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Review Paper on Internet on Things (IoT) and its Applications

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Abstract:

Internet of Things (IoT) is a advance era that helps to change all the conventional life style into a high technology life style. This paper explains how IoT evolved from different technologies. This paper gives information of applications based on Internet on Things (IoTs). In this era objects or things which are attached to the internet instead of people.

The Internet technology utilizes the Radio Frequency Identification (RFID) technology and wireless sensor networks (WSN). IoT applications are applicable in the area like Smart city, Smart health, Smart transportation, Smart homes, Pollution control, Traffic congestion, Energy saving, Waste management, Water management, Smart industries.

To enhance the technology alot of research have been done through IoT. Still, there are so many challenges and issues are present in IoT. These challenges and issues must be depend upon various features of IoT like enabling technologies, challenges, applications, social and environmental impacts etc. So, the main objective of this review paper is to provide a detailed discussion from both high tech and social way. The paper discusses different technologies used in IoT, applications of IoT, challenges and key issues of IoT. This article would help the student's and new researcher to understand the Internet on Things and its application to worldwide. In the last, this paper focuses on key issues and challenges involved in IoT.

Keywords: *ICT, IoT, RFID, NLP, LPWAN, BLE, NB-IoT*

Introduction:

The Internet of Things (IoT) describes the network of "things" that is nothing but physical objects or peoples. These objects are connected with sensors, software, networks and other technologies. Here objects are connecting and exchanging data with other devices and systems by

using internet. These devices range from common household objects to innovative industrial tools. Using IoT, people makes many things virtually "smart".

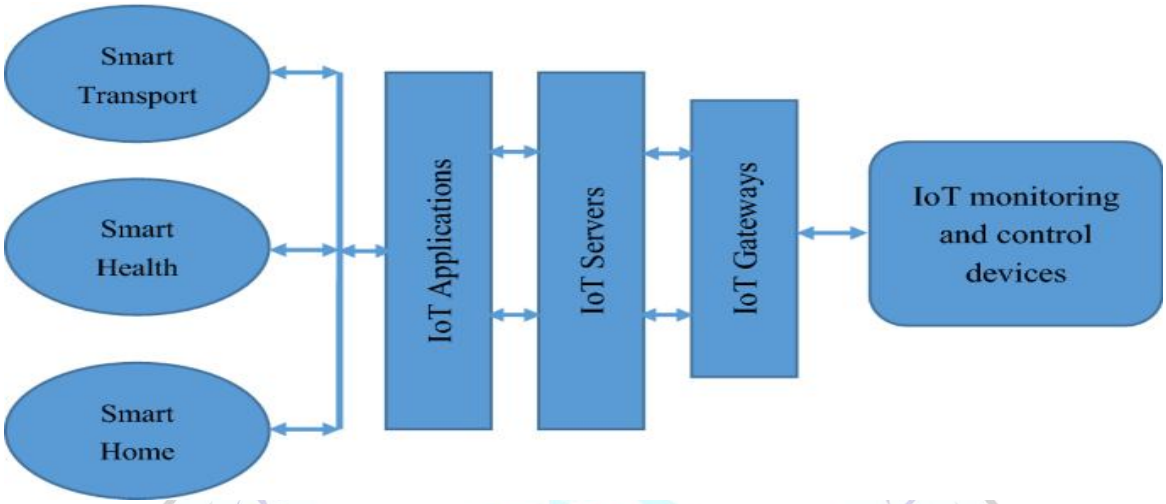

Fig. 1 Working Structure of IoT

Some design issues of IoT are Scalability, modularity, interoperability and openness. IoT architecture are used in different types of environment. The aim of designing IoT architecture is to achive the requirements of domain specific interaction, multi-system integration with functionalities, big data analytics, data processing , network technologies, data centers and storage with user friendly applications. Also, the architecture provides different functionality by adding some artificial intelligence and finite automation. [1][2]

