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IOT SENSORS AND APPLICATION

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***Abstract*— As the Internet of Things (IoT) evolves as the next phase of the Internet's growth, it's becoming increasingly important to define the numerous possible areas for IoT applications, as well as the research issues connected with these applications. IoT is projected to penetrate practically every facet of daily life, from smart cities to health care, smart agriculture, logistics and retail, and even smart living and smart ecosystems. Despite the fact that current IoT enabling technologies have vastly improved in recent years, there are still a slew of issues that need to be addressed. Many research issues are sure to occur since the IoT idea is based on heterogeneous technology. The fact that the Internet of Things is so vast and influences nearly every aspect of our life complicates things**.

***Keyword*s—Technologies, heterogeneous**

I. INTRODUCTION

The Internet is a communication network that connects people to information, whereas the Internet of Things (IoT) is a network of uniquely addressable physical items with varying degrees of processing, sensing, and actuation capabilities that share the ability to interoperate and communicate using the Internet as their common platform [1]. As a result, the Internet of Things' primary goal is to enable items to communicate with other objects, as well as persons, at any time and from any location, utilising any network, method, or service. The Internet of Things (IoT) is progressively becoming recognized as the next step in the growth of the Internet. Ordinary gadgets will be able to connect to the internet, allowing them to perform a variety of tasks.

The internet has evolved from a basic network of computers to a network of diverse devices, whereas IoT functions as a network of various "connected" devices, or a network of networks [3, as seen in Fig. 1]. Smartphones, automobiles, industrial systems, cameras, toys, buildings, household appliances, industrial systems, and a plethora of other items may now all communicate data through the Internet. These devices can perform smart reorganisations, tracing, positioning, control, real-time monitoring, and process control regardless of their size or function. There has been a significant increase in the number of Internet-capable gadgets in recent years. Despite the fact that its most major commercial impact has been witnessed in the consumer electronics market, specifically the smartphone revolution and interest Wearable technologies (watches, headsets, etc.) that connect individuals have become a small part of a larger movement toward the merging of the digital and physical worlds.

With all of this in mind, the Internet of Things (IoT) is predicted to continue to grow in terms of the number of devices and functionalities it can support. This is evidenced by the vagueness in the term "things," which makes defining the IoT's ever-expanding boundaries problematic [4]. While commercial success continues to emerge, the Internet of Things (IoT) continues to provide an almost unlimited supply of potential, not just in industry but also in research. As a result, the course examines the different prospective areas for IoT domain applications as well as the research

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problems that come with them.

II. APPLICATION POTENTIAL DOMAINS OF THE INTERNET OF THINGS :

The internet of Things' potential applications are not only many but also diversified, since they pervade nearly every element of people's, institutions', and society's everyday lives. According to [5,] IoT applications span a wide range of industries, including manufacturing, healthcare, agriculture, smart cities, security, and disaster relief, among others.

A. Smart Cities

According to [6], the Internet of Things plays a critical role in developing city smartness and general infrastructure. Intelligent transportation systems [7], smart buildings, traffic congestion [7, 8], waste management [9], smart lighting, smart parking, and urban mapping are some of the IoT application areas in constructing smart cities. This might include functions like monitoring available parking spots inside the city, monitoring vibrations and material states of bridges and buildings, installing sound monitoring devices in sensitive areas of cities, and monitoring pedestrian and vehicle levels. In Smart Cities, Artificial Intelligence (AI) powered IoT may be used to monitor, regulate, and minimise traffic congestion [6]. Furthermore, IoT enables for the installation of intelligent and weather-related devices.

The use of radio frequency identification and sensors in IoT applications to develop smart cities would be required. The Aware Home and Smart Santander features are two examples of already established applications in this area. Some large cities in the United States, such as Boston, have plans to integrate the Internet of Things into most of their systems, including parking metres, streetlights, sprinkler systems, and sewage grates, which are all set to be interconnected and connected to the internet. Such applications will represent substantial advancements in terms of cost and energy savings.

