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Data Management for the Internet of Things: Architecture, Challenges and Technologies

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***Abstract*:*. A perception that is being enacted by numerous in the world is an ample range of day to day things associated and interfacing with one another across world network economically- "the Internet of Things." The gadgets around us trigger extensive amounts of data and an endless interaction between these electronic appliances and the Internet produces useful data for analysis and future prediction. These gadgets are often classified as data sources like sensors, end-user devices like displays, databases and even a knowledge source and sink such as Actuator and Smartphone. Internet of Things (IoT) has promised to facilitate ease and enhanced standard of living for users. Data management for IoT takes part during essential function in its efficient activities and has become a key research theme of IOT. This paper brings the representations of IOT architecture, various techniques for data acquisition, collection, pre-processing and visualization*

Keywords : *Internet of things, Data supervision, RFID, Sensors*

I. INTRODUCTION

Million of devices like PCs, tablets, smart phones, televisions, automobiles and wearable devices are going to be connected to the web every day. Each day, new machines, sensors and gadgets come on the web and feed data into different systems. As associations set out on new IOT activities and work to remove more knowledge from growing information volumes, information the executives approach is named for [1].Traditional databases and analytics architecture will always be vital, but the IOT involves for specific capabilities to handle diverse data which are constantly streaming from untold number of sources. IoT data is complex, vast, and fast-moving data is complex, vast, and fast-moving. Sensors are more moderate than any other time in recent era and costs on associated gadgets keep on dropping. New gadgets and machines that transmit information come online consistently and full-scale information age from the IoT is presently financially plausible. Information supervision is the concept of a particular idea that alludes to models; Data the executives is the idea of a particular idea that alludes to designs, techniques, and procedures for the correct administration of a specific framework's information life cycle.

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With regards to IoT, information the board should go about as the layer between information delivering merchandise and gear and applications that entrance information for investigation purposes and administrations [3]. Segment I incorporates a prologue to the present work, Section II incorporates information the board related errands for the Internet of Things, Section III contains a few answers for the IoT engineering, Section IV manages IoT reference model, Section Five highlights genuine information, Section VI clarifies the qualities of huge information. Segment VII depicts the primary difficulties, Section VII has applications for the present work, and Section VIII Explores various IoT technologies with future bearings. Section IX depicts IoT applications. Section X gives results and Section XI Presents the conclusion.

II. LITERATURE SURVEY

[4] "Large data management in IoT application" focuses that IOT applications can face the challenge of real time managing or displaying or extracting client useful information from the whole data stored on servers. Especially in critical situations, client's database query can take too long. A distinct layer of data processing is used to "cache" fields based on selected or most frequent database queries.

[5] In "Data management for Internet of things: Green direction", the life cycle of data within the Internet of Things and survey the current research in the data management field for the Internet of Things has discussed. The discussion will focus on the research which is related to the optimization of communication overhead and storage mechanisms as they have the most significant impact on energy consumption.

[6] "Data management for internet of things: design primitives and solutions" focuses on the survey of the data management solutions that are proposed for IoT or subsystems of the IoT has been done. The distinctive design primitives are highlighted. Finally, a data management framework for IoT is proposed that takes into consideration the discussed design elements and acts as a seed to a comprehensive IoT data management solution.

[7] "Enabling Query of Frequently Updated Data from Mobile Sensing Sources", Wei Wang[4] focuses on two problems: (i) how to design a common, structured sensing layer for the heterogeneous, mobile data sources and, (ii)how to query FUTS (Frequently Updated, Time stamped and Structured) data from these sources.

[8] "Efficient Storage of Multi-Sensor Object-Tracking Data" proposed the first read/write-optimized solution for storing multi-sensor object-tracking data on HDFS. The results suggest the efficiency of the proposal with respect to diskwrite throughput,

memory-write throughput, search performance, and sensor clustering.

[9] ”A Unified storage and query optimization framework for sensor data” proposed that Traditional data storage and query approaches cannot handle large amount of sensor data properly. To deal with such limitations, a unified storage and query optimization framework, named DeCloud-RealBase, is proposed towards the management of large volumes of sensor data.

[10] ”A storage solution for massive IoT data based on NoSQL” proposed a storage management solution called IOTMDB based on NoSQL as current storage solutions are not performing well support storing massive and heterogeneous data collected by IoT devices. Some evaluations are also carried out instead of considering only about expressing and organizing of IoT data.