As Iot exist from long time and it uses different technologies as follows,

- **By Using low-cost, low-power sensor technology: By using** low price and authentic sensors, IoT technology makes advanced manufacturing techniques such as agricultural, buildings, waste energy.
- **Connectivity:** IoT connectivity **refers to establish a proper communication path between things of IoT and IoT platforms such as server, cloud, network structureetc. In this era it is easy to connect sensors to the clouds for data collecting, data sending and data exchanging.**
- **Cloud Computing platforms:**
  Cloud platforms provide end to end services such as cloud service IoT platform. To achieve business and consumers success without managing other things like application development, system management, data management, deployment management , monitoring management etc.
- **Machine Learning and analytics:**
  Using machine learning and data analysis with access large amount of data and heterogeneous data which are stored on cloud. In this technique continuously data pushed on clouds and data handles easily.
- **Conversational Artificial Intelligence (AI)**:

IoT makes things smart and enhance high tech life using neural network, natural-language processing (NLP), Artifial Intelligence powerd IoT like face recognition , retina scanning etc. [3][4]

IoT uses different kinds of technologies as shown in following table.

Sr. No	Technology	Data Rate	Range
1	RFID	1KBps	1m
2	BLE	100KBps	10m to 100 m
3	Zigbee		
4	Z-Wave		
5	Unlicensed LPWAN	100KBps	1Km to 10Km
6	LTE-M		
7	EC-GSM		
8	NB-IoT		
9	Bluetooth	1MBps	10m
10	Wi-Fi	100MBps	10m
11	Celluar 5G	100MBps	1Km to 10Km
12	4G/LTE 3G		

