Internet of Things (IoT) Technology, Application And Challenges

Nainsi Gupta[1], Dinesh Swami[2], Anil Dhankhar[3]
[1]Dept of MCA
[2, 3]Assoc. Professor, Dept of MCA
[1, 2, 3]RIET Jaipur

Abstract- *Internet of things (IoT) is a very unique platform which is getting very popular day by day. The very reason for this to happen is the advancement in technology and its ability to get linked to everything. This feature of getting linked has in itself provided multiple opportunities and a vast scope of development. The fact that technology in various fields has evolved through the years, is the reason why we observe a rapid change in the shape, size and capacity of various instruments, components and the products used in daily life. And this benefit of simplified technology when accompanied by a platform like IoT eases the work as well as benefits both the manufacturer and the end user. The Internet of Things gives us an opportunity to construct effective administrations, applications for manufacturing, lifesaving solutions, proper cultivation and more. This paper proposes an extensive overview of the IoT technology and its varied applications in life saving, smart cities, agricultural, industrial etc. by reviewing the recent research works and its related technologies. It also accounts the comparison of IoT with M2M, points out some disadvantages of IoT. Furthermore, a detailed exploration of the existing protocols and security issues that would enable such applications is elaborated. Potential future research directions, open areas and challenges faced in the IoT framework are also summarized.*

Keywords- IoT, Smart cities, Agriculture, Life saver, Industry, Protocols, Security

I. INTRODUCTION

The Internet can be described as the communication network that connects individuals to information while The Internet of Things (IoT) is an interconnected system of distinctively address able physical items with various degrees of processing, sensing, and actuation capabilities that share the capability to interoperate and communicate through the Internet as their joint platform. Thus, the main objective of the Internet of Things is to make it possible for objects to be connected with other objects, individuals, at any time or anywhere using any network, path or service. The Internet of Things (IoT) is gradually being regarded as the subsequent phase in the Internet evolution. IoT will make it possible for ordinary devices to be linked to the internet in order to achieve countless disparate goals. Currently, an estimated number of only 0.6% of devices that can be part of IoT has been connected so far [2]. However, by the year 2020, it is likely that over 50 billion devices will have an internet connection.

As the internet continues to evolve, it has become more than a simple network of computers, but rather a network of various devices, while IoT serves as a network of various "connected" devices a network of networks. Nowadays, devices like smartphones, vehicles, industrial systems, cameras, toys, buildings, home appliances, industrial systems and countless others can all share information over the Internet. Regardless of their sizes and functions, these devices can accomplish smart reorganizations, tracing, positioning, control, real-time monitoring and process control. In the past years, there has been an important propagation of Internet capable devices. Even though its most significant commercial effect has been observed in the consumer electronics field; i.e. particularly the revolution of smartphones and the interest in wearable devices (watches, headsets, etc.), connecting people has become merely a fragment of a bigger movement towards the association of the digital and physical worldsWith all this in mind, the Internet of Things (IoT) is expected to continue expanding its reach as pertains the number of devices and functions, which it can run. This is evident from the ambiguity in the expression of "Things" which makes it difficult to outline the ever-growing limits of the IoT [4]. While commercial success continues to materialize, the IoT constantly offers a virtually limitless supply of opportunities, not just in businesses but also in research. Accordingly, the understudy addresses the various potential areas for application of IoT domains and the research challenges that are associated with these applications.

II. POTENTIALAPPLICATION DOMAINS OFIOT

IoT has a multidisciplinary vision to provide its benefit to several domains such as environmental, industrial, public/private, medical, transportation etc. Different researchers have explainedthe IoT differently with respect to specific interests and aspects. The potential and power of IoTcan be seen in several application domains

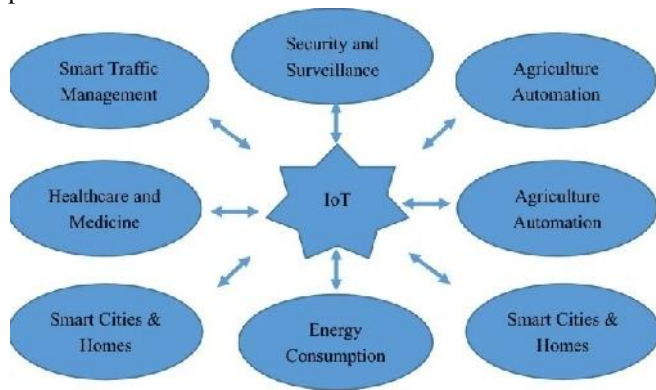**Fig.1** illustrates few of the applicationdo mains of IoTs potentials.