[11] ”IoT data management methods and optimization algorithms for mobile publish/subscribe services in cloud environment” focuses on design principles for data management methods in IoT and optimization algorithms by way of publish/subscribe middleware and linked data which spread over mobile network for producing a coherent IoT ecosystem.

[12]”Data management in ambient assisted living platforms approaching IoT : a case study” analyzes the issues related to data management starting from a review of state of art for drawing a general approaches. In this paper , investigation has been done on data handling and management issues from the adoption of IoT paradigm in ambient assisted living platform

[13]I ”W Things Matter: A Data Centric View Of The Internet Of Things”, Main Techniques In Iot From Data Centric Point Of View, Which Includes Data Stream Processing ,Data Storage Models, Complex Event Processing And Searching Has Been Discussed.

III VARIANCE ANALYSIS

Paper	Data	Storage	Architecture	Speed
4	Discrete	Rdbms	Layered	Med
5	Continuous	Rdbms	M2m	Low
6	Discrete	Rdbms	Layered	Med
7	Continuous	Sql	M2m	High
8	Continuous	Decloud Realbase	Publisher	Low
9	Continuous	Nosql	Subscriber	High
10	Discrete	Cloud/ Fog	M2m	Med
11	Discrete	Cloud	M2m	Low
12	Continuous	Cloud	Layered	High
13	Continuous	Fog	Layered	High

IV 4-PHASE IOT ARCHITECTURE

The IoT is a dynamic and global network infrastructure, in which ―Things are called as subsystems and individual physical and virtual entities—are identifiable, autonomous, and self-configurable. Things are expected to communicate among themselves and interact with the environment by exchanging data generated by sensing, while reacting to events and triggering actions to control the physical world The vision that the IoT should strive to achieve is to provide a standard platform for developing cooperative services and applications that harness the collective power of resources available through the individual―Things and any subsystems designed to manage the aforementioned Things. At the centre of these resources is the wealth of information that can be made available through the fusion of data that is produced in real-time as well as data stored in permanent repositories .Figure 1 shows 4 layered Iot architecture[14].purpose of acceptance/ rejection. There should be minimum 01 to 02 week time window for it.

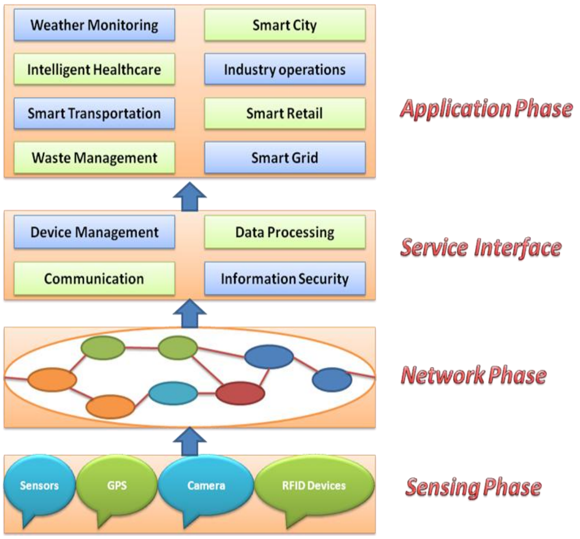


Figure 1 Phase IoT Architecture

Sensing Phase: is also called as data collection/acquisition phase. It has many devices for knowledge elicitation such as RFID reader, various sensors, GPS system, monitoring camera, etc. With the help of sensing layer, IoT can achieve a real-time monitoring and management on the objects properties or behavior patterns. Data is sensed from various sources. some o[f the sources are listed below.

1.Radio Frequency Identification Device(RFID): In a RFID system, tags are attached to all items that are to be tracked. These tags are made from a tiny tag-chip called as integrated circuit (IC), that is connected to an antenna that can be built into many different kinds of tags including apparel hang tags, labels, and security tags, as well as a wide variety of industrial asset tags. These tags can store information internally, which can be transmitted as radio waves to an RFID reader through an antenna.

2.Sensor Data:. A sensor is an component, which detects events or changes in its environment and send the information to a computer processor. In disastrous scenarios, sensory data such as temperature, humidity, light, and pressure which is usually multidimensional time series is frequently transmitted through Wireless Sensor Networks (WSN).