Applications of Interneton Things

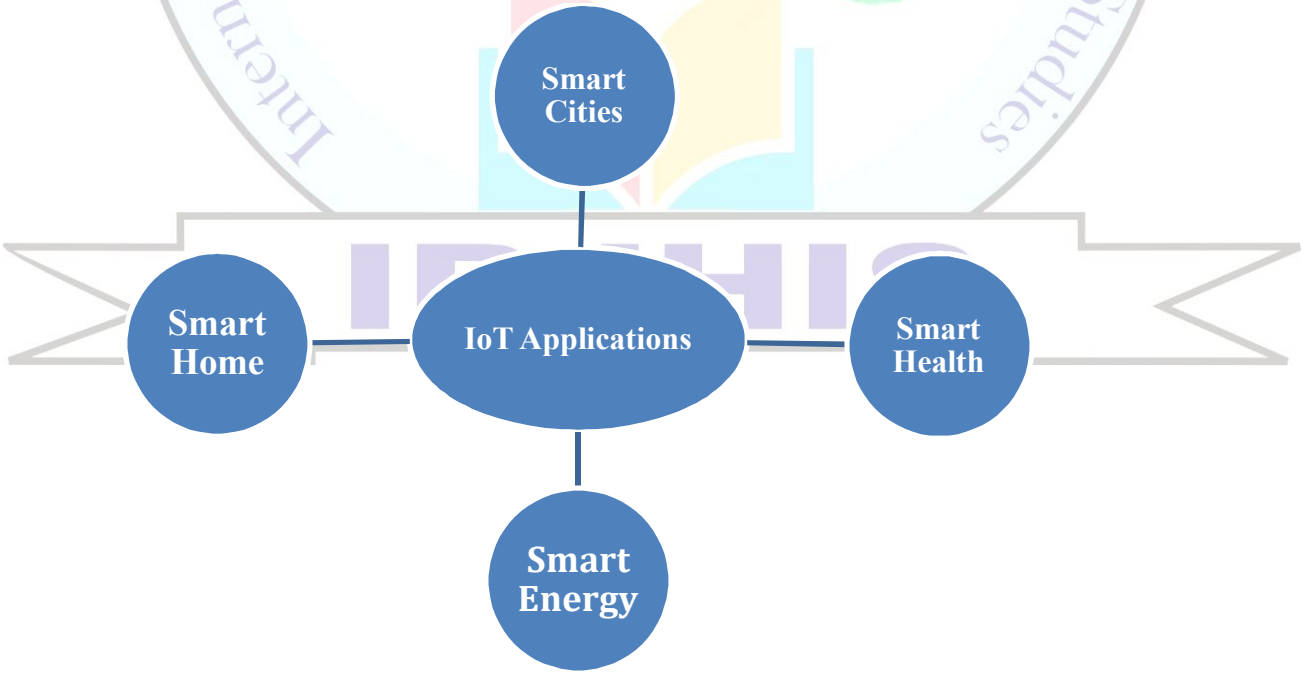

Fig. 2 Applications of IoT

1. Smart Cities :

The city which is connected with different types of infrastructures like physical, ICT, Social, and business to support and collect information of the city. By using large formation of IoT city can be smart specially when machine to machine, human to machine communication are performed.[5]

The cities which are changes from typical urban areas to high technologies that uses sensor network, communication with 2G, 3G, 4G , devices based on Internet on Things, application cloud computing and big data. [6]

Many researchers wrote their views about various aspects of smart city. Some of the important related work with their key information is mentioned in the following table.

Sr. No.	Related Work	Description
1	Adil , Syed Hasan, et.al [7] in 2017	Suggested work on Smart City Simulator, it provides 3D model with several types of sensors like humidity sensor, noise sensor, ultrasonic sensor, temperature sensor etc. In this era information send through open cloud and virtual gateway.
2	Saloni Matteo et.al [8] in 2017	This paper suggested upgraded technique forresources in smart cities applying on device to device group observation with smart phones, Bluetooth Low Energy (BLE). So this approach is attainable for little scale execution evaluation.
3	Marine loriot et.al [9] in 2017	This paper suggested an exploration of the usage of LoRaWan innovation in fundamental smart city demonstrator. LoRa uses local network system to information server and sensors. Different types of smart sensors used with IoT devices for innovative parameters.
4	Sanghi Gyayak et.al [10] in 2017	This paper suggested automatic multi label image notation. In this research KNN(K-nearest neighbor) and ML-KNN (Multi label K- nearest neighbor)approaches are discussed . Also provides study about arranging regional location, land and water in city.
5	Khatavkar Nikhil et.al [11] in 2017	Suggested smart energy which utilizes in street light controller. In this technique WSN(Wireless Sensor Network) is used to remote switch of road light nodes. Controller like Real Time Clock(RTC), infrared sensors, ARM(Advanced

		Risk Machine) , PVM(Pulse Width Modulation) utilized with Zig Bee module.
6	Rogelio rivera et.al [12] in 2017	Provides a technology that displays digital identification on block chain used in smart city domain.
7	M. Saravanan et.al [13] in 2017	This paper suggest a system for human safety in garbage collection, unutilized well and drainage. For this research microcontrollers are used to sense/ detect gases which are not safe. Also alarming framework is used to control air impurities.
8	Amitdua et.al [14] in 2017	This paper suggested vehicles with secure message communication. In this some critical condition recognized by sensors or communicated data got by vehicles should be confirmed.
9	Chunshengzhu et.al [15] in 2017	This paper suggested trust assisted sensor for cloud using secure multimedia big data.
10	Gaikwad Sneha, Pooja kanase, [16] in 2016	This paper suggested smart hospital concept which uses IoT and sensors technology. Sensors like ultrasonic sensor , temperature sensor, light ward resistor, USB sensors are used for monitoring patients issues on screen.
11	Giorgos et.al [17]	This paper suggested smart room concept in smart city. The main objective of smart room is to reduce effects of the domain, delays, costs, uses of services.

12	Massimo dallacia et.al[18] in 2017	This paper suggested 5G Self arrenging network using smart city by using heterogeneous networks for cell scope territories and street traffic.
13	Ahmed noureddine et.al[19] in 2017	This paper suggested smart city campus to smart city, by applying IoT technologies on waste management and accumulation of the city.
14	Chia-yinglin et.al [20] in 2018	This paper suggested parking space utilization in smart city.