Fig .1 **potential application domains of IoT**

A .Smart Cities

People continue to move towards cities the reason being good opportunities offered, this increases the population and in order to manage the increased population and the problems comes with that city needs to be smart. We all have experienced the irritation we feel when we spend hours waiting in jams .The smell of improper disposal of waste in neighbourhood etc. All this problem will be solved with IoT. Some of the potential applications of IoT in smart cities are shown in the Fig.2

Fig..2 IoT application areas for smart cities

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C. Healthcare

Most healthcare systems in many countries are inefficient, slow and inevitably prone to error. This can easily be changed since the healthcare sector relies on numerous activities and devices that can be automated and enhanced through technology. Additional technology that can facilitate various operations like report sharing to multiple individuals and locations, record keeping and dispensing medications would go a long way in changing the healthcare sector .

A lot of benefits that IoT application offers in the health- care sector is most categorized into tracking of patients, staff, and objects, identifying, as well as authenticating, individuals, and the automatic gathering of data and sensing. Hospital workflow can be significantly improved once patients flow is tracked. Additionally, authentication and identification reduce incidents that may be harmful to patients, record maintenance and fewer cases of mismatching infants. In addition, automatic data collection and transmission is vital in process automation, reduction of form processing timelines, automated procedure auditing as well as medical inventory management. Sensor devices allow functions centered on patients, particularly, in diagnosing conditions and availing real-time information about patients' health indicators.

The applications of Internet of Things (IoT) and Internet of Everything (IoE) are further being extended through the materialization of the Internet of Nano-things (IoNT) [3]. The notion of IoNT, as the name implies, is being engineered by integrating Nano-sensors indiverse objects(things) usingNano networks. Medical application, as shown in ,is one of the major focuses of IoNT implementations. Application of IoNT in human body, for treatment purposes, facilitates access to data from in situ parts of the body which were hitherto in accessible to sense from or by using those medical instruments incorporated with bulky sensor size. Thus, IoNT will enable new medical data to be collected, leading to new discoveries and better diagnostics.

B. *Smart Agriculture and Water Management*

According to , the IoT has the capacity to strengthen and enhance the agriculture sector through examining soil moisture and in the case of vineyards, monitoring the trunk diameter. IoT would allow to control and preserve the quantity of vitamins found in agricultural products, and regulate microclimate conditions in order to make the most of the production of vegetables and fruits and their quality. Further more, studying weather conditions allows forecasting of ice information, drought, wind changes, rain or snow, thus controlling temperature and humidity levels to prevent fungus as well as other microbial contaminants.

When it comes to cattle, IoT can assist in identifying animals that graze in open locations, detecting detrimental gases from animal excrements in farms, as well as controlling growth conditions in offspring to enhance chances of health and survival and so on. Moreover, through IoT application in agriculture, a lot of wastage and spoilage can be avoided through proper monitoring techniques and management of the

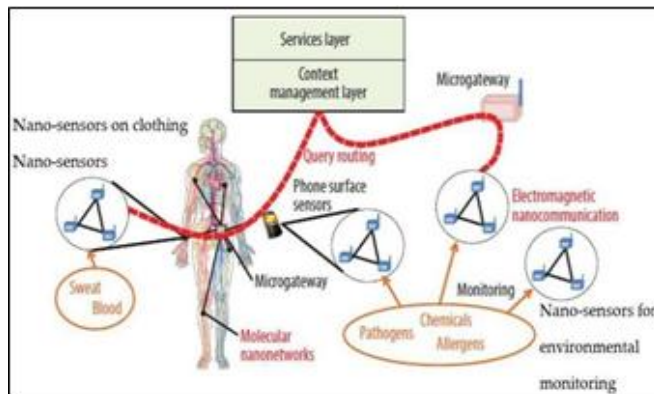entire agriculture field. It also leads to better electricity and water control.

Fig. 3.The Internet of Nano-Things [3].

