

Internet Of Things (IOT)

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CHAPTER ONE

Introduction in (IOT)

Internet of Things

- Embedded electronics to connect an internet
- Network of physical object

Example

1. Smart agriculture
2. Energy consumption
3. Security and serval robotics
4. Healthcare

- **What is IOT?**

The Internet of Things is a network that creates a channel between the internet and physical devices to deliver the best output with maximum possibilities. Today, IoT applications are ruling the roots of the IT industry.

- **Purpose**

I am not merely writing this article to discuss the final year **IoT** projects for CSE and ECE but want to mention a possible list of creative thoughts for students and engineers. Aspiring students on projects use devices like microcontrollers, Raspberry Pi, Arduino, and other devices today.



Smart City



Smart Park



Street Lighting



Tunnel Lighting



Commercial Lighting



Smart Factory



Parking lot Lighting



Solar lighting

- **Shopping Cart using RFID**

It is a revolutionary technology all over the world. This particular product technology is awesome, and nobody can avoid it, and business owners and customers depend literally to buy products based on it. RFID and [Raspberry Pi](#) sensors - a Note MCU microcontroller and mobile application connected to each other. In this IoT-based Smart shopping cart, RFID tags are the source of business calculations for every product. This application can scan the given code and translate it into the price of the product. Today, no product is seen without an RFID tag. Based on the RFID tag, any business will run in the market. It is the technology that is enhanced in IoT.

- **Virtual Doctor Robot**

Doctors should be in the hospital to treat the patients by observing patients' diagnosed reports. It is natural to expect doctors at hospitals to provide medication. But, IoT has changed the scenario completely. No matter wherever doctors can be, they can treat the patient with the help of an IoT virtual robot.

- **Anesthesia Machine Control**

Anesthesia is mandatory for patients who undergo surgeries. But, if the surgery takes a long time, doctors cannot give a heavy dose to perform operations. So, a right is given to patients for a long time in surgery in intervals based throughout the surgery time. But, every time the same dose is not required and cannot be given by doctors. To avoid this unexpected circumstance at the operation theater, the Raspberry PI project allows doctors to set the anesthesia levels on an hourly basis for the patient during surgery with a syringe infusion pump.

- **Charging Station for E-Vehicle**

Solar power is turning out to be a new way for all that is off the grid to enjoy. This energy is used to recharge e-vehicles, and the purpose is to control the usage of greenhouse emissions and fossil fuels. Now, IoT technology-designed devices help in a way to charge E-Vehicles. Proteus software is used for this simulation design, and the entire setup is connected to Arduino UNO R3. The battery level charging process is displayed on LCD. The status of charging is available on a webpage to view.

- **Water Supply Control using Raspberry pi**

Raspberry pi enables the embedded-based water supply control system that can monitor theft prevention systems and record the flow rate of the water at the user's end. The complete process consists of one or more central PCs that work with internal functions built inside the pumping channels.

- **Parking System**

This is one of the best and most advanced methods to find space at parking from anywhere to anyplace. IoT-based smart parking system – Node MCU, handles the entire process and shows the availability of parking space time info to this platform.

- **Gas Level Detection and Booking**

LPG is the preferred fuel for domestic purposes. It is not only convenient but also economical for domestic usage. IoT came onto the board to measure and display gasoline content in an LPG cylinder. It can easily monitor the automatic booking of gas and leakage in case. The measuring process will take place by the SEN-10245 load sensor. The output is connected with Arduino R3. This GSM module allows the user to get the SMS automatically. In the case of leakage detection, it is enabled by the MQ-6 sensor. Booking, leakage detection, and usage of gas percentage will be monitored easily by IoT.

- **Wet and Dry Waste Segregation**

Separation of wet and dry is needed to keep the environment clean and healthy. IoT-enabled systems have been helped in this regard by Node MCU.

It can identify the bin filling and inform the municipality department to ensure that they must be active in cleaning all the necessary things. The system helps in the segregation of wet and dry wastage. If not, garbage filling is more troublesome in cities. This monitor system can indicate employees to be alert and clean and keep the environment healthy.

- **Baggage tracking in airport**

RFID handles security systems at the airport for baggage tracking by using Node MCU. This security system will help travelers feel comfortable during their journey.

