ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

Internet of Things (IoT) – Applications and Challenges

U. Harita,

Assistant Professor, Koneru Lakshmaiah Education Foundation, Vaddeswaram Guntur

uharita@gmail.com

Abstract

As the Internet of Things (IoT) continues to develop as the next stage of the Internet's rapid growth, it is important to understand the various fields in which IoT may be applied as well as the research difficulties that go along with them. IoT is predicted to permeate almost every element of daily life, from smart surroundings and smart living to smart cities, health care, smart agriculture, logistics, and retail. Despite the fact that the technologies that enable the Internet of Things today have advanced significantly in recent years, there are still many issues that need to be resolved. Many research issues are certain to occur as heterogeneous technologies constitute the foundation of the Internet of Things idea. The fact that IoT is so widespread and has an impact on almost every aspect of our life. This paper addresses various research problems and prospective uses of IoT technologies, highlighting their recent developments and challenges.

Keywords—Internet of Things; IoT applications; IoT challenges; future technologies; smart cities; smart environment; smart agriculture; smart living

I INTRODUCTION:

The Internet can be defined as a communication network that links people to information, whereas the Internet of Things (IoT) is a network of interconnected physical objects that can be uniquely addressed and have varying degrees of processing, sensing, and actuation capabilities. These objects can cooperate and communicate with each other using the Internet as a common platform [1]. Making it possible for objects to be connected to other objects and people at any time or place via any network, channel, or service is, thus, the primary goal of the Internet of Things. With time, the Internet of Things (IoT) is becoming recognized as the

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

next stage of the development of the Internet. Regular devices can now be connected to the internet to accomplish a plethora of goals.

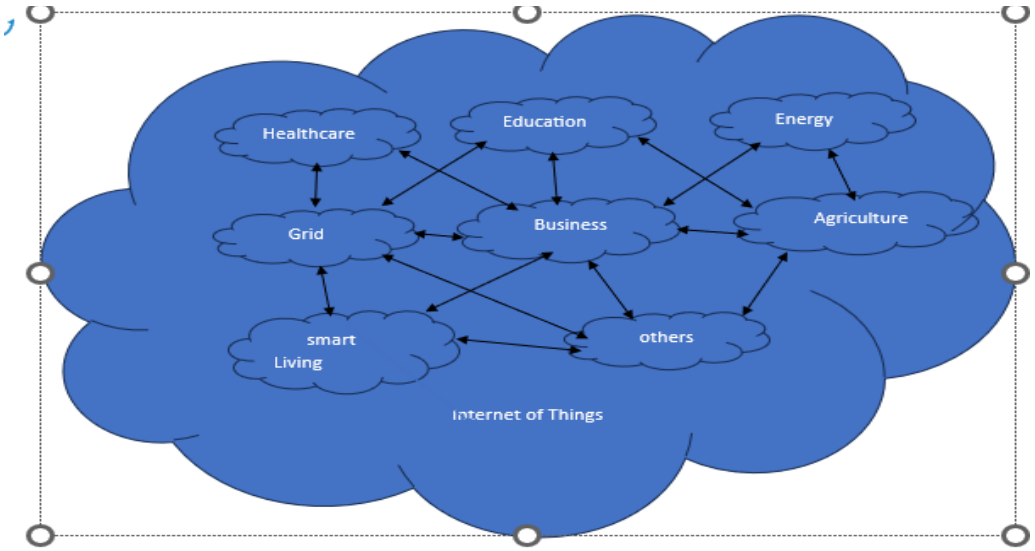

Fig. 1 Internet of Things

The internet of things (IoT) functions as a network of different "connected" devices, or a network of networks, as illustrated in Figure 1. As the internet continues to develop, it has transformed from a simple network of computers to a network of diverse devices. These days, a wide range of devices can communicate with one another via the Internet, including cellphones, automobiles, industrial systems, cameras, toys, buildings, home appliances, and countless more. These devices can perform process control, real-time monitoring, tracking, positioning, smart reorganizations, and control, regardless of their sizes and functions. The number of Internet-capable devices has significantly increased in recent years. Though its most notable commercial impact has been seen in the consumer electronics sector, specifically with the rise of smartphones and the interest in

Information can be shared via the Internet among many different systems, including industrial ones. These devices can perform intelligent reorganizations, tracking, positioning, control, real-time monitoring, and process control, regardless of their sizes and functions. There has been a significant increase in the number of Internet-capable devices in recent years. Even though the consumer electronics industry has seen its greatest commercial impact—namely, the revolution in smartphones and the growing popularity of wearable technology, such as watches and headsets—connecting people has now become only a small part of a larger movement that aims

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

to integrate the digital and physical worlds. In light of everything mentioned above, it is anticipated that the Internet of Things (IoT) will keep growing in terms of the range of gadgets and features it can support.

