IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 11, Issue 11, November 2022

DOI: 10.17148/IJARCCE.2022.111158

# Internet of Things (IOT): Future Application and research Challenges

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**Abstract:** With the Internet of Things (IoT) gradually it evolves as the subsequent phase of the evolution of Internet, it becomes crucial for recognizing the various potential domains and also for application of the Internet of things, and the challenges of the research that are associated with these applications. Ranging from smart cities, to health care, agriculture, logistics and retail, to even smart living and smart environments Inter of things is expected to infiltrate into virtually all aspects of daily life. Even though the current Internet of things it enables the technologies which have greatly improved in the present years, there are still many more problems which require attention. Since the Internet of things concept ensues from heterogeneous technologies, many research challenges are therefor bound to arise. The fact that Internet of things is so expansive that affects practically all areas of our lives, makes it a significant research topic for studies in various related fields as information technology and computer science. Thus, Internet of things is paving the way for new dimensions of research that should be carried out. This paper presents the recent development of IoT technologies and future applications and challenges.

**Keywords:** Internet of Things; applications; smart:cities , environment , agriculture, living ,challenges .

## I. INTRODUCTION

The IOT can be described as the network of communication which connects to the individual information whereas the internet of things is interconnected system distinctively address able physical items with various degree of processing and actuation capabilities that share the capability to communicate through the Internet as their joint platform . the main objective of the Internet of Things is to make possible for objects which is been connected with other objects, individuals, at any time and also anywhere using any network or service.

The Internet of Things ( is gradually being regard as the subsequent phase in the Internet evolution. Internet of things will make possible for ordinary devices be linked to the internet in order for achieve minimum goals. Currently, an estimated number of only 0.6% devices that can be part of Internet of things has been connected so far . However, by the year of 2023, it is likely to say that over 90 billion devices will having internet connection an internet connection.

As the internet continues to evolve in the system and environment, it has become more than a simple network of computers, but also network of various devices, while Internet of thing serves as a network of various "connected" devices a network of networks as shown in Fig. 1. Nowadays we can see that, devices like smart phones, vehicles, industrial systems, cameras, toys, buildings, home appliances, others can all share information over the Internet. Regardless of sizes and functions, these devices can accomplish smart reorganizations, tracing, positioning, and process control. In the earlier years, there has been an important of Internet capable devices.

Even its most significant commercial effect has been observed in the consumer electronics field, . particularly the revolution of smartphones and the interest in wearable devices (watches , bluetooth etc.), connecting people has become merely a fragment of a bigger movement towards the association of the digital worlds. With all this, the Internet of Things (IoT) is expected to continue expanding, which it can run.

This is the evident from ambiguity in the expression of "Things" which makes difficult to outline the ever- growing limits of the Internet of things. While in commercial success it continues to materialize, the Internet of things constantly it offers a virtually limitless supply of opportunities, not only just in businesses but also in researches

  

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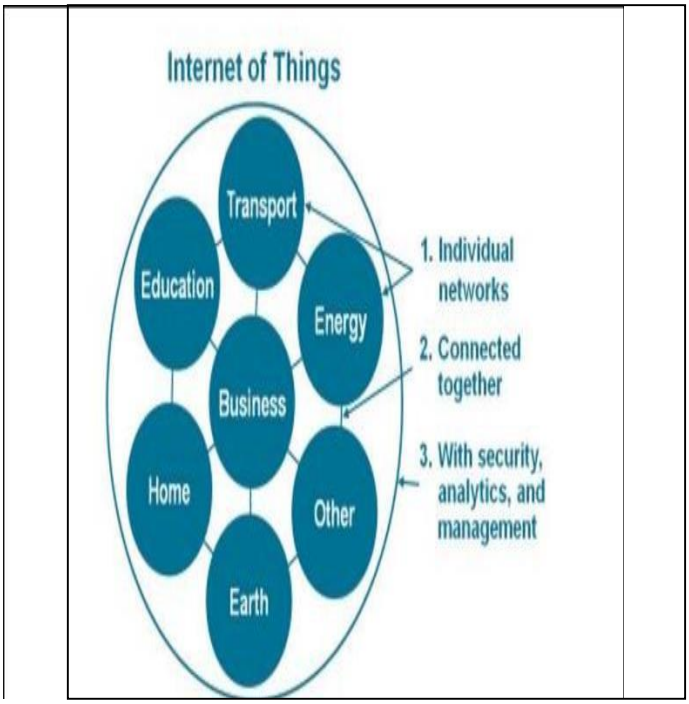