- **Wireless Black Box**

You might have heard that the black box provides accident information from different sources. This system is developed by Raspberry Pi.

- **IOT Solar Power Plant Monitoring System**
- **IOT based intelligent traffic management system**
- **IOT based Predictive Maintenance of machines powered with AI and ML algorithms**

In factories, Diesel generators, heavy equipment, heavy motors, etc. it is very crucial to keep track of the maintenance as it affects the smooth functioning and it may cause loss or catastrophe. For example, it may cause accidents, production loss. So to address the above issue, using sensors we acquire some important parameters from the machine and we will develop an ML model, detect minute changes and predict the fault for predictive maintenance.

- **Smart Door Camera with Facial Recognition with visitor management.**

Ever since IoT has come onto board to provide technology-based services by applying for various programs, final year ECE students are thronging to institutes to do projects that can enhance their practical knowledge to get into companies. This article will help you with key aspects to follow and put into practice.



Technology

IOT is possible at fast on possible when low low power technology
EX: - Bluetooth

OIC

OIC means Open System inter connection.
OIC is use on to connect all equipment.

Why these batches are merged?

- **Robot:** An epitome of an embedded system.
- **IOT:** Implementation based on embedded system.
- **IOT:** instead of creating network that connects people once connected the things can communicate with each other for variety of useful purposes.

Robotics:-

- **Mechanical**

- 1- Mechanical Aspect : mechanical construction like a frame form or shape designed to achieve a particular task
- 2- The mechanical aspect is mostly the creator's solution to completing the assigned task and dealing with the physics of the environment around it

- **Electrical**

Electronics and electrical components which power and control the machinery

The electrical aspect of robots is used for:-

- a) movement through motors
- b) sensing: where electrical signals are used to measure things like heat sounds and energy
- c) operation: robots need some level of electrical energy supplied to their motors and sensors in order to active and perform basic operation

- **Computer science**

1. programs are the core essence of robots
2. there are three different types of robotic programs:-
 - a) remote control program: preexisting commands responds to a remote control signal
 - b) Artificial intelligence: interaction with the environment
 - c) hybrid: combination of both RC&AI

Applications OF Robots:-

1. Military robots
2. Medical robots
3. Agricultural robots

What is the difference for IOT&IIOT?

IIOT: the industrial internet of things

The adoption of the IIOT is being enabled by improved availability and affordability of sensors, processors and other technologies that have helped facilitate capture of and access to real-time information.

IIOT requirements:

1. Cloud computing
2. Access (anywhere, anytime)
3. Security
4. Big data, Analytics
5. UX (User Experience)
6. Assets Management
7. Smart machines

IIOT benefits:-

1. **vastly improved** operational efficiency (e.g., improved uptime, asset utilization) through predictive maintenance and remote management
2. **the emergence** of an outcome economy, fueled by software-driven services; innovations in hardware; and the increased visibility into products, processes, customers and partners
3. **new connected ecosystems**, coalescing around software platforms that blur traditional industry boundaries
4. **Collaboration** between humans and machines, which will result in unprecedented levels of productivity and more engaging work experiences.

Other challenges

- many iot systems are poorly designed and implemented using diverse protocols and technologies that create complex configurations
- lack of mature IOT technologies and business processes
- limited guidance for life cycle maintenance and management of IOT devices
- The IOT introduces unique physical security concerns
- IOT privacy concerns are complex and not always readily evident
- limited best practices available for IOT developers

CHAPTER TWO

IOT Devices

What is an IOT device?

It's a physical object that connects to the Internet. It can be a fitness tracker, a thermostat, a lock or appliance – even a light bulb.

Imagine shoes that track your heartbeat... and can flag potential health problems. You don't have to imagine – these “smart” shoes already exist!