II POTENTIAL DOMAINS OF IOT

A **HealthCare**

The majority of healthcare systems across numerous nations are inherently slow, inefficient, and prone to mistakes. Given how many processes and tools the healthcare industry uses that can be improved and automated by technology, this is easily modifiable. The healthcare industry would be greatly altered by additional technology that could support a variety of tasks like record keeping, medication dispensing, and report sharing to numerous people and locations. Many of the advantages that Internet of Things applications bring to the healthcare industry fall into three main categories: tracking of individuals, staff, and objects; individual identification and authentication; and automated data collection and sensing. Tracking the flow of patients can greatly improve hospital workflow. Furthermore, there are fewer instances of mismatched infants, record maintenance, and potentially harmful patient incidents when authentication and identification are used. Furthermore, process automation, a reduction in form processing times, automated procedure auditing, and medical inventory management all depend on automatic data collection and transmission. Sensor devices facilitate patient-centered functions, specifically in the areas of condition diagnosis and real-time access to patient health indicators. This industry's application domains include alerts for patients' well-being, telemedicine solutions, and the ability to track a patient's adherence to prescriptions. Thus, sensors can be used on both inpatient and outpatient patients, as well as patient monitoring and Bluetooth-enabled toothbrushes and dental devices that provide information after use. In this sense, additional components of the Internet of Things include Wi-Fi, Bluetooth, and RFID. These will significantly improve methods for measuring and keeping an eye on a variety of vital signs, including blood pressure, temperature, heart rate, blood glucose, cholesterol, and many more.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

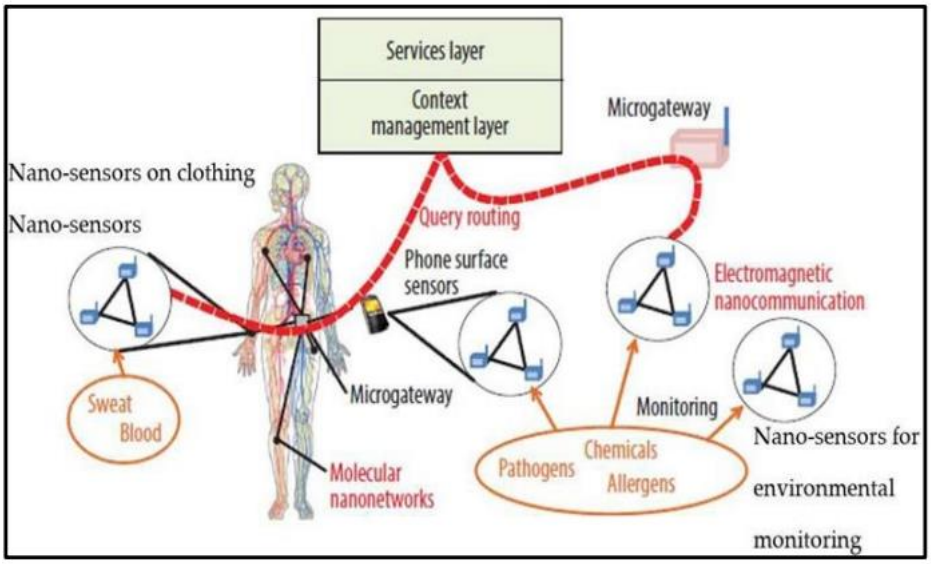

Fig.2 Internet of Nano Things

The materialization of the Internet of Nano-things (IoNT) is expanding the applications of the Internet of Things (IoT) and the Internet of Everything (IoE) [3]. As the name suggests, the idea behind IoNT is being developed by utilizing nano networks to integrate nano-sensors into various objects (things). As Fig. 2 illustrates, one of the main areas of interest for IoNT implementations is medical application. The use of IoNT in the human body for therapeutic purposes makes it easier to access data from in-situ body parts that were previously inaccessible through those medical instruments that had large sensor sizes. IoNT will therefore make it possible to gather new medical data, which will result in discoveries and improved diagnostics.