3.Historical Data*:* is collected data about past events and circumstances pertaining to a particular subject. By definition, historical data includes most data generated either manually or automatically within an enterprise. Sources, among a great number of possibilities, include press releases, log files, financial reports, project and product documentation and email and other communications.

4.Physics Models: Reduced power microcomputers and communication methods, energy-harvesting transducers, and improved micro-batteries are defined as physics models. Their characteristics such as instance gravity, force, light, sound, and magnetism.

5.Positional Data and Pervasive Environmental Data: Positional data is generally obtained from a global positioning system (GPS), a local positioning system or a position of tagged object. These devices. include satellites, Wi-Fi access points, or cellular base stations.

The collaboration of these architectures provides transparent tracking of static and moving components.

6.Addresses/Unique Identifiers*:* The objects in IoT are uniquely identified by IP addresses. As the number of objects grows, the number of IPs will also grow. At present, this barrier can be moderately handled from the availability of IPv6, which can accommodate the explosion growth of the Internet through the 128-bit addressing.

Network Phase*:* is the phase which acts as a mediator to convey the sensed knowledge to upper layers for further processing and higher-level abstraction. The usage of IPv4/IPv6 based Internet,3G/4G wireless networks and private networks provides IoT a seamless control over pervasive objects.

Service Interface*:* is an important part in IoT architecture. This phase deals with the effective integration of several major functions including communications management, devices management, data processing and information security .This layer provides service interfaces for applications allowing users to get rid of the trivial details in sensing and network layers.

Application Phase*:* is established based on the three lower layers and provides domain-oriented IoT applications for end-users in various application domains. This phase provides access for global information about various services like mail services, directory services and remote file access and management.

III. IOT DATA MANAGEMENT REFERENCE MODEL

A three-layer reference model for planning applications (Figure 2). The functionalities of each layer are depicted as below:Data preprocessing layer: Data cleaning is the way toward distinguishing and remedying (or erasing) degenerate or erroneous records from a record set, table, or database. What's more, alludes to the recognizable proof of fragmented, mistaken, erroneous or superfluous pieces of the information, and afterward to the substitution, adjustment or erasure of messy or coarse information. Event processing layer: the cleansed IoT information is truly solid and usable. In any case, crude information just gives straightforward data, which isn't legitimately identified with business forms. The occasion handling layer induces and changes the crude information into more significant level business rationale.

Data storage and analysis layer: having information as business rationale, IoT frameworks must give benefits in different angles and store them with the fitting pattern. Such a plan should pack the measure of information and bolster investigation in an assortment of chains of command.

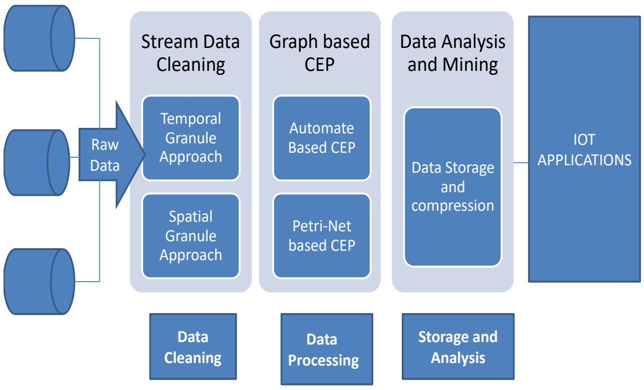


Figure 2 - IoT Data Management Reference model

VI. CHARACTERISTICS OF DATA IN IOT

There are different qualities of information dependent on volume, speed, veracity, and assortment [15]. They are

1) Polymorphism and heterogeneity: Applications in IoT regularly include different kinds of information from various applications. Information can be physical information, organic information, and concoction information. As the multifaceted nature of uses is expanding, different information from various sources can be corresponded. For instance, Logistics and Supply Chain Management [7] and transportation control and screen frameworks [8] [9] create physical information, for example, direction, situating, and course guide of articles from GPS, accelerometer, and GIS. Wellbeing observing frameworks [10], [11] assess persistent status by taking organic information, for example, circulatory strain, pulse, outward appearance, and sound.

2) Massive-scale A gigantic measure of clever bits of hardware associated with the Internet can build up billions as well as trillions of ongoing information. Such information needs an enormous putting away space and an amazing framework to process. Envision a situation in a retail location where a huge number of merchandizes are accessible day by day. In the event that these items should be followed every day, and each track creates 100 bytes information.

