management

Maintenance management is one of those areas where the application of IoT technology is most extensive. Sensors and software specialized in EAM/CMMS maintenance management provide a multifunctional tool applicable to many disciplines. It helps extend the functional life of physical assets, guaranteeing availability and reliability. (simplilearn.com)

Real-time monitoring of physical assets enables the determination of instances when a measurement gets out of range and demands condition-based maintenance (CBM) or AI application to predict a failure. (simplilearn.com)

Conclusion

The IoT is that which is widely used in various fields to work efficiently. There are many more applications of IOT which is related to the real-life world and these are also very popular. Actually, there is no limit to show the applications of IOT. We can combine the IOT to the Artificial Intelligence and Machine Learning to get very sensitive information. With the help of Internet of Things, we can provide the security for any devices and tools. We can also provide the security for personal use also. IOT applications focuses to monitoring, tracking and decision-making system in real-world.

Future Scope

A Gartner report predicts that connected devices across all manner of technologies will hit 20.6 billion. That number could hit 1 trillion by 2025, according to HP, and that's just a staggering figure. According to a Cisco report, the next decade will see IoT devices creating $14.4 trillion worth of value across several industries like the ones mentioned above. (simplilearn.com)

The Internet of Things, and its association with technologies such as ITIL (Information Technology Infrastructure Library), Blockchain and Big Data, is a worthwhile field with lots of potential for careers.

References

1. https://www.simplilearn.com/iot-applications-article#:~:text=IoT%20has%20helped%20address%20the,sensors%20in%20combination%20with%20IoT.

2. https://www.geeksforgeeks.org/top-applications-of-iot-in-the-world/

3. https://stl.tech/blog/what-are-the-applications-of-iot/

4. https://www.researchgate.net/figure/Block-diagram-of-proposed-IoT-based-Air-Pollution-Monitoring-System_fig1_342338791

5. Mohammed Sharrab, Supriya Pulparambil and Medhat Awadalla, "Development of an IoT based real-time traffic monitoring system for city governance", Volume 2, 2020. ScienceDirect Elsevier

6. https://www.datasciencecentral.com/smart-cities-of-the-future-powered-by-iot/

7. https://blog.temboo.com/iot-and-wastewater-treatment-plants/