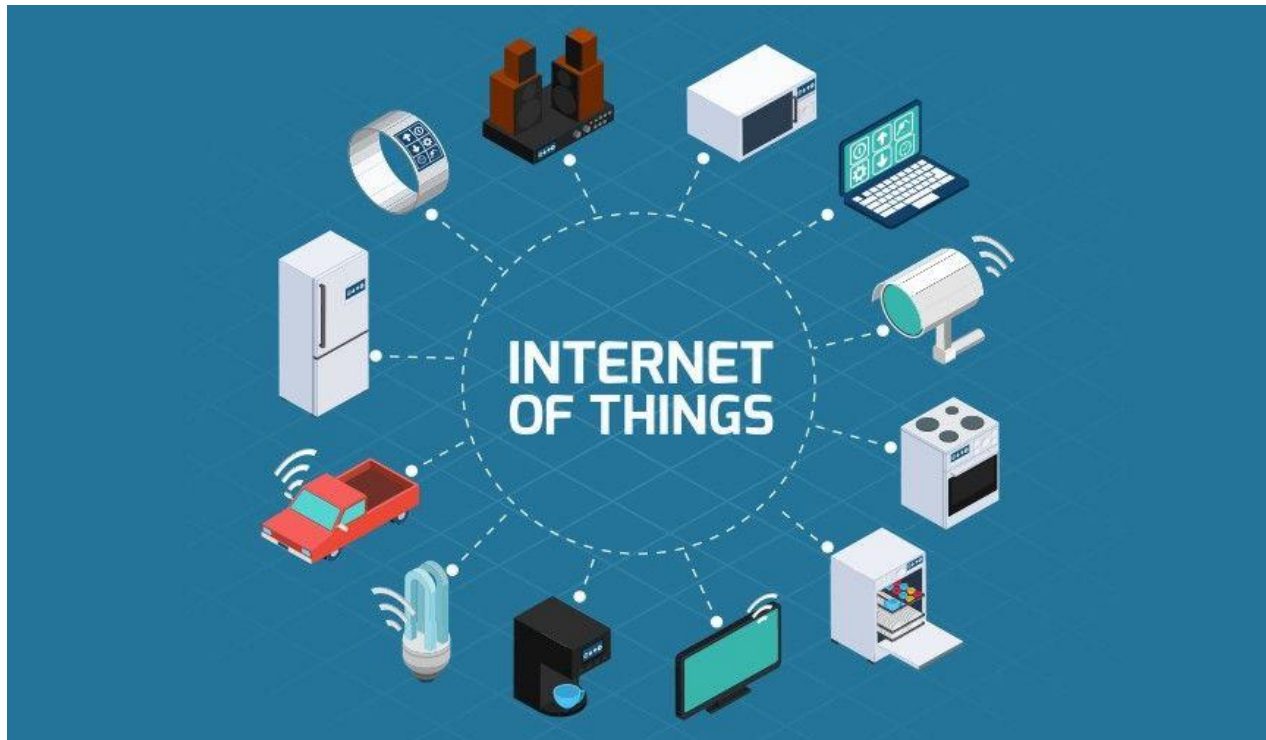
How will it affect me?

The Internet of Things has arrived and it's going to introduce incredible opportunity over the next five years. And while smart things are exactly that, the IOT industry has a long way to go in terms of overall security. Many of today's IOT devices are rushed to market with little consideration for basic security and privacy protections: “Insecurity by design.”

This puts you and everyone else at risk: from unwittingly being spied on or having your data compromised to being unable to lock your own home. You could even become part of a botnet that attacks the Internet. Your insecure webcam – along with millions of others – could be used to attack the power grid of an entire country.

From dental sensors that can monitor what a person eats to kitty litters that can track a cat's every movement, it can be difficult to sort fact from fiction when it comes to the Internet of Things. Can you tell which is real and which is not?

Examples of Internet of Things in Daily Life



IOT is a network of electronic devices that are interconnected in order to exchange information. The main purpose of IOT is to access and operate the gadgets from a distance with little or no human assistance. IOT-equipped gadgets are connected to each other via the internet and are designed to exchange data with each other to perform remote operations. These interconnected devices or electronic gadgets are often referred to as 'things'. Most of the electronic devices consist of embedded sensors. These sensors are used to emit data and tell about the status of the device. IOT establishes a common site for all the devices to dump their data and provides a common language for them to communicate with each other. This dumped data is then analyzed, and valuable information is extracted from it as per the need and convenience. The result is shared by all the connected devices. The devices may be connected to each other either by the wired method with the help of Ethernet or wirelessly through Bluetooth. The term IOT was first coined by Kevin Ashton in 1999.

CHAPTER THREE

Internet of Things Applications.

