

Original Article

# An Introduction to the Internet of Things

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**Abstract:** The domain of technology and communication is ever-expanding, and so a conversation about a key technology that is a part of this domain is in order. That key technology is the Internet of Things, or IoT. IoT technology is of various types, from the commonly known Bluetooth and Wi-Fi, to the somewhat known ones like NFC (Near Field Communication) and Zigbee, and then also to some of the lesser-known ones like Sigfox. These are used in various industries like agricultural, technical etc. for various purposes like industrial automation & agricultural monitoring. They have also become a part of our life in the form of smart homes and even our wearable devices. Thus, IoT is here to stay.

**Keywords:** Internet of Things, Near Field Communication, Sigfox, Zigbee.

## I. INTRODUCTION

The domain of technology and communication is ever-expanding, and so a conversation about a key technology that is a part of this domain is in order. That key technology is the Internet of Things, or IoT.

IoT, or Internet of Things, refers to a network of physical objects or “things” that are present in sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. <sup>[1]</sup> They all are unique devices and are capable of exchanging data over a network, and this is an automated process.

IoT is absolutely important is because it has so many applications. There are various types of IoT devices. I'm sure that most people who are reading this article would be familiar with Bluetooth and Wi-Fi. Bluetooth and Wi-Fi are IoT based wireless communication protocols that work over a short-range and long-range respectively. But I will talk about some of the lesser known IoT technologies in this article.

A commonly used IoT technology is RFID, or Radio Frequency Identification. It refers to a form of wireless communication that incorporates the use of electromagnetic or electrostatic coupling in the radio frequency portion of the electromagnetic spectrum to uniquely identify an object, animal or person. <sup>[2]</sup>

It consists of a scanning antenna, a transceiver, and a transponder. The RFID reader is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data. <sup>[2]</sup> It is very useful as it is used for various purposes such as identification of animals and components, inventory management, vehicle tracking, healthcare etc.

Another IoT based technology is Zigbee. ZigBee is a communication protocol which is open standard, and is used to facilitate wireless communication between smart devices at home, offices, hospitals, etc. This means that with the Zigbee protocol, signals can hop from one Zigbee device to another in an open structure without connecting each device to a central hub (Wifi). <sup>[3]</sup> It is useful because it is a cheaper alternative that helps connect low power devices with low data rates for short-range wireless communications.

It is evident that a lot of these technologies are used for communication between devices that are in vicinity. Another IoT technology that works in this domain for this specific purpose is NFC or Near Field Communication. It is a method of wireless data transfer that detects and then enables technology in close proximity to communicate without the need for an internet connection. It's easy and fast. <sup>[4]</sup>

The one technology that has become very popular in the last couple year is LoRa or Long Range. LoRa stands for Long Range Radio and is mainly targeted for the Internet of Things (IoT) and M2M networks. It is a sort of new wireless modulation approach designed precisely for long-range connectivity and low-power communications. This technology will allow multi-tenant or public networks to connect a number of applications running on the same network. <sup>[5]</sup>



There is also LTE-M or Long-Term Evolution Machine type which is a form of 4G or communication technology that offers affordable and efficient connectivity for Internet of Things (IoT) applications.<sup>[6]</sup> It is capable of transmitting and receiving large amounts of data without draining the battery of the phone (which is mainly used), as is the case with 2G, 3G and 4G networks. I will explain 4G and 5G later.

The engineers who are reading this may be familiar with most of the technologies above, but very few of them may be familiar with this technology: Sigfox. It is a technology that operates over a narrow band. It uses a standard radio transmission method called binary phase-shift keying (BPSK), and it takes very narrow sections of spectrum and changes the phase or direction of the carrier radio wave to encode the data. This helps the receiver listen in a small part of the spectrum, which helps mitigate the effect of noise. It requires an inexpensive endpoint radio and a more sophisticated base station to manage the network.<sup>[7]</sup>

After discussing all these different types of IoT technologies, it is evident that IoT serves a very important purpose in our world that is replete with technology. It has various applications. Firstly, as discussed in the case of RFID, IoT is used for identification and tracking purposes. This is important as in the technical world, as it is important to identify the different components. In wildlife sanctuaries, it is used for tracking animals. Secondly, as it is evident from a lot of these examples, it is used to facilitate and communication between devices that are in close range. This is necessary because data transmission and data accumulation is important for the proper working of a technical system.

This leads us to the next important usage of IoT: wearable devices. These days everyone is wearing wearable devices like Google Fitbit or Apple watches. IoT is one of the key technologies over here. It enables the sensors on these devices to send the collected data to the smartphone, which then use them for data storage and processing. This is crucial for healthcare monitoring.

It also finds use in smart homes. A smart home uses sensors to control and maintain lighting, resource management, and security systems. A smart home is a smaller, independent version of a smart city.<sup>[8]</sup> Usage of IoT for the purpose of building smart homes means that IoT can also be used for building smart cities and also for industrial automation, and that is also a major use of IoT today.

In addition, IoT is also leveraged in the field of agriculture. As population continues to rise, the field of agriculture would also need innovation to meet the growing demand for food. That is where IoT helps. IoT is used for soil moisture monitoring, crop-health monitoring and also for monitoring weather condition. Collecting data for these things helps optimize irrigation and the use of fertilizer.

A similar yet different technology that also belongs in the domain of wireless communication is 5G. G stands for Generation, and it is a form of a communication technology that is used for smartphones. Compared to the previous generations of phone communication, it has bigger channels (to speed up data), lower latency (to be more responsive), and the ability to connect a lot more devices at once (for sensors and smart devices).<sup>[9]</sup>

5G helps improve IoT in several ways, making it a powerful combination for various applications. One key advantage that it offers is that it enables high-speed data transmission, as 5G networks offer significantly faster data transmission speeds compared to previous generations. It is said that 5G is 10 times faster than LTE networks of today.<sup>[10]</sup> I hope this article has offered a good insight into the technology that is powering our world to be a “smarter” place today.

## II. CONCLUSION

Thus, it's clear that Internet of Things is absolutely an indispensable part of our lives. The various IoT technologies like Bluetooth, Wi-Fi, somewhat known ones like NFC (Near Field Communication) & Zigbee, and some of the lesser-known ones like Sigfox are being used in the fields of agriculture, industries etc. for purposes of data collection and automation. Data collection is absolutely important, especially since our world is moving towards AI, and so data collection is the first and one of the most important parts of AI. Thus, we must continue to invest in IoT as it is making our world a better and more efficient place.

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