3) Rich semantic Data in IoT is commonly spatial with space-time data, for example, individual articulation information and GIS information. The previous is broadly utilized in social insurance applications, for example, in-home human services stations (IHHS) [13] and non-contact wellbeing observing framework (NCHMS).

4) Inaccuracy: One of the essential variables restricting the across the board appropriation of IoT is the incorrectness of the information created [10]. For instance, tests says that Radio Frequency Identification frameworks be capable of catching 65% to 75% right information brought by problematic readings which creates problems for direct use [11]. A similar circumstance exists in most other detecting advancements

5) Timeliness: An information investigation arrangement that utilizations out-dated information can limit an organization from accomplishing its objectives or from getting by in an aggressive field. New and current information is more important to a business than old out-dated information. Despite the fact that old information ought not to be totally neglected by an information examination arrangement, the accentuation ought to be put on the present information.

VII. KEY DIFFICULTIES

IoT can evolve the state of the web Internet and can offer tremendous financial advantages yet it likewise faces many key difficulties [16], [17].
Some of them are quickly portrayed underneath.

1) Naming and Identity Management: The IoT will connect billions of objects to provide innovative services. Each object/sensor needs to have a unique identity over the Internet which can be achieved by an efficient naming and identity management system that can dynamically assign and manage a unique identity for such a large number of objects.

2) Interoperability and Standardization: In order to avoid accessibility to others many manufacturers provide devices using their technologies and services. The standardization of IoT is very significant to provide better interoperability for all objects and sensor devices.

3) Information Privacy: It is necessary to take proper privacy measures and prevent unauthorized access as the IoT uses different kinds of object identification technologies e.g., RFID, 2D-barcodes, etc. Since every kind of daily use objects will carry these identification tags and embed the object-specific information taking proper privacy measure is challenging.

4) Objects safety and security: Securing IoT objects is vital as IoT consists of a very large number of perception objects that spread over some geographic area, it is necessary to prevent the intruder’s access to the objects that may cause any kind of damage to them or may change their action.

5) Data confidentiality and encryption: Data integrity is major challenge in IoT as the sensor devices perform independent sensing or measurements and transfer data to the information processing unit over the transmission scheme. The sensor devices must have appropriate encryption mechanism to guarantee the data integrity at the information processing unit. The IoT service determines who can see the data, thus, it is necessary to safeguard the data from externals.

6) Network security: The data from sensor devices is sent over a wired or wireless transmission network. The transmission system should be capable to handle data from a large number of sensor devices without causing any data loss due to network congestion, ensure proper security measures for the transmitted data and prevent it from external intrusions or monitoring or disturbances.

7) Spectrum: The sensor devices require dedicated spectrum to transmit data over the wireless medium. Due to inadequate spectrum availability, an efficient dynamic cognitive spectrum allocation mechanism is required to allow billions of sensors to communicate over the wireless medium.

8) Greening of IoT: The data rates has made the increase of the network energy consumption at a very high rate, an increase in the number of Internet-enabled services and the rapid growth of Internet-connected edge-devices. Future IoT will cause a significant increase in network energy consumption. Thus, green technologies need to be adopted to make network devices as energy-efficient as possible.

VIII TECHNOLOGIES

Network Layer technology

Network layer technologies allow the nodes to be recognized via any local area networks or internet and to have a secure communication. Many new devices like smart wearable's, smart electronic gadgets use often Bluetooth, wifi and Nfc.

A. Identification of nodes

When a node connects to a network, unique id is assigned to each node which will be used to communicate and control with the other nodes. Various naming solutions have been assigned to identify the nodes. They are

1.Uniform Resource Identifier: A different set of characters in the web link are used to recognize and place the resources on the network

2.Electronic Product Code: Epc global standard tag is assigned on each physical object are used to keep track of all things.

3. Ubiquitous code: with the help of Ucode, instance information and locations are derived from www.uidcenter.org.These tags can exist in many forms like QR code, bar code, RFID tags, infrared tags and acoustic tags.
Nodes are assigned with unique network addresses for secured network management. Below are the addressing protocols used in the network layer.