Examples of IOT in Real Life

1. Home Automation

Home automation is one of the best examples of IoT. Smart homes or IoT-based home automation systems are becoming popular day by day. In a smart home, consumer electronic gadgets such as lights, fans, air-conditioners, etc. can be connected to each other via the internet. This interconnection enables the user to operate these devices from a distance. A smart home is capable of lighting control, energy management, expansion, and remote access. Currently, this application of IoT is not utilized at a large scale because the installation cost is too high, which makes it difficult for a majority of people to afford it. However, home automation holds quite a promising future.



2. Wearable Health Monitors

Wearable health monitors are both captivating and useful. They include smart clothes, smart wristwear, and medical wearables that provide us with high-quality health services. They are designed to track activities such as pulse rate, step count, heart rate, etc. This data is recorded and can be sent to the doctors for detailed fitness analysis. These IoT based smart wearable devices are influencing our lifestyles a lot. Apart from performing these basic operations, they can also raise an alarm and send an alert in case of a medical emergency such as an asthma attack, seizures, etc.



3. Disaster Management

IoT helps in the prediction and management of natural disasters. For instance, take the example of forest fires. To avoid the chaos and destruction caused by a forest fire, various sensors can be installed around the boundaries of the forests. These sensors continuously monitor the temperature and carbon content in the region. A detailed report is regularly sent to a common monitoring hub. In case of a forest fire, an alert is sent to the control room, police station, and fire brigade. Therefore, IoT helps in staying prepared and respond swiftly in case of emergency.



4. Biometric Security Systems

A lot of security agencies make use of biometric systems to mark daily attendance, allow access to the authorized personnel only, and other related services. Advanced security, data communication, and minimized human intervention are some of the features of IoT being utilized in this sector. Biometric technology makes use of fingerprint, voice, eye, and face recognition. The reliability of IoT based security systems is higher than the manual or automated approach. The devices used in biometric security systems are interlinked to each other and possess the ability to dump the data after every usage to the host computer. This scanned data is stored for future use, and the useful information is retrieved as per requirement.



5. Smart Cars

IoT can be used to connect cars with each other in order to exchange information like location, speed, and dynamics. An estimate shows that by 2020, there will be 24 billion connected cars in the world. We use IoT in our daily life without even realizing its presence. For example, while finding the shortest route, while driving semi-automatic smart cars, etc. IoT is also used in vehicle repair and maintenance. It does not only remind the customer about the regular servicing date but also assists the consumer in repair and maintenance by providing proper guidance. On the basis of features provided, the communication technique of connected vehicle technology is classified into two broad categories:

- *Vehicle-to-infrastructure (V2I)*

It allows the smart car to run a diagnostic check and provide a detailed analysis report to the user. It is also used to find out the shortest route and to locate the empty parking spot.

- *2. Vehicle-to-vehicle (V2V)*

V2V communication of smart cars makes use of high-speed data transfer and high-bandwidth. It lets the car to perform hefty tasks such as avoiding collisions, clipping unnecessary traffic, etc.



6. Process Automation

In the manufacturing industry, performing reoccurring tasks, such as label wrapping, packaging, etc., manually is difficult and is prone to human errors; therefore, automation comes into play. For instance, take the example of a cold drink manufacturing industry. Here, manufacturing machines and conveyor belts are required to be interconnected in order to share information, status, and data. This interconnection is IoT dependent. The status of the manufactured product and the machine health report is sent to the manufacturer at regular intervals in order to identify the faults in advance. An IoT equipped industry is advantageous as it elevates the production speed and maintains the uniform quality of the product throughout the production. It also helps to make the workplace more efficient and safe by reducing human error.



7. Farming

Due to climate change and water crisis, farmers go through a lot of troubles such as crop flattening, soil erosion, drought, etc. These problems can be easily suppressed by using IoT based farming system. For example, the IoT based irrigation system makes use of a number of sensors to monitor the moisture content of the soil. If the moisture level drops below a certain range, it automatically turns on the irrigation pump. Other than this, IoT also helps farmers to examine soil health. Before planning to farm a new batch of crops, a farmer needs to recover the soil nutrients. The IoT enriched software allows the user or the farmer to select the best nutrient restoring crops. It also helps in sensing the requirement of fertilizer and numerous other farming needs.



Why is IOT important?