B Smart Agriculture

As per [11], the Internet of Things possesses the ability to fortify and augment the agricultural industry by analysing soil moisture content and, concerning vineyards, keeping an eye on the trunk diameter. To maximize the production and quality of fruits and vegetables, IoT would enable the control and preservation of vitamin content as well as the regulation of microclimate conditions. Moreover, monitoring weather data enables forecasting of ice, drought, wind shifts, rain, or snow, allowing temperature and humidity levels to be regulated to avoid fungus and other microbiological pollutants. In terms of cattle, IoT can help identify animals that graze in open spaces, identify harmful gases from animal waste on farms, control the growth conditions of offspring to increase health and survival rates, and more. Furthermore, by using IoT in agriculture, a great deal of waste and spoiling can be prevented by using appropriate monitoring

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

methods and field-wide field management. It also results in improved water and electricity management.

C Smart Living

IoT can be used in this field to create remote control devices that allow users to turn appliances on and off from a distance, reducing the risk of accidents and using less energy [1, 3].

Refrigerators with LCD (Liquid Crystal Display) screens are among the other smart home appliances that allow users to see what's inside, what's almost gone and what needs to be restocked. Additionally, this data can be connected to a smartphone application, allowing users to access it while they're out and about and make the necessary purchases. Furthermore, laundry can be remotely monitored with the help of washing machines. Furthermore, a smartphone can interface with a variety of kitchen appliances, allowing temperature adjustments, such as in microwave ovens. It sounds surprising but it’s a fact that certain ovens are designed with self-cleaning capabilities. Alarm systems and cameras that are installed to monitor and detect window or door openings can be used to apply IoT to home security, deterring potential intruders.

D Smart Cities

As per [6], the Internet of Things is vital for augmenting general infrastructure and making cities smarter. Intelligent transportation systems [7], smart buildings, waste management [9], traffic congestion [7, 8], smart lighting, smart parking, and urban maps are a few IoT application areas in the development of smart cities. This could involve a variety of features, like keeping an eye on the number of parking spots that are available within the city, keeping an eye on building and bridge material conditions and vibrations, installing sound monitoring equipment in high-risk areas of the city, and keeping an eye on the number of cars and pedestrians. IoT enabled by artificial intelligence (AI) can be used to monitor, manage, and lessen traffic congestion in smart cities [6]. Additionally, IoT enables the installation of weather-adaptive and intelligent street lighting.

E RETAIL AND LOGISTICS

There are numerous advantages to implementing IoT in supply chain or retail management. Among them are monitoring storage conditions all the way through the supply chain, tracking products for the purpose of enabling traceability, and processing payments based on the location or time of day in public transportation, theme parks, gyms, and other establishments. IoT can be used for a number of purposes inside retail spaces, including directing customers

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

based on a pre-selected list, expediting checkout times using biometrics, identifying potentially allergenic products, and managing the rotation of merchandise on shelves and in warehouses to automate restocking processes.Radio frequency identification and wireless sensor networks are the two main Internet of Things components utilized in this context. SAP (Systems Applications and Products) is currently used in retail, and there are many examples of its application in logistics, such as quality consignment conditions, item location, identifying storage incompatibilities, and fleet tracking. To ensure the safety of goods and workers, IoT is used in the industry to detect gas levels and leaks within the industry and its surroundings, monitor toxic gases and oxygen levels within chemical plant confines, and monitor the levels of water, gas, and oil in cisterns and storage tanks. IoT application helps with upkeep and repair as well because it allows for the installation of systems that anticipate equipment failures.