- Ipv4: A networking protocol uses 32bit addresses to each node and forms smaller networks. Hence small number of 232 addresses are not appropriate for IoT environments.
- Ipv6:Ipv6 supports larger addresses 2128 addresses which auto configuration without the need for dynamic host configuration protocol server. It has large header size of 320 bits are used to compress the address to make it attuned with the conventional wireless sensor network protocols.

B. Communication Technologies of nodes

Once the nodes are identified it can communicate with other server or node based on some communication criteria listed in the ascending order based on the range.

- Power Line communication: PLC can be used to connect the nodes in an IoT environment to share data with the backend that performs many tasks. It is mainly used in stationary nodes because they rely on power lines.
- X10: X10 is an industry standard that uses electrical cabling for signalling and controlling devices, in which the signals contain short Radio Frequency (RF) bursts that can include data.
- Near field communication: A set of protocols that enable communication between 2 devices over very short distances.
- Ultra wide Bandwidth: It is older wireless technology uses low energy transmissions to provide high bandwidth communications.

- Wifi: Is useful for ad hoc configurations such as WiFi Direct which does not require wireless access point.
- Bluetooth low energy: A wireless standard id intended to exchange data over short distances and build personnel area networks(PANs).

• Z-wave:A technology widely applied in smart homes. Which enable them to be controlled over internet.
• Cellular Networks: These networks exist in various generations(eg.,3G and 4G) of cellular network standards that are employed in IoT with high speed and mobility.
• 5G:A medium range communication is already available but improved versions are expected from 5th generation network.
• Long range wide area Network: A technology from LoRa alliance that gives low-cost, mobile and secure communication results in less power consumption.
• Software defined Network: This architecture is dynamic,manageable,adaptable and cost effective.

C. IoT platforms

• AWS IOT[18] :AWS has broad and deep IoT services, from the edge to the cloud. Device software, FreeRTOS and AWS IoT Greengrass, provides local data collection and analysis.
• IBM Watson[19]: A Commercial IoT platform that is strongly integrated with Bluemix to bring the power of cognitive computing and machine learning to IoT. This platform can be deployed on the cloud or on-premises in which on boarding of devices to the platform is automated using the SDKs and APIS.
• ThingWork[20]:A commercial platform allows users to connect devices, establish a data source, establish device behaviors and build an interface without any coding.
• Bosch IoT Suite[21]: A commercial flexible cloud based IoT that allow developers to test the applications before implementing them, deploying them and operating them under normal conditions. Its device management capabilities(i.e., executing software roll-out processes, connecting third party systems and services and analyzing data)can also be used stand -alone and on-premise.
• Xively[22]:A commercial cloud-based platform enables visualization of data graphically in real time as well as updating devices remotely.
Evrythng[23]: A cloud based platform enables elastic semantic data store to customize these dynamic data profiles for any product so that authorized applications can interact with them and exchange data in real time during their lifecycle.
• KAA[24]:An open source cloud based platform for managing IoT devices and analyzing generated data to provide complete end to end IoT solutions, connected applications and smart products.

D. IoT Supporting operating Systems.

• RIOT[25]: This is a free,open source operating system supports low power Iot devices and microcontroller architecture. It ensures IoT as connected, secure and durable by supporting all open standards.
• Contiki [26]:Contiki is an open source operating system that runs on tiny low-power microcontrollers and makes it possible to develop applications that make efficient use of the hardware while providing standardized low-power wireless communication for a range of hardware platforms.

E. Data Communication Protocols

Each day numerous nodes (devices) are generating and sending information to the other receiving nodes on TCP/IP application layer. It is the responsibility of each node to capture data, analyze them and control the operation of other node. The process of identifying and registering each node in an IOT environment as a part of service is called node subscription. Subscribed node has to request the network before it publishes or get the services from the publishers. This model is called as Publish/Subscribe model. In the publish/subscribe model, once the subscriber joins the network it is assigned network resources and can exchange the data. Some commonly used application protocols are

1. Constrained Application Protocol (CoAP) [27]
It uses request/response kind of architecture where interactions uses HTTP commands like Get, Put, Post and Delete over User Datagram Protocol. COAP Header has 2 bytes to determine the quality of Service (QOS) level. CAOP includes 4 types of messages such as confirmable, no confirmable, Acknowledgement and reset. In confirmable, Source is acknowledged by the receiver with an acknowledgement [Ack] packet. In no confirmable Source sends the message and forgets that do not require the acknowledgement. In Acknowledgement source gets the acknowledgement for a received message. In reset messages gets rejected or the observer is removed. Coap has simple retransmission mechanism to detect and prevent duplicates for confirmable messages via 16 bit unique id. Datagram transport layer security (dtls) provides security Coap applications though consumes additional resources which lead to reduced battery life and increases conversion complexity between Http and Coap.