B. Healthcare

Many nations' healthcare systems are inefficient, sluggish, and prone to mistakes. This is readily changeable because the healthcare industry relies on a variety of activities and technologies that may be automated and improved through technology. Additional technology that can assist activities such as report sharing to different persons and places, record keeping, and medicine delivery would go a long way toward altering the healthcare industry [7].

Many of the advantages that IoT applications provide in the health-care industry are most commonly classified as tracking of patients, personnel, and items, identifying and authenticating persons, and automatic data collection and sensing. Once the flow of patients is recorded, the hospital's workflow may be considerably improved. Furthermore, verification and identification limit potentially dangerous situations, record maintenance, and the number of cases of mismatched newborns. Furthermore, process automation, form processing timeline reduction, automated procedure auditing, and medical inventory management all benefit from automatic data gathering and transfer. Sensor devices provide patient-centered tasks, such as detecting illnesses and providing real-time data on patients' health indicators [6].

The materialisation of the Internet of Nano-things (IoNT) is extending the applications of the Internet of Things (IoT) and Internet of Everything (IoE) [3]. As the name indicates, the Internet of Things (IoNT) is being created by integrating Nano-sensors into a variety of items (things) via Nano networks. One of the key objectives of IoNT implementations, as indicated in Fig. 2, is medical applications. The use of IoNT in the human body for medical therapy enables access to data from in situ regions of the body that were previously inaccessible to sense from or by employing medical tools with cumbersome sensor sizes. As a result, IoNT will enable the collection of new medical data, resulting in novel discoveries and improved diagnoses.

C. Water Management and Smart Agriculture

According to [8], the Internet of Things has the potential to boost and expand the agriculture industry by monitoring soil moisture and, in the case of vines, the trunk diameter. IoT would enable for better management and preservation of vitamin content in agricultural goods, as well as regulation of microclimate conditions to maximise vegetable and fruit output and quality. Furthermore, examining meteorological conditions enables forecasting of ice information, drought, wind changes, rain, or snow, allowing temperature and humidity levels to be controlled, preventing fungus and other microbial pollutants.

When it comes to cattle, IoT can help with things like recognising animals that graze in open areas, detecting harmful gases from animal waste in farms, and managing growing circumstances in progeny to improve health and survival prospects, among other things. Furthermore, via efficient monitoring techniques and administration of the entire farm area, a lot of loss and spoiling may be avoided through IoT implementation in agriculture. It also leads to improved regulation of power and water.

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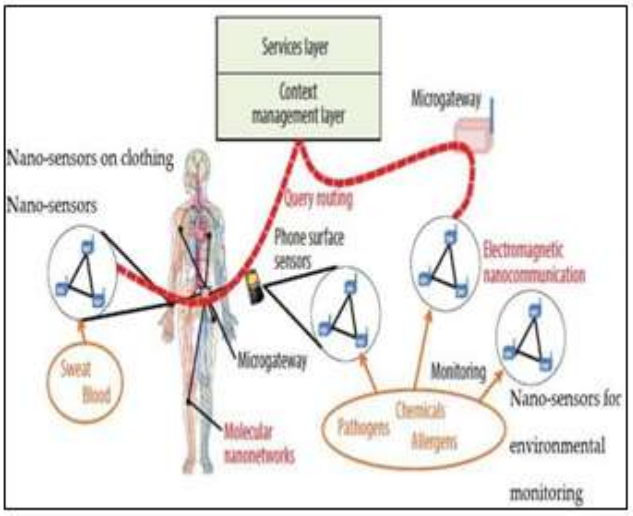

Figure 2: The Nano-Things Internet [3].

According to [9], the role of IoT in water management includes determining the suitability of water in seas and rivers for both drinking and agricultural purposes, detecting pressure variations in pipes and liquid presence outside tanks, as well as monitoring water variation levels in dams, rivers, and reservoirs. Wireless sensor networks are used in these IoT applications. SiSviA, GBROOS, and SEMAT are examples of existing IoT applications in this sector.