III RESEARCH CHALLANGES

To determine the viability and functionality of some of the aforementioned IoT applications, appropriate feasibility studies across various domains must be conducted. IoT has its ramifications and difficulties, just like any other innovation or technology, which must be resolved for widespread adoption. Even though the IoT-enabling technologies available today have advanced significantly in recent years, there are still many issues that need to be addressed, opening up new research avenues. Many research challenges are sure to arise since the Internet of Things (IoT) concept stems from heterogeneous technologies that are used in sensing, collecting, action, processing, inferring, transmitting, notifying, managing, and storing of data.

A Security and Privacy

Since wireless sensor networks (WSN) are the basis of the Internet of Things, IoT inherits the same privacy and security concerns as WSN [3, 15]. Numerous cyberattacks and vulnerabilities on Internet of Things (IoT) systems demonstrate the necessity for comprehensive security designs that will safeguard data and systems throughout their lifecycle. Numerous attacks typically take advantage of flaws in particular devices to access their systems and thereby render secure devices vulnerable [16, 17]. This security gap further drives the need for comprehensive security solutions, which include frameworks that help developers create safe systems on heterogeneous devices, effective applied cryptography research for data and system security, and non-cryptographic security techniques.Further research is necessary to determine

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

whether cryptographic security services can function on Internet of Things devices with limited resources. This would make it possible for a variety of proficient users to deploy and utilize IoT systems securely, despite the fact that nearly all IoT devices have subpar user interfaces. Apart from the security and safety features of the Internet of Things, other domains such as message integrity, confidentiality in communication, and the reliability and authenticity of communication parties should also be included. These could have capabilities like the ability to stop different parties from communicating. For instance, in commercial dealings, it is imperative to stop smart objects from making it easier for rivals to obtain sensitive data from the devices and utilize it for their own advantage.

B Interoperability

In terms of the internet, interoperability has historically been and still is a basic fundamental value because the ability of "connected" systems to "speak a similar language" in terms of encodings and protocols is a prerequisite for Internet connectivity. Different standards are currently used by different industries to support their applications. Using standard interfaces in such diverse entities is very important, especially for applications that support cross-organizational collaboration, given the large volumes and variety of data, heterogeneous devices, and a wide range of system limitations. As a result, even higher levels of interoperability are intended to be supported by IoT systems [24].

C Monitoring and Sensing

Despite the enormous advancements in monitoring and sensing technologies, these fields are always changing, with an emphasis on form and energy efficiency. Since sensors and tags are typically expected to be active all the time in order to collect real-time data, this feature is critical for energy efficiency, particularly when it comes to lifespan extension. New developments in miniaturization and nanotechnology/biotechnology have made it possible to develop actuators and sensors at the nanoscale concurrently.

D Fusion with other technologies like Block chain

Like IoT, blockchain technologies have experienced tremendous growth in popularity since their launch in 2018. Although blockchain was initially developed as the foundational technology of the Bitcoin cryptocurrency, it is currently being used in a wide range of non-financial applications [21]. According to Miraz, by removing each technology's innate architectural constraints, blockchain and IoT can complement one another [22]. WSN is the IoT's underlying technology. Thus, IoT experiences security and privacy problems, much like

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

WSN. On the other hand, blockchain's inherent security, immutability, trust, and transparency are the main drivers of its adoption trend in non-monetary applications. These features are made possible by the distributed ledger technologies (DLTs) and consensus method used by blockchain, which heavily rely on participating nodes.

CONCLUSION

The best way to characterize the Internet of Things is as a Complex Adaptive System (CAS), which means that it will keep evolving and need new and creative approaches to software engineering, systems engineering, project management, and many other disciplines to manage and grow over the next few years. IoT can serve a wide range of users, each with different needs, thanks to its many application areas. Three user categories are benefited by technology: individuals, society or communities, and institutions. The Internet of Things (IoT) has the potential to be a hugely transformative force that will, and in some cases already has, positively impacted millions of lives worldwide, as this research paper's application section discusses. Numerous research groups from all over the world have been founded and are still being formed with the primary goal of pursuing IoT-related research. New aspects of IoT processes, technologies, and connected objects continue to emerge as more research studies are undertaken, further opening the door for a wide range of IoT application functionalities. IoT is an important research topic for studies in a variety of related fields, including computer science and information technology, because it is so broad and impacts almost every aspect of our lives. The paper outlines a number of possible Internet of Things application domains and associated research challenges.

