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IoT Specification with it's Applications

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Abstract:This paper provides an overview of the Internet of Things (IOT) with emphasis on enabling technologies, protocols and applica tion issues. The Internet of things (IOT) is the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The IOT Mainly us es the connectivity of devices system and services that beyond the machine to machine communication. Internet of thing defined the IOT as the infrastructure of the informat ion society. The main objective of this paper is to provide an overview of Internet of Things, architectures, and vital technologies and their usages in our daily life.

Keywords: IOT, RFID, Arduino controller, electrical switch, WiFi, Bluetooth, RFID Reader.

1. INTRODUCTION

The term Internet of Things (IOT) has been around for quite a few years. In this scenario, it is gaining ground with the evolution of advanced wireless technology. The basic idea of this concept is the presence of a variety of objects – such as RFID, NFC, sensors, actuators, mobile phones. In this IOT technology the RFID is the most important concept and it is necessary for internet of things. Different technologies in market like RFID, machine to machine communication, vehicle to vehicle communicat ion etc are implemented using IOT. The main problem of IOT is facing scenario of security the potential Hackers who always eager to attack. The ability to code and track objects has allowed companies to become more efficient, speed up processes, reduce error, prevent theft, and incorporate complex and flexible organizational systems through IOT. The "Internet of Things" refers to the coding and networking of everyday objects and things to render them individually machine-readable and traceable on the Internet Much existing content in the Internet of Things has been created through coded RFID tags.

2. TECHNOLOGIES INVOLVED

There are several technologies that can be used to implement the concept of Internet of Things. In this paper, we discussed the following technologies:

- Radio Frequency Identification (RFID)
- GPS
- Machine-to-Machine Communicat ion (M2M)
- Vehicle-to-Vehicle Communication (V2V)
- RFID Reader
- Internet Protocol(IP)

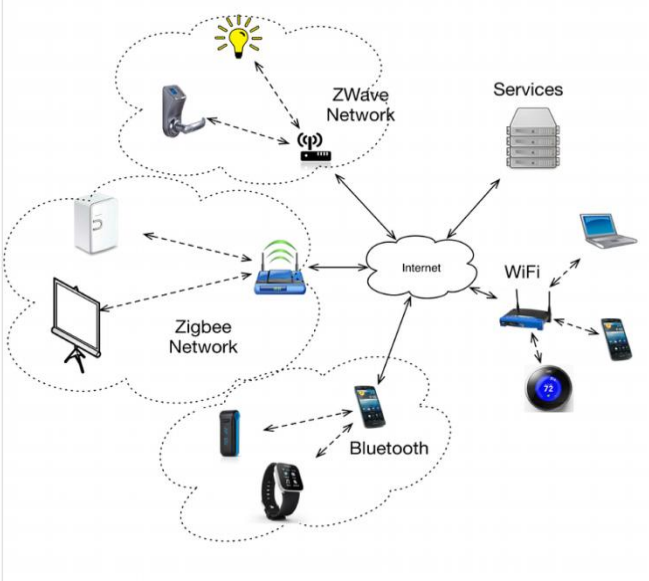


Figure.1. IOT

3. TECHNOLOGY IN IOT

1)RFID

Radio-Frequency Identification (RFID) is the use of radio waves to read and capture information stored on a tag attached to an object. A tag can be read from up to several feet away and does not need to be within direct line-of-sight of the reader to be tracked. radio-frequency identification system uses *tags*, or *labels* attached to the objects to be identified. Two-way radio transmitter-receivers called *interrogators* or *readers* send a signal to the tag and read its response

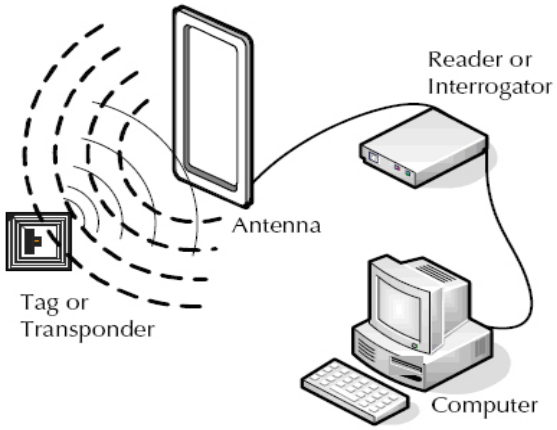


Figure:2 RFID

2)RFID Reader

A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader.

RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.

An **Active Reader Passive Tag** (**ARPT**) system has an active reader, which transmits interrogator signals and also receives authentication replies from passive tags.

An **Active Reader Active Tag** (**ARAT**) system uses active tags awoken with an interrogator signal from the active reader. A variation of this system could also use a Battery-Assisted Passive (BAP) tag which acts like a passive tag but has a small battery to power the tag's return reporting signal.

3)INTERNT PROTOCOL

The **Internet Protocol** (**IP**) is the principal communications protocol in the Internet protocol suite for relaying packets across network boundaries. Its routing function enables internetworking, and essentially establishes the Internet.IP has the task of delivering packets from the source host to the destination host solely based on the IP addresses in the packet headers. For this purpose, IP defines packet structures that encapsulate the data to be delivered. It also defines addressing methods that are used to label the datagram with source and destination information.

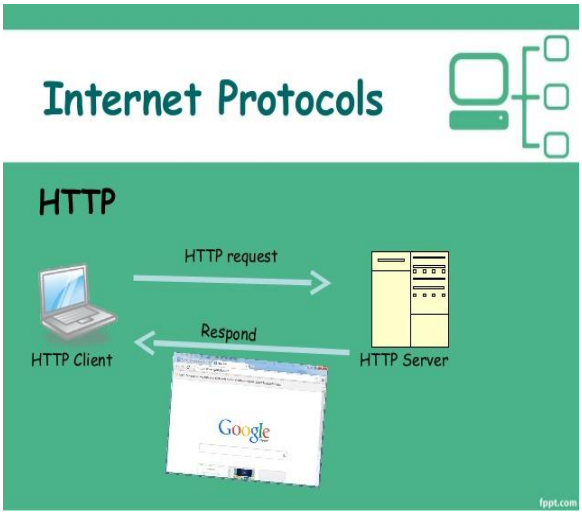


Fig:Internet Protocol

4)Wireless Fidelity

Wi-Fi or **WiFi** is a technology for wireless local area networking with devices based on the IEEE 802.11 standards. *Wi-Fi* is a trademark of the Wi-Fi Alliance, which restricts the use of the term *Wi-Fi Certified* to products that successfully complete interoperability certification testing.[1]

Devices that can use Wi-Fi technology include personal computers, video-game consoles, phones and tablets, digital cameras, smart TVs, digital audio players and modern printers. Wi-Fi compatible devices can connect to the Internet via a WLAN and a wireless access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square kilometres achieved by using multiple overlapping access points.

5)Machine to Machine communication

Machine to machine refers to direct communication between devices using any communications channel, including wired and wireless.[1][2] Machine to machine communication can include industrial instrumentation, enabling a sensor or meter to communicate the data it records (such as temperature, inventory level, etc.) to application software that can use it (for example, adjusting an industrial process based on temperature or placing orders to replenish inventory).[3] Such communication was originally accomplished by having a remote network of machines relay information back to a central hub for analysis, which would then be rerouted into a system like a personal computer.[4]

4.ALGORITHM USED IN IOT

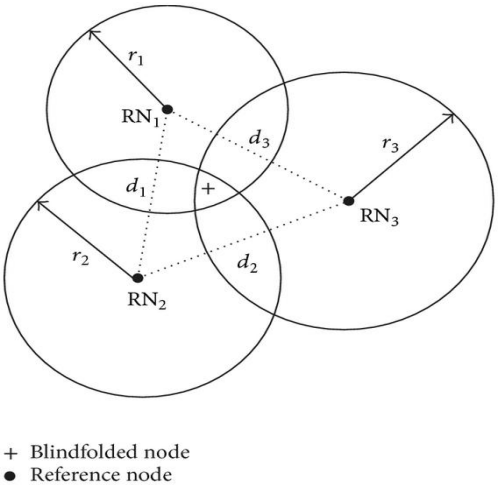
1)Trilateration Algorithm

Trilateration is the process of determining absolute or relative locations of points by measurement of distances, using the geometry of circles, spheres or triangles.

