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IOT AND ITS ENABLING TECHNOLOGIES

Dr. Syed Azhar Abbas Rizvi
Associate Professor
Era University
Lucknow, Uttar Pradesh, India.

ABSTRACT

The Paper deals with the Emergence of IoT and its Enableing Technolgies in 21st Century and Its benfits to the Organisations.

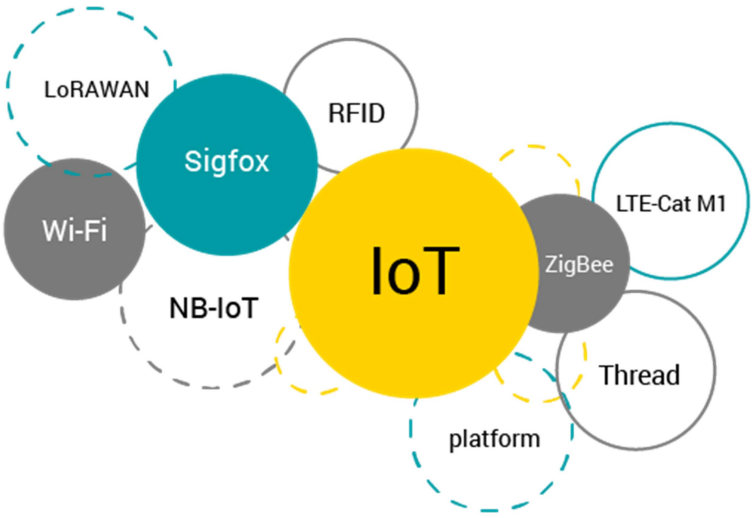
KEYWORDS: IoT, Internet, Technology

What is IOT

The internet of things, or IoT, is a network of connected computing devices, mechanical and digital machinery, items, animals, or people that may exchange data across a network without needing human-to-human or human-to-computer contact.

The term "thing" refers to any natural or artificial object that can be given an Internet Protocol (IP) address and has the ability to transfer data over a network, including people with implanted heart monitors, farm animals with biochip transponders, cars with built-in tyre pressure monitors, and other examples.

Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.



What are the benefits of IoT to organizations?

The internet of things offers several benefits to organizations. Some benefits are industry-specific, and some are applicable across multiple industries. Some of the common benefits of IoT enable businesses to:

- monitor their overall business processes;
- improve the customer experience (CX);
- save time and money;
- enhance employee productivity;
- integrate and adapt business models;
- make better business decisions; and
- generate more revenue.

IoT equips organisations with the resources they need to enhance their business strategies and challenges them to reevaluate how they conduct their operations.

However, it has also found use cases for organisations within the agriculture, infrastructure, and home automation industries, leading some organisations towards digital transformation. In general, IoT is most prevalent in manufacturing, transportation, and utility organisations, using sensors and other IoT devices.

IoT can benefit farmers in agriculture by making their job easier. Sensors can collect data on rainfall, humidity, temperature and soil content, as well as other factors, that would help automate farming techniques.

IoT can also assist with the capacity to monitor infrastructure-related processes. For instance, sensors might be used to track developments or changes in the structural elements of buildings, bridges, and other infrastructure. Benefits associated with this include cost savings, time savings, changes to the workflow's quality of life, and paperless workflow.

IoT may be used by a home automation company to control and monitor a building's electrical and mechanical systems. On a larger scale, smart cities may assist residents in using less garbage and energy.

Every industry, including those in healthcare, banking, retail, and manufacturing, is impacted by IoT.

IoT Enabling Technologies

IoT is enabled by several technologies including Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Embedded Systems, Security Protocols and architectures, Communication Protocols, Web Services, Mobile internet and semantic search engines.

1) **Wireless Sensor Network (WSN):** Comprises of distributed devices with sensors which are used to monitor the environmental and physical conditions. Zig Bee is one of the most popular wireless technologies used byWSNs.

WSNs used in IoT systems are described as follows:

- Weather Monitoring System: in which nodes collect temp, humidity and other data, which is aggregated and analyzed.
- Indoor air quality monitoring systems: to collect data on the indoor air quality and concentration of various gases.
- Soil Moisture Monitoring Systems: to monitor soil moisture at various locations.
- Surveillance Systems: use WSNs for collecting surveillance data (motion data detection).
- Smart Grids : use WSNs for monitoring grids at various points.
- Structural Health Monitoring Systems: Use WSNs to monitor the health of structures(building, bridges) by collecting vibrations from sensor nodes deployed at various points in the structure.

2) Cloud Computing: Services are offered to users in different forms.

- Infrastructure-as-a-service (IaaS):provides users the ability to provision computing and storage resources. These resources are provided to the users as a virtual machine instances and virtual storage.
- Platform-as-a-Service (PaaS): provides users the ability to develop and deploy application in cloud using the development tools, APIs, software libraries and services provided by the cloud service provider.
- Software-as-a-Service(SaaS): provides the user a complete software application or the user interface to the application itself.

3) Big Data Analytics: Some examples of big data generated by IoT are

- Sensor data generated by IoTsystems.
- Machine sensor data collected from sensors established in industrial and energy systems.
- Health and fitness data generated IoT devices.
- Data generated by IoT systems for location and tracking vehicles.
- Data generated by retail inventory monitoring systems.

4) Communication Protocols: form the back-bone of IoT systems and enable network connectivity and coupling to applications.

- Allow devices to exchange data over network.
- Define the exchange formats, data encoding addressing schemes for device and routing of packets from source to destination.
- It includes sequence control, flow control and retransmission of lost packets.

5) Embedded Systems: is a computer system that has computer hardware and software embedded to perform specific tasks. Embedded System range from low cost miniaturized devices such as digital watches to devices such as digital cameras, POS terminals, vending machines, appliances etc.,

IoT Software Technologies

- Cloud Computing
- IoT Platforms
- Edge AI/Analytics
- Containers
- IoT-based Streaming Analytics
- Supervised ML
- Cloud-native Application Design
- Cloud-native Data Warehouses
- Real-time Database
- Low-code/No-code Development Platforms
- Unsupervised ML
- Serverless/FaaS
- Deep Learning
- IoT Marketplaces
- Digital Twins
- IoT Security Platforms
- IoT Edge Data & Application Platforms
- ML Ops
- Automated ML
- Data ecosystems
- 2-way BMI (Brain Machine Interface)

IoT Hardware Technologies

- CPU
- MCU
- GPUs
- Security Chips
- Edge Gateways
- FPGA
- Intelligent Sensors
- ASIC
- Chaplets
- TinyML
- Edge + Micro Data Centers (MDCs)

- Cloud-connected Sensors
- AR Technology
- Edge AI Chip
- Neurosynaptic Chips
- QRNG Chips
- Wireless, Battery-free Sensors
- ML-optimized Gateways
- Quantum Computing
- Biodegradable Sensors

IoT Connectivity Technologies

- Cellular IoT (2G/3G/4G)
- LPWAN
- eSIM
- Mesh Networks
- 5G
- Wi-Fi 6
- Network Virtualization
- MQTT
- OPC Unified Architecture (UA)
- Satellite IoT
- TSN
- Li-Fi
- Open RAN
- Advanced Physical Layer (APL)
- Secure Access Service Edge (SASE)

Conclusion

Internet of Things is a new revolution of the Internet & it is a key research topic for researcher in embedded, computer science & information technology area due to its very diverse area of application & heterogeneous mixture of various communications and embedded technology in its architecture.

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