D. Logistics and Retail

There are several advantages to implementing IoT in supply chain or retail management. Some examples include monitoring storage conditions across the supply chain, product tracking for traceability purposes, and payment processing in public transportation, amusement parks, and gyms, among others. Inside the retail environment, IoT can be used for a variety of applications, including guiding customers through the store based on a pre-selected list, automating payment processes such as automatic check-out with biometrics, detecting potential allergen products, and controlling product rotation on shelves and warehouses to automate restocking procedures [9].

Wireless sensor networks and radio frequency identification are two IoT elements commonly employed in this scenario. SAP (Systems Applications and Products) is currently in use in retail, and various instances in logistics include quality consignment conditions, item location, detecting storage incompatibility concerns, and fleet tracking, to name a few. In the industrial domain, IoT aids in the detection of gas levels and leaks within the industry and its environs, the monitoring of toxic gases and oxygen levels within the confines of chemical plants to ensure the safety of goods and workers, and the monitoring of oil, gas, and water levels in cisterns and storage tanks. Because systems may be put in place to forecast equipment faults, IoT can also help with maintenance and repair.

E. Smart Living

In this domain, IoT can be applied in remote control devices whereby one can remotely switch appliances on and off hence preventing accidents as well as saving energy [1, 3]. Other smart home appliances include refrigerators fitted with LCD (Liquid Crystal Display) screens, enabling one to know what is available inside, what has over stayed and is almost expiring as well as what needs to be restocked. This information can also be linked to a smartphone application enabling one to access it when outside the house and therefore buy what is needed. Furthermore, washing machines can allow one to remotely monitor laundry. In addition, a wide range of kitchen devices can be interfaced through a smartphone, hence making it possible to adjust temperature, like in the case of an oven. Some ovens which have a self-cleaning feature can be easily monitored as well. In terms of safety in the home, IoT can be applied through alarm systems and cameras can be installed to monitor and detect window or door openingshence preventing intruders [3].

F. Smart Environment

The environment has an important influence in all parts of existence; people, animals, birds, and plants are all affected in some manner by an unhealthy environment. There have been countless efforts to establish a healthy environment in terms of minimizing pollution and resource waste, but the presence of industries and transportation wastes, as well as careless and dangerous human acts, are commonplace factors that continually hurt the ecosystem. As a result, the environment demands clever and creative approaches to waste monitoring and management, which generate a large quantity of data that drives governments to implement environmental protection systems.

Smart environment strategies that include IoT technology should be developed for detecting, tracking, and assessing environmental items that have the potential to help achieve a sustainable living and a green planet. IoT technology enables for improved traffic management in big cities by watching and controlling air quality through data collecting from distant sensors throughout cities and offering round-the-clock geographic coverage. In addition, IoT technology may be used to measure pollution levels in water and, as a result, inform water consumption decisions. IoT may also be used in trash management, which includes a variety of waste kinds such as chemicals and pollutants that are harmful to the environment as well as to humans, animals, and plants. This may be accomplished by using

IoT may be utilised in weather forecasting to provide substantial accuracy and high precision for weather monitoring through information sharing and data interchange. Weather systems may gather data from moving

cars, such as barometric pressure, humidity, temperature, light, motion, and other variables, and transfer it wirelessly to weather stations using IoT technology. Sensors are installed on cars and even buildings to collect data, which is then saved and analysed to help in weather predictions. Radiation endangers the environment, human and animal health, and agricultural output. IoT sensor networks can help manage radiation by constantly monitoring its levels, which is especially useful for identifying leaks and spreading deterrent around nuclear power plants.

III. CONCLUSION

The Internet of Things is best defined as a CAS (Complex Adaptive System) that will continue to expand in the next years, necessitating new and inventive kinds of software engineering, systems engineering, project management, and a variety of other disciplines to build and manage it. IoT application areas are highly broad, allowing it to serve a variety of consumers with a variety of demands. Individuals, society or communities, and institutions are three types of users that benefit from technology. As mentioned in the study paper's application section, the Internet of Things has undeniable potential to be a massively revolutionary force that will, and to some extent already does, positively touch millions of lives across the world. This, according to [9],

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