The internet of things helps people live and work smarter, as well as gain complete control over their lives. In addition to offering smart devices to automate homes, IOT is essential to business. IOT provides businesses with a real-time look into how their systems really work, delivering insights into everything from the performance of machines to supply chain and logistics operations.

IOT enables companies to automate processes and reduce labor costs. It also cuts down on waste and improves service delivery, making it less expensive to manufacture and deliver goods, as well as offering transparency into customer transactions.

As such, IOT is one of the most important technologies of everyday life, and it will continue to pick up steam as more businesses realize the potential of connected devices to keep them competitive.

What are the pros and cons of IOT?

Some of the advantages of IOT include the following:

- ability to access information from anywhere at any time on any device;
- improved communication between connected electronic devices;
- transferring data packets over a connected network saving time and money; and
- automating tasks helping to improve the quality of a business's services and reducing the need for human intervention.

Some disadvantages of IOT include the following:

- As the number of connected devices increases and more information is shared between devices, the potential that a hacker could steal confidential information also increases.
- Enterprises may eventually have to deal with massive numbers -- maybe even millions -- of IOT devices, and collecting and managing the data from all those devices will be challenging.
- If there's a bug in the system, it's likely that every connected device will become corrupted.
- Since there's no international standard of compatibility for IOT, it's difficult for devices from different manufacturers to communicate with each other.

Consumer and enterprise IOT applications

There are numerous real-world applications of the internet of things, ranging from consumer IOT and enterprise IOT to manufacturing and industrial IOT ([IIoT](#)). IOT applications span numerous verticals, including automotive, telecom and energy.

In the consumer segment, for example, smart homes that are equipped with smart thermostats, smart appliances and connected heating, lighting and electronic devices can be controlled remotely via computers and smartphones.

Wearable devices with sensors and software can collect and analyze user data, sending messages to other technologies about the users with the aim of making users' lives easier and more comfortable. Wearable devices are also used for public safety -- for example, improving first responders' response times during emergencies by providing optimized routes to a location or by tracking construction workers' or firefighters' vital signs at life-threatening sites.

In healthcare, IOT offers many benefits, including the ability to monitor patients more closely using an analysis of the data that's generated. Hospitals often use IOT systems to complete tasks such as inventory management for both pharmaceuticals and medical instruments.

Smart buildings can, for instance, reduce energy costs using sensors that detect how many occupants are in a room. The temperature can adjust automatically -- for example, turning the air conditioner on if sensors detect a conference room is full or turning the heat down if everyone in the office has gone home.

In agriculture, IOT-based [smart farming](#) systems can help monitor, for instance, light, temperature, humidity and soil moisture of crop fields using connected sensors. IOT is also instrumental in automating irrigation systems.

In a smart city, IOT sensors and deployments, such as smart streetlights and smart meters, can help alleviate traffic, conserve energy, monitor and address environmental concerns, and improve sanitation.

IoT security and privacy issues

The internet of things connects billions of devices to the internet and involves the use of billions of data points, all of which need to be secured. Due to its expanded attack surface, [IOT security](#) and [IOT privacy](#) are cited as major concerns.

In 2016, one of the most notorious recent IOT attacks was Mirai, a [botnet](#) that infiltrated domain name server provider Dyn and took down many websites for an extended period of time in one of the biggest distributed denial-of-service ([DDoS](#)) attacks ever seen. Attackers gained access to the network by exploiting poorly secured IoT devices.

Because IoT devices are closely connected, all a hacker has to do is exploit one vulnerability to manipulate all the data, rendering it unusable. Manufacturers that don't [update their devices regularly](#) -- or at all -- leave them vulnerable to cybercriminals.

Additionally, connected devices often ask users to input their personal information, including names, ages, addresses, phone numbers and even social media accounts - information that's invaluable to hackers.

Hackers aren't the only [threat to the internet of things](#); privacy is another major concern for IoT users. For instance, companies that make and distribute consumer IoT devices could use those devices to obtain and sell users' personal data.

Beyond leaking personal data, [IoT poses a risk](#) to critical infrastructure, including electricity, transportation and financial services.

Overview

- Understand the varied applications of the Internet of Things (IoT)
- Includes detailed study about smart homes, connected devices & many other work areas

Do you know what separates humans from other living beings?

