Study of Implementation of Internet of Things and its Applications

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ABSTRACT— Internet of things is the dream world where billions of objects can sense, communicate and share information, all objects interconnected over public or private Internet Protocol (IP) networks. These interconnected objects have data regularly collected, analyzed and used by cloud to initiate action, providing a wealth of intelligence for planning, management and decision making. The world of the Internet of Things is going to establish widely distributed, locally intelligent network of smart devices called as Things. It uses the embedded and ubiquitous communication, cloud computing and data analytics for providing an opportunity to manage the Things Numerous applications are developed by assembling the smart object for different fields. All the Internet of things systems work on different communication protocols as well technology but they are compatible for communication to construct smart network.

Keywords- *Internet of Things (IoT), IP, smart devices, ubiquitous, communication protocol, cloud computing, smart network.*

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I. . INTRODUCTION

The concept of IoT was introduced by a member of the Radio Frequency Identification (RFID) development community in 1999[1]. "Internet of Things" (IoT) is a Hierarchy in which animate and inanimate objects are equipped with the ability to collect and exchange data over a network without requiring human-to-human or human-to-computer interaction. It has recently become more referred by the people for practical use largely because of the challenging generation of mobile devices, embedded and ubiquitous communication, cloud computing and data analytics. From last decade many researcher have studied on the term “Internet of Things” to refer to the general idea of things, especially everyday smart objects , that are readable, recognizable, locatable, addressable, controllable via the Internet, It is irrespective of the communication network that means whether via RFID,LAN,WAN, Wireless communication or other means [1]. These “things” of the real world shall impeccably integrate into the virtual world, to provide anything, anytime, anywhere connectivity.

“Things” include Peoples, Location of objects, Time Information of objects, and Condition of objects. wide variety of devices can be referees to such as heart monitoring implants, electric clams in coastal waters,[2] biochip transponders on farm animals, automobiles with built-in sensors, DNA analysis devices for environmental/food/pathogen monitoring[3] or field operation devices that assist fire-fighters in search and rescue operations[4]. A vehicle with built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network.

II. CHARACTERISTICS OF IOT SYSTEMS

Every IoT based system is have a purposeful characteristics to fulfill need of any application. That’s why it is called as full-fledged IoT system [5].

1. Main Object should have a unique identification number, so that it can be easily differentiated from another objects (or Things) of the network.
2. By the rule of autonomy Main object have an ability to interact, sense every another object.
3. Every object of IoT system is assemble with sensors to capture autonomous data.
4. Different applications of IoT operate under various communication protocols. Objects belonging to every application should have compatible with different communication technologies.
5. Cloud computing provide a great characteristic that make IoT applications smarter. It is having teamwork possible between autonomous objects. If two autonomous objects can interact and cooperate with each other to complete any preset or necessary task, it can intensify value of such application numerous.
6. IoT systems and their objects should also have low power operations, contextual, programmable, redundant (fault tolerant) importantly secure [5].

III. BUILDING BLOCKS OF IOT

A. Connected devices: These are an electronic devices, generally connected to other devices or networks via different wireless protocols such as Bluetooth, NFC, Wi-Fi, 3G, etc., that can operate to some extent interactively and autonomously. This devices can be designed to support a variety of form factors, a range of properties affecting to ubiquitous computing and to be used in three main system environments: physical world, human-centered environments and distributed computing environments.

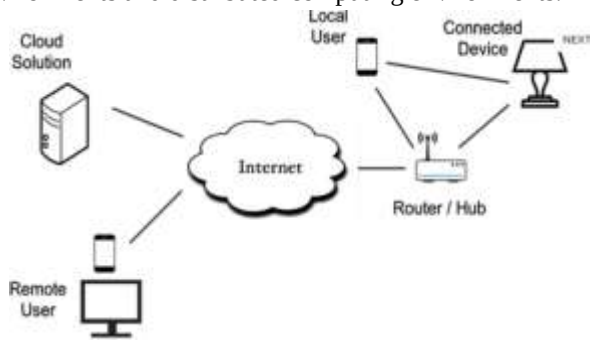

Fig.1 building blocks of IoT.[22]

B. Users: User is an actor who wants to interact directly with the smartphone or tablet to control it, or receive information regarding its operation

C. Router: It is used for connecting the devices with Internet. The connection can be via ADSL, cable, cellular.

D. Remote user: The user who is not in the proximity of the device, but wants to control or receive information regarding the device from a far [6].

E. Cloud Computing: A Cloud solution can be simple storage of data flowing from your connected device, or can include complex analytic functions that are performed on the data coming from the device and reported to the local or remote network [6].

III LAYERED ARCHITECTURE MODEL

IoT is designed by three layer architecture. Sensing layer, network layer and application layer. Technical implementation is seen by bottom-up hierarchy. Parallel representation shows the management of devices, technologies and interconnection [11].