2. Extensible Messaging and Presence Protocol (XMPP) [28]
It provides real time, low latency and platform independent communication in a decentralized manner. It operates on Transmission control protocol (TCP) works in both request/response and publish/subscribe models. Here client connects to a server using extensible markup language (XML) messages. But XMPP is relied on TCP for providing quality of service which is not suitable for the IOT.

3. Message Queue Telemetry Transport (MQTT) [29]
This protocol works better for slow, unreliable connections and less computational devices which uses publish/subscribe model. MQTT has 3 broker, publisher and subscriber modules. Publish subscribe is a type of message queue process provides more network scalability and dynamic network topology. This pattern enables an application to announce events to many interested subscribers asynchronously without coupling the senders to the receivers. The other version of MQTT (MQTT-SN) aims at embedded devices on non Tcp/Ip networks such as Zigbee.

4. Advanced Message Queuing Protocol (AMQP) [30]
This standard provides message oriented publish/subscribe communication. Guaranteed message delivery is achieved using 3 levels of quality of service. They are atmost once (Information is delivered with no acknowledgement), atleast once (Information is delivered atleast once with acknowledgement), exactly once(Information is delivered exactly once with handshaking).AMQP gives different messaging variations like one to one, broadcast and request-reply.

5. Data Distribution Service (DDS) [31]
This is a data centric publish/subscribe protocol does not rely on broker.

This standard is very trustworthy and reliable developed by object management group and thus provides variety of Quality of service .
There are 2 types of architecture. Data centric publish-subscribe ensures reliable transmission of messages to the receivers and Data Local reconstruction layer which integrates data distribution service to application layer. Following table depicts various protocol features.

IX APPLICATIONS

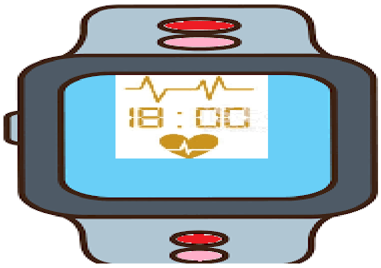
Internet of things has got a wide variety of applications which adds countless value to our life with advanced sensors, updated computing environment and revolutionary and they are[32],

Smart home: Stands out, ranking as the highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term "Smart Home" each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in a smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds $2.5bn. This list includes prominent startup names such as Nest or AlertMe as well as many multinational corporations like Philips, Haier, or Belkin. The following figure gives the overall view of smart home.

Smart Healthcare: IOT is called as network of physical devices which offers data exchange. These devices will not force to operate on very detailed or complicated technological advancements. At present healthcare based companies relaying on IOT.Most of the devices are enabled with internet connectivity like wifi or Bluetooth .Example wearable sensors to X-ray machines. Because of Iot enabled machines patients can view status of their health issue with the continuous monitoring by the specialist without need to visit the workstation/hospital. The following figure gives the overall view of smart healthcare.

Smart farm: it is the farming technique to use the advanced technologies to improve the crop development quality and quantity wise. Due to the enhancement in the current trends the formers are able to access soil quality, automated fertilizer and pesticide monitoring and control through GPS tracking and internet of things. Using smart farming the farmers are able to supervise the needs of individual animals and to manage their nutrition by avoiding virus infection and sickness to keep them healthy. Low capital smart phone applications are required to have the farm smart and capable.

Smart wearable's: Smart wearable uses sensitive sensors to collect the information of the user and his surroundings. It has lightweight operating system with quick networking facilities help users to manage their personal and workplace things remotely without much burden. Most demanding IOT wearable which has acquired the market are, Smart watches, connected headsets, fitness trackers, smart glasses, smart belt, smart shoes. In the case of activity monitor, the sensor called accelerometer senses each step of individual and converts the number of steps into calories burned and also the quality of the sleep.