IoT Applications for Smart cities:

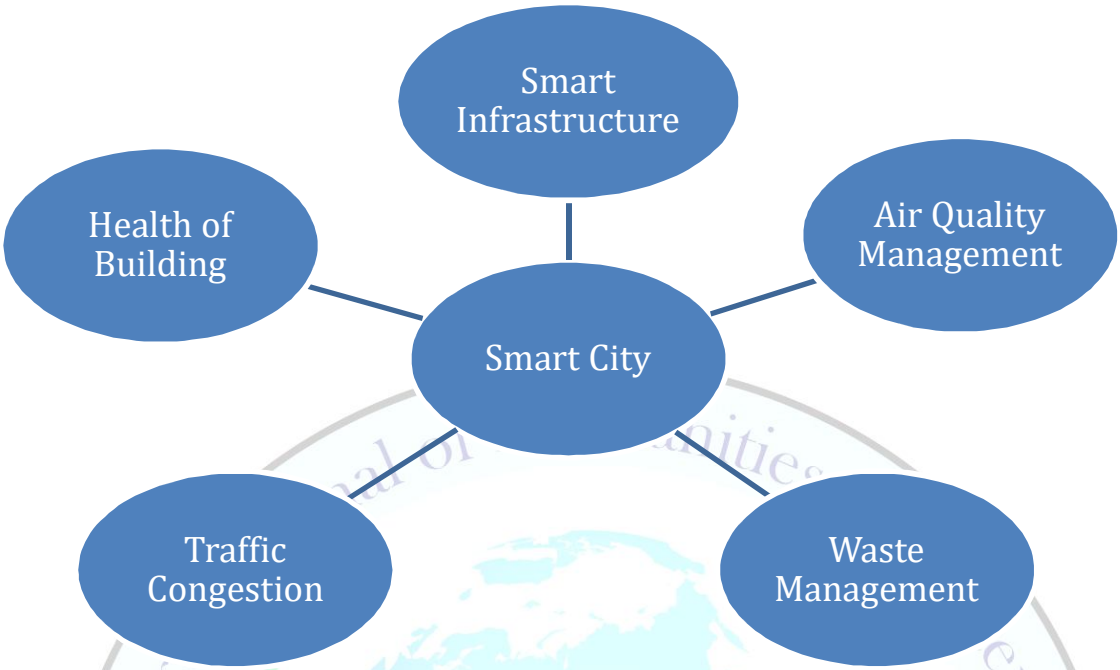

Fig. 3 Applications of Smart City

1.1 Smart Infrastructure:

Smart infrastructure involves different operators in various kind of activity like power, transport, public safety. Digital technologies plays important role in smart cities with condition of continuous development, buildings and urban infrastructures planned more adequate and supportable.

To reduce CO2 emission most of the cities invest in self moving cars and electric cars. Again to save electrical energy, smart lighting are on only when anyone actually goes from light.[21]

1.2Health of Building:

To keep appropriate maintains of old buildings of a city advance techniques like sensors, actuators are used to continuous monitoring on actual condition of buildings and also detects affected areas [5].

Smart buildings are interconnected with sensors, controllers, gateways and machines with Internet on Things formanageing, examining and automating internal and external operation of buildings.

This approach is useful for greater energy saving andbetter quality of life of the peoples by informing about fire, lighting, air quality, and temperature, parking and smart elevators.

1.3 Traffic Congestion:

Iot has used to monitor traffic congestion in urban cities .for that camera based traffic monitoring systems are used. In this technique GPs is connected on new vehicles for observing

them.City officials need to discipline the traffic, send officers where needed while traffic congestion may caused. [22]

1.4 Air quality management:

Using different types of web servers from internet Air Pollution Monitoring System checks the air condition and activate alarm when air quality is below the certain level that is when more number of unhealthy gases lies in air such as Carbon dioxide, exhaust, alcohol, ammonia, Nitrogen Oxides and Liquefied Propane Gas.