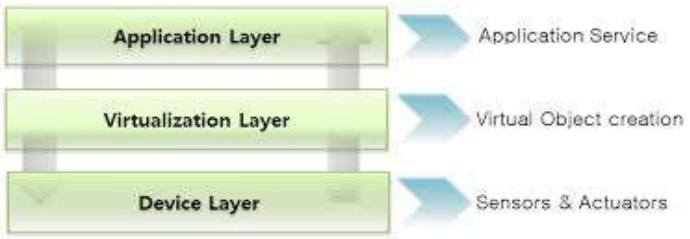

Fig.2 Three layer architecture of IoT [23]

Device layer /Sensing layer: Sensing layer is specially design for data collection and data communication. Various types of data acquisition devices are assembled for catching the data from objects. Data is sense by means of physical properties of system. Different types of devices are used are RFID, Cameras, GPS terminals, LAN, WAN [11] [12].

Virtual Layer: In the layer there is a major role of cloud network. IoT requires cloud computing for transmission of data. Several communication networks like mobile communication network, WLAN, satellite communication network are used for transferring the data [12].Heterogeneous networks as mobile network, Internet, PSTN, Wi-Fi, Bluetooth and GPS are also play an important role integration of cloud in IoT systems [11].

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Application Layer:

Three are different protocols are used for designing application layer for IoT. Most of them are HTTP, UDP, CoAP, and IETF. In the application layer first goal is to achieve following functionalities to develop a smart IoT application: The constrained communication and battery consumption, for massively updates of the same value, publish/subscribe protocols are more suitable, optimize the overall performance of the IoT in various application scenarios.

IV. APPLICATIONS OF IoT

A. Smart Home

Smart home is an automated systems home in 21'st century. It is a task to develop self-controlled, comfort automated Homes. Home automation is a self-employed system in which all the routine activities are handled automatically by self-predefined manner. As such different electric appliances are handled by and automated due to the relief it provides. Home automation is based on wired or wireless communication. It is easy to develop such system for new developing system but it is tedious and costly for developed building. Different types of sensing devices have to assembled on gateway places of home In existing system wired automation is in work but it is not as such effective. Advanced wireless technology like Wi-Fi, cloud networks, RFID are used for constructing smart home.

Fig.3 Smart home design of Samsung [24]

Wireless technologies have overcome the limitations of wired technologies among them few are:

1. Installation costs is less in wireless communication, because it is not required cable connection and assembling them in wall. Due to that it causes reduced cost.
2. Scalable and extensive system due to the wireless connection. Sensing devices are active in their specific range so that they are scalable and we can extend their range area for data acquisition.
3. Due to the use of highly integrated mobile devices like PDAs and Smartphones the automation system becomes possible anywhere, anytime, anyplace.

B. Wearable's

Wearable is an application of internet on body as a things. New smarter technologies are introduced for controlling the human body by applying and assembling them on or near to body. According to the distance of wearable controlling devices put for body automation they are differed from each other by their distance.

Closest to body devices: For measuring the physical affective parameter like temperature, movement, and pulse Smart electronics placed closest(on) to the body.

Connective and controlled devices: Usually smartphones, watches, jewelry are always near to our body or in 99% cases it is not far than body that's why it play an important role capturing an information. Wearable interfaces are designed much natural and gesture-centric. Peoples are feeling comfort in natural interaction with devices. Devices should be user friendly, easy to carry and should not require additional learning. Manceau found that "wearable cannot be handled by text input because they don't have keyboard". notes that text input or search is difficult on a wearable due to the size or design of the device [14]. There are certain techniques suggested below for data acquisition from wearable. Watches can be used for capturing or passing the commands to our eyeglasses. Smartphones can be connect with our home router by Bluetooth low energy protocol. Smartphones can be monitor all physical parameter of body. All these collected data is supplies to cloud network. Smart device developer always think on the collected data is taken by measuring which type of parameters. Actions are precisely set for every movement on collected data in cloud database only task is to set the communication in the network [14].

C. Smart city

Technology driven cities are called as "Smart cities".

Fig. 4 Smart city defined in IoT.[25]

The motto behind designing the smart city is to increase quality of services and to maintain the consistency in income [15]. The goal is to influence the technology for conforming the quality and efficiency of services.

The challenge is to influence technology for ensuring efficiency and quality in services in an appropriate manner. As guided by the Ministry of Urban Development (2014) the smart cities are expected to achieve four things. First is good Physical Infrastructure which is developed by placing the need of smart devices, second is Physical Infrastructure which required the transparent business and online services. Third is Economic Infrastructure, and finally very efficient cloud network [15]. These Smart cities then capable to provide safety and security, smart housing, high level of healthcare, entertainment and quality education. Thus there are so many expectations from a smart city in India. It includes hygienic water, Proper sanitation, and regular and uninterrupted power supply. Waste management, Connected India, Security and safety.