Fig :1 IOT can viewed as network of networks

## II. POTENTIAL DOMAINS FOR IOT

Potential applications of IOT are not only numerous they are also quite diverse as they permeate into virtually all aspects of daily life of individuals, society. The applications of Internet of things cover broad areas which include manufacturing and also industrial sector, health sector, agriculture, smart cities, security and emergencies among with many others.

### A. Smart Cities

The Internet of things plays a role in improving the smartness of cities and also enhancing general infrastructure. As some of the Internet of things application areas in creating smart cities which include intelligent transportation , smart building, traffic, waste management , smart light, smart parking, urban maps,That may include different functionalities as; monitoring parking spaces within the city, monitoring vibrations and material conditions of bridges and buildings, putting in place sound devices monotering in sensitive parts of cities, as well as monitoring the levels of vehicles.

Artificial Intelligence enabled internet of things can be utilized to monitor, control and reduce traffic congestions in Smart Cities . Moreover, Internet of things allows the installation of intelligent and adaptive street lighting and detection waste and also the waste containers by keeping tabs of trash collection . Intelligent highways can provide warning messages and information which are important, such as access to diversions depending on the climate conditions and it may be unexpected occurrences like traffic jams and accidents. Application of Internet of things to achieve smart cities would require using radio frequency identification , sensors. Some of them which are already developed applications in this area are the Aware home and the Smart Santander functionality. In the US, some major cities like Boston have plans , how to implement the Internet of Things in most of their systems ranging from their parking meters, sprinkler systems, and sewage grates are been scheduled to be interlinked and connected to the internet. Those applications will offer significant break throughs in terms of saving money and energy.

### B. Healthcare

Most of the healthcare systems in many countries are inefficient, slow and prone to error. This can be easily changed since the healthcare sector relies on the numerous activities and devices which can be automated and enhanced through technology.
Additional technology that can facilitate numerous operations like sharing of report to multiple individuals and locations,

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kipping of the record and dispensing medications would go long way in changing the healthcare sector. A lot of benefits that Internet of things application offers in the healthcare sector that are more categorized into tracking of patients, staff, identifying, as well as authenticating, individuals, and the automatic gathering of data. Hospital workflow can be improved once patients flow is tracked. The additional authentication and identification reduce incident which may be harmful to patient, maintains record and cases of fever mismatching infants. In addition, automatic data collection and transmission is vital process automation, reduction of form processing timelines, automated procedure auditing and medical inventory management.

The Sensor devices allows functions centered on patients, particularly, in diagnostic, conditions and gathering real-time information about patients' health indicators . utility domain names in this area consist of; being able to reveal a affected person's compliance with prescriptions, telemedicine answers, and indicators for patients' well-being. Thereby, sensors may be applied to outpatient and inpatient sufferers, dental Bluetooth gadgets and toothbrushes which could deliver facts after they may be used and patient's surveillance. other factors of IoT in this capability include; RFID, Bluetooth, and c084d04ddacadd4b971ae3d98fecfb2a among others. those will substantially enhance dimension and tracking techniques of crucial features like blood pressure, temperature, heart charge, blood glucose, levels of cholesterol, and many others.

The packages of net of factors (IoT) and net of everything (IoE) are further being prolonged via the materialization of the net of Nano-matters (IoNT) . The notion of IoNT, because the call implies, is being engineered by using integrating Nano-sensors in numerous gadgets (things) using Nano networks. scientific software, as shown in fig is one of the predominant focuses of IoNT implementations. utility of IoNT in human frame, for treatment purposes, facilitates get right of entry to to facts from in situ elements of the body which were hitherto in reachable to experience from or by using the use of the ones scientific instruments incorporated with bulky sensor size. for this reason, IoNT will permit new clinical records to be accumulated, main to new discoveries and better diagnostics.