In this case system will check air quality in PPM and display on LCD as well as web page.also it checks pollution level and if pollution level increased then system sends alert message to the user [23].

1.5 Waste Management

IoT platforms are main part of supply chain. There are many types of waste management systems based on IoT but they have noted many difficulties.

Garbage collection is time exhausting and inadequate procedure. In this technique trucks empty bins whether that are full or empty because of constant method and predefined street paths and days but technique is costly. [24]

In waste management, trash bins are connected with sensors, databases, and logistic platforms to provide more useful part of the high tech life. [25]

1.6 **Smart Water Management:**

Smart Water Management requires connection of objects with a complex issues about monitoring, controlling and regulating the use and quality of water services with equipments pipes, pumps etc. In this era so many types of hardware and software devices like detectors, sensing instruments, meters, data processing and resolveinstruments, web and mobile controls connecting people with water systems.For Smart Water Management sensors have broad use due to their grate diversity and purpose.

2. Smart Health:

IoT plays very important role in the era of e-health sectors and telecommunication organizations. IoT can be used in hospitals and easy way to attending the patients in health issues. In this era continuous observingactions of normal people or patients are done. The patients health status is continuouslysensed using various sensors and radio frequency identification RFID. The peoples and patients who in need of medical, IoT platforms provides advanced and inventive services to them. [26]

3. Smart Energy:

Smart energy having many different aspects or features of energy management that uses IoT

to deliver profitable, systematic energy organization. It integrate the use of acceptable, reusable energy sources and IoT devices. Also smart energy includes smart meters, smart electrical grid, smart oil and smart gas industry.

Applications of Smart Energy:

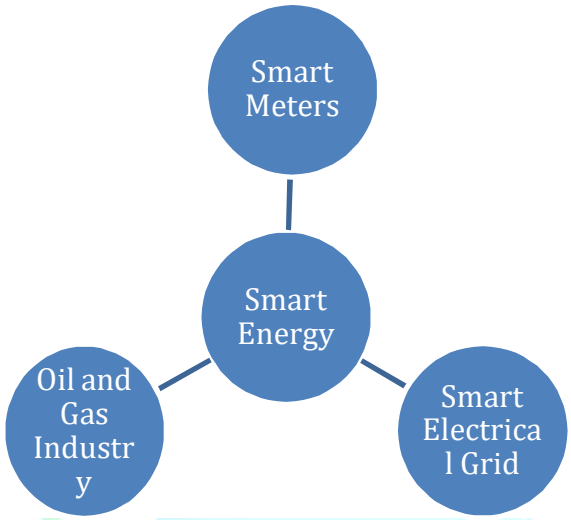

Fig. 4 Applications of Smart Energy

3.1 Smart meters provide existing energy opportunities and utilization data. This data helps service providers distribute energy to maximize benefits and reduce outages.

3.2 smart electrical grid systems assist energy providers in meeting increasing damands. They help increase the quality and resilience of energy delivery. In IoT smart grids are used for collecting data, detecting malfunction, monitoring system, smart electrical vehicles.

3.3 The **oil and gas industry** uses smart energy technique in IoT, here results are to enhance the outputs like production and make sure safe removal and delivery. Oil and gas companies can produce higher insightobservation into framework to find difficulties and removing problems. [27]

Major key issues and Challenges of IoT:

IoT based systems are involved in human lives as well as many more technologies like data transmission between devices made it crusial and generates some issues and challenges.

Resolving these issues are challenges to IoT developers for advanced technologies. so advanced IoT platform is growing too fast.[1]

Security problems in IoT (Internet on Things) are as follows:

- Security and confidentiality
- Exchanging and using information in large heterogeneous network (Interoperability) issues
- Conventional issues
- Ethics, rules and regulations
- Radio Frequency Identification (RFID) security

- Accessibility, responsibility
- Service quality
- Information security
- Quality of Service (QoS)

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