D. Smart Grid

Smart grid are a project under advanced technologies to secure the future of energy supply. As we know that there is a very limited power production capacity with us. A smart grid is very efficient system under IoT to reduce the excess of energy loss, to fulfill energy demand, and to produce large-scale renewable energy such as solar and wind deployments a reality. Though the grid is having several challenges like recurring black-outs in major industrialized cities.

The smart grid will develop a communication network which connect all the different energy-related equipment [16]. The distributed grid topology will collect the energy dynamically from energy sources like transmission and distribution power infrastructure, electrical, water, gas, and heat meters. It will trace out the applications/devices which

demands the on time energy and it measures it dynamic requirement by sensors. Olivier Monnier Worldwide Smart Grid Marketing Director Texas Instruments was try to solve this problem in October 2013. By his research he analyses the instruments energy data and use it to implement a self-healing grid. These grid increase the efficiency, level of self-monitoring and decision making system for energy consumption [16].

E. Industrial Internet

The Industrial Internet is global industrial system. With the power of advanced computing, analytics, low-cost sensing and advanced cloud network permitted by the Internet. The collaboration of the digital world with the world of machines will establish an ability to intense transformation to global industry. It improves efficiency, integrate productivity, with the combine innovation of industry and internet revolt. It gives the rapid raise in standard and profit [18].

There are three building blocks Industrial internet Smart machines which facilitates, convoys and networks with advanced sensors, monitor the software applications. Advanced logics will Harness the power of physics-based analytics, analytical algorithms, automation and cavernous domain proficiency in material science, electrical technologies and to understand how machines in larger systems will operate. Connecting people who are at work in industry, or at industrial applications/sites at any time to sustenance intelligent design, operations, maintenance, quality of service and safety [17].

F. Connected vehicle

Idea of connected vehicle is defined in GSM but Internet of Things will going to extend the interaction of enterprises with their goods transportation. It is directly related to the expectations of people have based on the interaction, immediate feedback, and richness of today's smartphones.

A connected vehicle has considerable benefits, such as its ability to communicate with the vehicle owner, the manufacturer, and the local dealership when potential maintenance issues are detected. Instead of simply flashing a dashboard warning light, the fault codes and other relevant information can be sent automatically. With this information, your dealer can inform you of the repair cost, ensure the parts are available beforehand, and suggest a convenient time for repair based on what it knows about your schedule. If you're not eligible for a loaner vehicle from your dealer, your insurance policy can be crosschecked automatically to arrange a rental for drop off at your convenience [19].

G. Connected Health

This application has been develop for the intelligent independent living. It focus on the computational aspect of user data with which it provide health awareness services. In this application different sensors are used for acquisition of multiple types of data related to physical fitness and activities. On the cached data there is a context estimation is determined for multiple sensor data.

Due to the requirement of multiple sensor it is much cost effective, imperfect and ambiguous. That's why a precarious challenge facing the development of truthful and installable context-aware services. For conversion of user centric data into high-level context information requires processing. Filtering, transformation, and aggregation.is performed to minimize the ambiguity of the resulting contexts. Context processing is performed by following parameters a value matching, data correlation, data fusion or information theoretic reasoning techniques [20].

H. Smart retail

Physical and digital worlds are connected with network to provide an opportunity for retailers to develop a vastly improved ecosystem. The direct in store or out store interaction can be possible within the customer and retailer is possible. The smartphone will be the hub for these interactions. The smartphone aware shopkeepers are evolving from fearing smartphone-toting [21]. To exploring new ways to connect with showrooms is through location-based beacon technology, through these technology retailers can interact directly with customers as they enter the store.

Retailers can control the numerous amounts of data produced by these interactions to improve the customer's in-store experience. Sensors can track customers' paths through a store, it can help managers improve store layout and products placement strategies.

I. Smart supply chain

Supply chains will trace out the customer demand for quicker, cheaper, more reliable, more easily delivered, highly configurable goods. IoT is very much acting on the design of supply chain for analyzing market trends like Omni channel, fast fashion, and smart manufacturing. The IoT will further work this demand for speed up the customization. It enable manufacturers and retailers to modify their operations to real-time market conditions, and deliver high levels of operational excellence to customers [21].

CONCLUSION

This paper is a brief view about the advanced technology referred as Internet of things (IoT). "Things" are the objects in a particular system through which we can measure the changing parameter of that system when it works. Sensors

are used for data acquisition on "Things". Sensors are connected to the network through wired or wireless communication. Huge data collected by sensors are communicated through cloud network to run a smart application.

Three tier architecture as Device (sensor) layer, Virtual (network) layer and application layer is designed to develop applications. In this paper most popular developing applications are studied with their parameters, challenges, and advantages

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