### C. Smart Agriculture and Water Management

The IoT has the capability to strengthen and decorate the agriculture region thru inspecting soil moisture and in the case ofvineyards, tracking the trunk diameter. IoT would permit to manipulate and maintain the quantity of vitamins discovered in agricultural merchandise, and regulate microclimate situations so that it will make the maximum of the production of veggies and fruits and their nice. furthermore, reading climate conditions allows forecasting of ice statistics, drought, windchanges, rain or snow, for this reason controlling temperature and humidity tiers to prevent fungus in addition to different microbial contaminants. with regards to farm animals, IoT can help in figuring out animals that graze in open places, detecting damaging gases from the animal excrements in the farms, and also controlling boom conditions in offspring to enhance chances of fitness and survival and so forth. furthermore, via IoT software in agriculture, a number of wastage and spoilage may be averted thru right tracking strategies and management of the complete agriculture field. It additionally results in better electricity and water manage.


Fig: 2 Internet of Nano Things

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### D. Smart Living

In this area, IoT can be carried out in far flung manage gadgets wherein you possibly can remotely transfer home equipment on and off for this reason stopping injuries in addition to saving power . other smart home appliances encompass refrigerators equipped with liquid crystal display (Liquid Crystal show) displays, allowing one to understand what is available interior, what has over stayed and is nearly expiring as well as what desires to be restocked.

This statistics also can be related to a smartphone application allowing one to access it while outdoor the residence and therefore purchase what is wanted. moreover, washing machines can permit one to remotely screen laundry. in addition, a huge range of kitchen devices can be interfaced through a telephone, consequently making it possible to adjust temperature, like in the case of an oven. a few ovens which have a self-cleaning characteristic can be without difficulty monitored as well.

In terms of protection in the home, IoT may be implemented thru alarm systems and cameras can be setup to screen and locate window or door openings as a result stopping intruders.

### E. Smart Environment

The environment has a important position within all factors of lifestyles, from humans, to animals, birds and additionally flora, are all affected via an unhealthy surroundings in one way or another.

There have been severa efforts to create a wholesome surroundings in phrases of removing pollutants and lowering wastage of resources, but the lifestyles of industries, as well as transportations wastes coupled with reckless and dangerous human actions are commonplace location elements which always damage the surroundings. therefore, the environment calls for smart and revolutionary ways to assist in monitoring and coping with waste, which offer a giant amount of data that forces governments to install place systems with a purpose to guard the environment. clever environment techniques integration with IoT generation should be created for sensing, tracking and evaluation of gadgets of the environment that provide potential benefits in achieving a sustainable lifestyles and a green international.

The IoT era lets in watching and handling of air fine through records collection from faraway sensors throughout cities and presenting round the clock geographic insurance to accomplish better methods of coping with traffic jams in principal cities. additionally, IoT generation may be applied in measuring pollution tiers in water and consequently enlighten selections on water usage. In waste control, which includes various sorts of waste, like chemical substances and pollutants being detrimental to the environment and to humans, animals, and plants as nicely, IoT also can be implemented. this could be finished by using environmental protection by using controlling industrial pollutants through instantaneous tracking and control systems mixed with supervision similarly to selection making networks. This serves to lessen waste

## III. RESEARCH CHALLENGES

For all of the above capacity packages of IoT, there has to be right feasibility into the extraordinary domain names to examine the achievement of a few programs and their functionality. As with another form of generation or innovation, IoThas its challenges and implications that ought to be looked after out to allow mass adoption. despite the fact that the contemporary IoT allowing technology have substantially improved in the latest years, there are nevertheless numerous problems that require interest, as a result paving the manner for brand new dimensions of research to be carried out. for the reason that IoT idea ensues from heterogeneous technologies which can be used in sensing, collecting, movement, processing, inferring, transmitting, notifying, dealing with, and storing of records, a variety of studies challenges are sure to arise. these studies challenges that require attention have consequently spanned one-of-a-kind research regions .