The IoT elements mostly used in this setting include; wireless sensor networks and radio frequency identification. In retail, there is a current use of SAP (Systems Applications and Products), while in logistics numerous examples include quality consignment conditions, item location, detecting storage incompatibility issues, fleet tracking among others. In the industry domain, IoT helps in detecting levels of gas and leakages within the industry and its environs, keeping track of toxic gases as well as the oxygen levels within the confines of chemical plants to ensure the safety of goods and workers and observing levels of oil, gases and water in cisterns and storage tanks. Application of IoT also assistsin maintenance and repair because systems can be put in place to predict equipment malfunctions and at the same automatically schedule periodic maintenance services before there is a failure in the equipment. This can be achieved through the installation of sensors inside equipment or machinery to monitor their functionality and occasionally send reports.

D. 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 openings hence preventing intruders

E. Smart Environment

The environment has a vital role within all aspects of life, from people, to animals, birds and also plants, are all affected by an unhealthy environment in one way or another. There have been numerous efforts to create a healthy environment in terms of eliminating pollution and reducing wastage of resources, but the existence of industries, as well as transportations wastes coupled with reckless and harmful human actions are common place elements which consistently damage the environment. Consequently, the environment requires smart and innovative ways to help in monitoring and managing waste, which provide a significant amount of data that forces governments to put in place systems that will protect the environment.

Smart environment strategies integration with IoT technology should be created for sensing, tracking and assessment of objects of the environment that offer potential benefits in achieving a sustainable life and a green world. The IoT technology allows observing and managing of air quality through data collection from remote sensors across cities and providing round the clock geographic coverage to accomplish better ways of managing traffic jams in major cities. Additionally, IoT technology can be applied in measuring pollution levels in water and consequently enlighten decisions on water usage. In waste management, which consists of various types of waste, like chemicals and pollutants being detrimental to the environment and to people, animals, and plants as well, IoT can also be applied. This can be achieved by environmental protection by means of controlling industrial pollution through instantaneous monitoring and management systems combined with supervision in addition to decision making networks. This serves to lessen waster.

III. CHALLENGESOFIOTSECURITY

As the basic principle of IoT involves connecting devices, it makes everything addressable and locatable which in turn makes our life easier .However, making everything con- nected to internet opens the door for hackers. Without proper confidence about privacy and security, user will not be attracted towards IoT.So, it must have a strong infrastructure dealing with security and some of the issues that IoT might face are listed below.

The primary issue the IoT facing is unauthorized Access to RFID. The RFID tags can contain any sort of information and as RFID tag can be easily modified or read by the reader. This opens a whole bunch of threat for the user as the data can be easily accessed by a miscreant reader. Wireless sensor networks security breach sensors node in IoTare bidirectional. Acquisition of data is also possible other than transmission. In this sce- nario, some of the possible attacks include tampering where the data in the node can be extracted or altered. Next flooding creates a whole lot of problems inIoT.

Flooding the name suggests, it explains when traffic amount is high and exhaustion of memory takes place. Sybil attack wherein multiple pseudo identities are claimed for anode in order for it to give big influence. Security issues from Android where once when we connect IoT to an android, unlike IOS android it is an open source network which means it can easily be discovered. Once the front end devices are compromised, the IoT network is exposed. Software updating problem is usually faced by the developers because of high cost and memory, the do not update their software and devices. Once the hackers discover the devices, they can be easily accessed. Cloud Computing in IoT is a big network that allows sharing of resources and some of the security threats faced by shared resources are listed below.

Data loss happens when any miscreant user having unauthorized access can modify or delete the data. Cloud computing can also be used for controlling other devices, once the hackers get hold of an account it can upload certain software's which will give him control of any devices that come in contact. The Man-in-the-middle (MITM) the hacker works as a third person and can intercept or alter any message.

IV. CONCLUSION

In this review, the technological standard required for implementation of IoT is discussed. Moreover, basic communication entities and networks which support IoTare also reviewed in such a way to foresee the problems of ideal implementation of IoT. IoT is also pitted against M2M to illustrate the similarities and difference between the tech- nologies. Most importantly, recent advancements and potential applications in smart cities, agricultural environment and industrial control areas are also presented. Detailed review of IoT environment in life saver applications, protocols used for various applications, security issues involved in implementing the IoT is also demonstrated in this research. Future research directions, the implementation challenges and open issues are also reviewed for real time scenarios.

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