Curiosity. Humans are curious. We question a lot. We are the ones who challenge the status quo of existing rules and strive to build/produce something better. Such curiosity & efforts have promised us a life where electronic devices & machines will probably become our best friend.

Yes, you read it correctly the vision to [make machines smart enough](#) to reduce human labour to almost nil. The idea of inter-connected devices where the devices are smart enough to share information with us, to cloud based applications and to each other (device to device).

Smart devices or “Connected devices ” as they are commonly called, are designed in such a way that they capture and utilize every bit of data which you share or use in everyday life. And these devices will use this data to interact with you on daily basis and complete tasks.

CHAPTER FOUR

History of Internet of Things.

How big is IOT?

This new wave of connectivity is going beyond laptops and smartphones, it's going towards connected cars, smart homes, connected wearables, smart cities and connected healthcare. Basically a connected life. According to Gartner report, by 2020 connected devices across all technologies will reach to 20.6 billion. Woah! That's a huge number.

YEAR	NUMBER OF CONNECTED DEVICES
1990	0.3 million
1999	90.0 million
2010	5.0 billion
2013	9.0 billion
2025	1.0 trillion

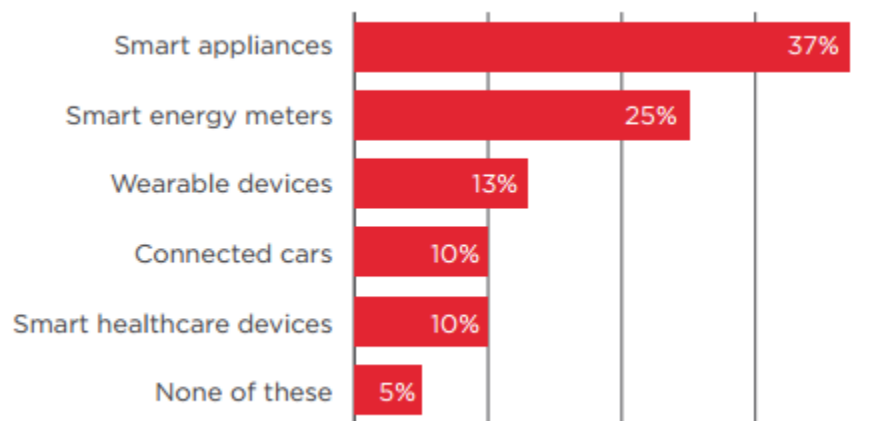
Source: HP

HP did a small survey in which they estimated the rise of connected devices over the years and the results are surprising. Are we moving towards a fully automated world?

These devices will bridge the gap between physical and digital world to improve the quality and productivity of life, society and industries. With IoT catching up Smart homes is the most awaited feature, with brands already getting into the competition with smart appliances. Wearables are another feature trending second on the internet. With launch of Apple Watch and

more devices to flow in, these connected devices are going to keep us hooked with the inter-connected world.

A survey conducted by KRC Research in UK, US, Japan and Germany the early adopters of IOT has revealed which devices are the customers more likely to use in the coming years. Smart Appliances like thermostat, smart refrigerator to name a few are most liked by the customers and are seem to change the way we operate.