### A. Privacy and Security

Thanks to the fact that IoT has emerge as a vital element as regards the destiny of the net with its elevated usage, it necessitates a want to correctly address protection and accept as true with features. Researchers are aware about the weaknesses which presently exist in lots of IoT devices. furthermore, the basis of IoT is laid on the existing wireless sensor networks (WSN), IoT as a consequence architecturally inherits the same privacy and protection troubles WSN possesses . diverse assaults and weaknesses on IoT systems prove that there's certainly a want for extensive ranging security designs so that you can protect data and systems from stop to give up. Many assaults commonly make the most weaknesses in precise gadgets thereby gaining get admission to into their structures and therefore making comfy devices inclined . This safety hole similarly motivates complete protection answers that encompass research that is efficient in applied cryptography for facts and machine protection, non-cryptographic safety strategies as well as frameworks that

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helpdevelopers to come up with secure systems on devices which can be heterogeneous. there's a want for more studies to be performed on cryptographic protection offerings that have the capability to operate on useful resource constrained IoT devices. this would allow specific skilled users to securely use and installation IoT structures no matter the inadequate consumer interfaces that are available with nearly all IoT gadgets. similarly to the safety and safety factors of the IoT, extra regions like confidentiality in conversation, trustworthiness, and authenticity of verbal exchange parties, and message integrity, and supplementary protection necessities ought to also be integrated. those may include features like being capable of save you verbal exchange of diverse events. as an instance, in commercial enterprise transactions, smart objects should be prevented from facilitating competitors' get entry to to exclusive statistics in the gadgets and for this reason the usage of this records maliciously.

### B. Processing, Analysis and Management of Data

The process for processing, analysis and facts management is quite difficult due to the heterogeneous nature of IoT, and the huge scale of facts amassed, specially in this period of large data . presently, most structures make use of centralized structures in offloading facts and carrying out computationally intensive tasks on an international cloud platform. though, there may be a regular challenge about traditional cloud architectures now not being effective in terms of moving the largevolumes of information which can be produced and fed on by IoT enabled devices and to have the ability similarly help the accompanying computational load and simultaneously meet timing constraints . maximum systems are therefore relying on modern-day answers such as cellular cloud computing and fog computing that are both based totally on edge processing, to mitigate this project.

### C. Monitoring and Sensing

Although technology concerned with monitoring and sensing have made extraordinary development, they're continuously evolving specially focusing on the electricity performance and shape element. Sensors and tags are usually anticipated to be energetic constantly as a way to achieve on the spot statistics, this thing makes it essential for power efficiency especially in lifetime extension. concurrently, new advances in nanotechnology/biotechnology and miniaturization have allowed the improvement of actuators and sensors on the Nanoscale.

## IV. CONCLUSION

The IoT can great be defined as a CAS (complex Adaptive gadget) so as to keep to adapt hence requiring new and progressive forms of software engineering, structures engineering, project control, in addition to severa other disciplines to expand it further and manage it the coming years. The application regions of IoT are quite numerous to allow it to serve one of a kind customers, who in turn have distinctive needs. The generation serves three categories of customers, individuals, the society or groups and institutions. As mentioned in the application section of the research paper, the Internet of things has without a doubt a large functionality to be a exceedingly transformative force, a good way to, and to a degree does already, undoubtedly effect hundreds of thousands of lives international. according to, this has become even extra obtrusive, as unique governments around the arena have shown an hobby in the IoT concept through presenting more investment inside the subject that is supposed to facilitate similarly research. a terrific example is the chinese government.

## V. ACKNOWLEDGEMENT

I would like to expand gratitude to project guide **Prof. Vijay.M.Rakhde** who guided by providing the valuable suggestion in numerous way on this project which gave us the inspiration to improve our self independency. Secondly I would like toexpress my gratitude toward the project mentor **Prof. B.Deharkar** who help in finalizing the work done within the limitedtime period, I would also like to express heartfelt thanks to Head Of Department **Lovelesh Yadav** who has given us a platform where we can work on developing the projects and demonstrate the practical applications.

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