Smart Transportation: From ancient times our lives relay on different modes of transportation. The time we wake up in the morning to the time we will sleep back in the night in between we may use land transportation vehicles like cycle, scooter, car and bus or rail. Individuals prefer air or water transportation to visit far way places across the world. Transportation started to relay on IOT slowly. It has lead to reduction in speed control, travel time management by avoiding the paths with more traffic, accidental control and safety.

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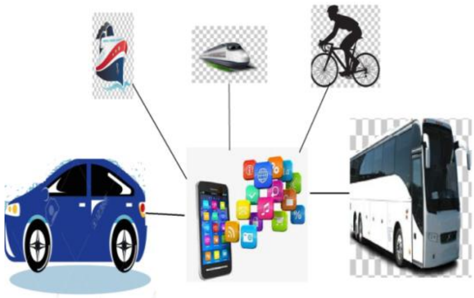
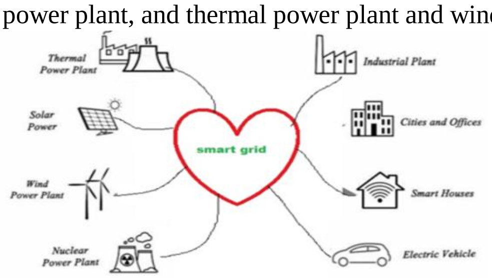
X. RESULTS

Assessment of communication Technologies

Features / Technology	Data Rate	Range	Mobility	Security	Latency	Frequency	Scalable	Header size	Data size
PLC	10mbps	9km	No	No	Varies	Narrowband Broadband	Yes	133 bytes	200 bytes
Z-WAVE	9.6Mbps,40	30m	Yes	No	Low	Regional bands	yes	Varies	100
ZigBee	20, 40 and 250kbps	100m	Yes	128-bit Encryption	Low	Regional and global 2.4GHz	Yes	15 bytes	100 Bytes
LoRa	0.3–50 kbps	13km	Yes	128-bit Encryption	Low	Regional sub-GHz bands	Yes	Varies	100 Bytes
3G	144–400 kbps	Vary	Yes	KASUMIb)	Medium	UMTS 850MHz–2100MHz	Yes	Varies	100 Bytes
4G	Up to 1Gbps	Vary	Yes	Enhanced SNOW 3Gc)	Low	LTE bands	Yes	Varies	100 Bytes
Wireless HART	250 kbps	200	Yes	AES-128 bit	Low	Global 2.4 GHz	Yes	21 bytes	100 Bytes
NFC	106,212,424 and 848kbps	20cm	Yes	LPI	Low	13.56MHZ	No	4 bytes	100 Bytes
BLE	1mbps	50m	Yes	AES-128 bit	Low	Global 2.4 GHz	No	2 bytes	100 Bytes
UWB	480mbps-1.6gbps	10m	Yes	LPI	Low	3.1-10.6GHZ	Yes	40bits	100 Bytes



Smart grid: It is one of the leading applications of internet of things which has a great influence on managing daily or occasionally occur able events from parking spaces, lighting, traffic warnings and to avoid power fluctuations as a result of earthquakes and natural calamities. Iot enables us smart energy usage, Improved transportation and parking, waste management, water management and immediate solution to drought or wildfires in regional areas. Smart grid generates ideas to provide optimistic view towards almost all the areas of development like smart homes, transportation, health care, nuclear power plant, and thermal power plant and wind mills.



a) Low probability of intercept/Detect (LPI/D) is a set of wireless security technique allow devices to see but not to seen by modern and capable intercept receivers.
b) KASUMI is a block cipher with a 128-bit key and 64-bit input and output
c) SNOW 3G is a word-based synchronous stream cipher.

X CONCLUSION

An overview of Internet of things has been elaborated on this paper. Internet of things showed us how things are connected to everything and everyone. We presented various behavioural stages of data and big data. A layered reference model for IOT data management which constitutes various phases of information sensing, pre-processing, processing and visualization for various end to end services. In the result part for the given data size, header size, data rate and size various communication technologies have been assessed through several quality attributes like mobility,security,Latency,frequency and scalability. This paper also gives the introduction of gradual development of Internet, key difficulties with respect to data acquisition, storage and manipulation. It is also mentioned that wide range of applications which makes use of IoT. The IoT Deployment could be hard and require huge research endeavours to handle the difficulties yet it can give huge individual, proficient and financial advantages in a matter of seconds.

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