REFERENCES

1] M. H. Miraz, M. Ali, P. S. Excell, and R. Picking, “A Review on Internet of Things (IoT), Internet of Everything (IoE) and Internet of Nano Things (IoNT)”, in 2015 Internet Technologies and Applications (ITA), pp. 219– 224, Sep. 2015, DOI: 10.1109/ITechA.2015.7317398.

[2] P. J. Ryan and R. B. Watson, “Research Challenges for the Internet of Things: What Role Can OR Play?,” Systems, vol. 5, no. 1, pp. 1–34, 2017.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

[3] M. Miraz, M. Ali, P. Excell, and R. Picking, "Internet of Nano-Things, Things and Everything: Future Growth Trends", Future Internet, vol. 10, no. 8, p. 68, 2018, DOI: 10.3390/fi10080068.

[4] E. Borgia, D. G. Gomes, B. Lagesse, R. Lea, and D. Puccinelli, "Special issue on" Internet of Things: Research challenges and Solutions".," Computer Communications, vol. 89, no. 90, pp. 1–4, 2016.

[5] K. K. Patel, S. M. Patel, et al., "Internet of things IOT: definition, characteristics, architecture, enabling technologies, application future challenges," International journal of engineering science and computing, vol. 6, no. 5, pp. 6122–6131, 2016.

[6] S. V. Zanjal and G. R. Talmale, "Medicine reminder and monitoring system for secure health using IOT," Procedia Computer Science, vol. 78, pp. 471–476, 2016.

[7] R. Jain, "A Congestion Control System Based on VANET for Small Length Roads", Annals of Emerging Technologies in Computing (AETiC), vol. 2, no. 1, pp. 17–21, 2018, DOI: 10.33166/AETiC.2018.01.003.

[8] S. Soomro, M. H. Miraz, A. Prasanth, M. Abdullah, "Artificial Intelligence Enabled IoT: Traffic Congestion Reduction in Smart Cities," IET 2018 Smart Cities Symposium, pp. 81–86, 2018, DOI: 10.1049/cp.2018.1381.

[9] Mahmud, S. H., Assan, L. and Islam, R. 2018. "Potentials of Internet of Things (IoT) in Malaysian Construction Industry", Annals of Emerging Technologies in Computing (AETiC), Print ISSN: 2516-0281, Online ISSN: 2516-029X, pp. 44-52, Vol. 2, No. 1, International Association of Educators and Researchers (IAER), DOI: 10.33166/AETiC.2018.04.004.

[10] Mano, Y., Faical B. S., Nakamura L., Gomes, P. G. Libralon, R. Meneguete, G. Filho, G. Giancristofaro, G. Pessin, B. Krishnamachari, and Jo Ueyama. 2015. Exploiting IoT technologies for enhancing Health Smart Homes through patient identification and emotion recognition. Computer Communications, 89.90, (178-190). DOI: 10.1016/j.comcom.2016.03.010.

[11] V. Sundareswaran and M. S. null, "Survey on Smart Agriculture Using IoT," International Journal of Innovative Research in Engineering & Management (IJIREM), vol. 5, no. 2, pp. 62–66, 2018.

[12] P. Tadejko, "Application of Internet of Things in logistics-current challenges," Ekonomia i Zarz{a˛}dzanie, vol. 7, no. 4, pp. 54–64, 2015.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 8, Issue 3, 2019

[13] S. Rajguru, S. Kinhekar, and S. Pati, "Analysis of internet of things in a smart environment," International Journal of Enhanced Research in Man-agement and Computer Applications,vol. 4, no. 4, pp. 40–43, 2015.

[14] H. U. Rehman, M. Asif, and M. Ahmad, "Future applications and research challenges of IOT," in 2017 International Conference on Informa-tion and Communication Technologies (ICICT), pp. 68–74, Dec 2017

[15] Z. Alansari, N. B. Anuar, A. Kamsin, M. R. Belgaum, J. Alshaer, S. Soomro, and M. H. Miraz, "Internet of Things: Infrastructure, Architecture, Security and Privacy", in 2018 International Conference on Com- puting, Electronics Communications Engineering (iCCECE), pp. 150– 155, Aug 2018, DOI: 10.1109/iCCECOME.2018.8658516