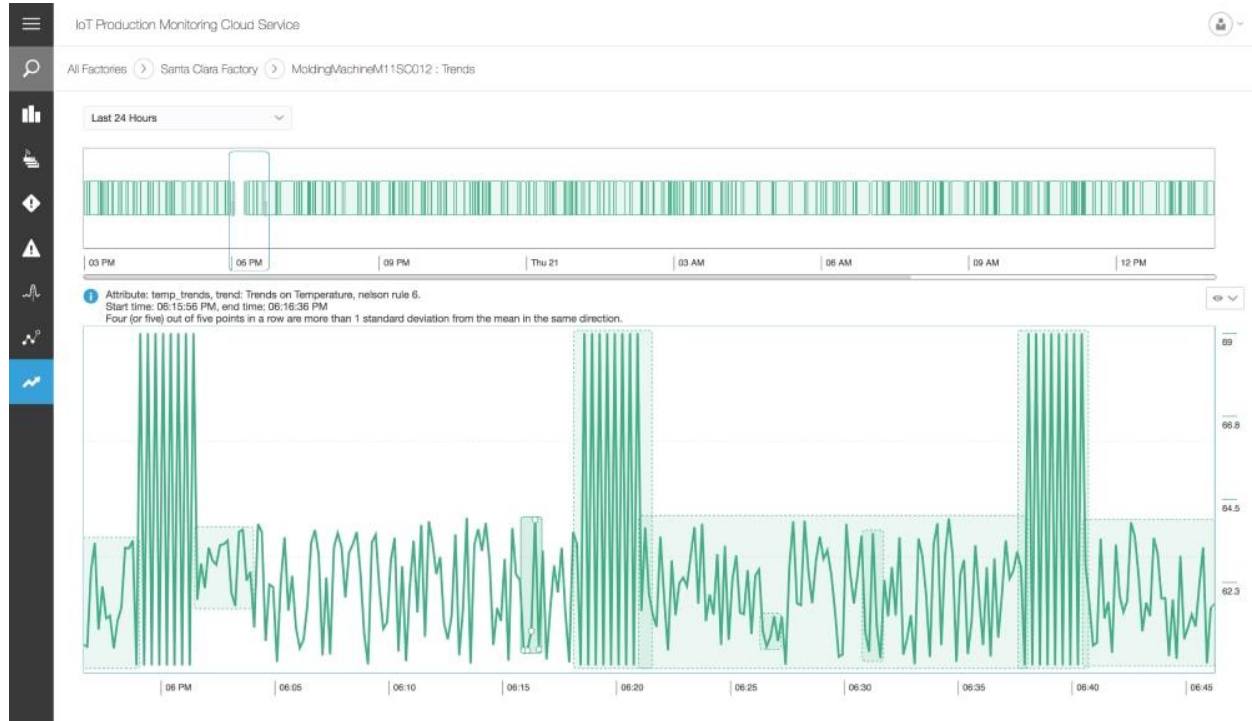
Source: GSMA Report

If you are wondering what impact will IOT have on the economy then for your information as per the Cisco report IOT will generate \$14.4 trillion in value across all industries in the next decade. Yes, you are thinking correctly IoT will bring a wave, nobody can foresee.

Now, to give you a glimpse of how applications of IoT will transform our lives I have listed down few areas where IoT is much awaited and companies are preparing to surprise you with smart devices. For better understanding.

Read on and tell us which smart devices are you eager to use.

The future of IoT is more fascinating than this where billions of things will be talking to each other and human intervention will become least. IoT will bring macro shift in the way we live and work.



I hope you had fun reading about all these powerful and promising applications of Internet of things. There are many more areas where IOT is making an impact. Networked Toys is one application of IoT which will change the playing experience of your kids. IoT can also be used in the detection of environmental issues.

Did you like reading this article? Now am sure you will be able to tell which smart device you are eagerly waiting for. Tell us in the comments below.

And if you are currently related to an IoT related profile. Do share your experience and concerns in the comments sections.

What are some ways IoT applications are deployed?

The ability of IoT to provide sensor information as well as enable device-to-device communication is driving a broad set of applications. The following are some of the most popular applications and what they do.

Create new efficiencies in **manufacturing** through machine monitoring and product-quality monitoring.

Machines can be continuously monitored and analyzed to make sure they are performing within required tolerances. Products can also be monitored in real time to identify and address quality defects.

Improve the tracking and “ring-fencing” of physical assets.

Tracking enables businesses to quickly determine asset location. Ring-fencing allows them to make sure that high-value assets are protected from theft and removal.

Use wearables to monitor human health analytics and environmental conditions.

IoT wearables enable people to better understand their own health and allow physicians to remotely monitor patients. This technology also enables companies to track the health and safety of their employees, which is especially useful for workers employed in hazardous conditions.

Drive efficiencies and new possibilities in existing processes.

One example of this is the use of IoT to increase efficiency and safety in **connected logistics** for fleet management. Companies can use IoT fleet monitoring to direct trucks, in real time, to improve efficiency.

Enable business process changes.

An example of this is the use of IoT devices for connected assets to monitor the health of remote machines and trigger service calls for preventive maintenance. The ability to remotely monitor machines is also enabling new product-as-a-service business models, where customers no longer need to buy a product but instead pay for its usage.