The intersections of the surfaces of three spheres is found by formulating the equations for the three sphere surfaces and then solving the three equations for the three unknowns, *x*, *y*, and *z*. To simplify the calculations, the equations are formulated so that the centers of the spheres are on the $z = 0$ plane. Also, the formulation is such that one center is at the origin, and one other is on the *x*-axis. It is possible to formulate the equations in this manner since any three non-collinear points lie on a unique plane. After finding the solution, it can be transformed back to the original three dimensional Cartesian coordinate system.

We start with the equations for the three spheres:

$$r_1^2 = x^2 + y^2 + z^2$$
$$r_2^2 = (x - d)^2 + y^2 + z^2$$
$$r_3^2 = (x - i)^2 + (y - j)^2 + z^2$$



IOT Elements

1. Sensing

The first step in IoT workflow is gathering information at a "point of activity." This can be information captured by an appliance, a wearable device, a wall mounted control or any number of commonly found devices. The sensing can be biometric, biological, environmental, visual or audible (or all the above). The unique thing in the context of IoT is that the device doing the sensing is not one that typically gathered information in this way. Sensing technology specific to this purpose is required.

2. Communication

This is where things start to get interesting. Many of the new IoT devices we are seeing today are not designed for optimal communication with cloud services. IoT devices require a means for transmitting the information sensed at the device level to a Cloud-based service for subsequent processing. This is where the great value inherent in IoT is created. This requires either WiFi (wireless LAN based communications) or WAN (wide area network… i.e. cellular) communications. In addition, depending on the need short range communication, other capabilities may also be needed. These could include Bluetooth, ZigBee, Near-field or a range of other short range communication methods. For positioning, GPS is often required as well.

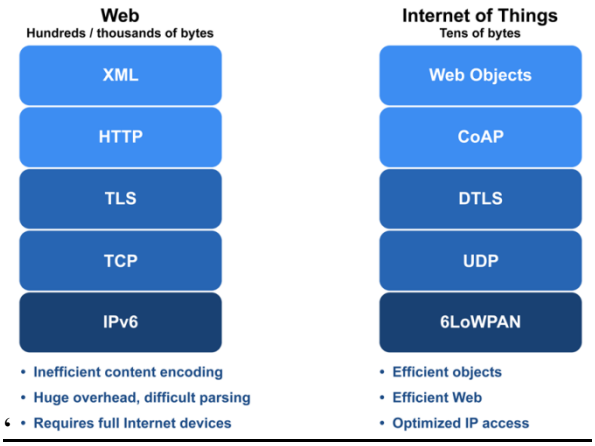
3. Cloud Based Capture & Consolidation

Gathered data is transmitted to a cloud based service where the information coming in from the IoT device is aggregated with other cloud based data to provide useful information for the end user. The data being consolidated can be information from other internet sources as well as from others subscribing with similar IoT devices. Most often, there will be some data processing required to provide useful information that is not necessarily obvious in the raw data.

4. Delivery of Information

The last step is delivery of useful information to the end user. That may be a consumer, a commercial or an industrial user. It may also be another device in the M2M workflow. The goal in a consumer use case is to provide the information in as simple and transparent a method as possible. It requires execution of a well thought out, designed and executed user interface that provides an optimized experience across multiple device platforms – tablets, smartphones, desktop – across multiple operating systems – iOS, Android, Windows, etc.

PROTOCOL IN IOT



5.APPLICATION OF IOT

1. Smart Home

With IoT creating the buzz, 'Smart Home' is the most searched IoT associated feature on Google. But, what is a Smart Home?

Wouldn't you love if you could switch on air conditioning before reaching home or switch off lights even after you have left home? Or unlock the doors to friends for temporary access even when you are not at home. Don't be surprised with IoT taking shape companies are building products to make your life simpler and convenient.Smart Home has become the revolutionary ladder of success in the residential spaces and it is predicted Smart homes will become as common as smartphones.

The cost of owning a house is the biggest expense in a homeowner's life. Smart Home products are promised to save time, energy and money.

2. Wearables

Wearables have experienced a explosive demand in markets all over the world. Wearable devices are installed with sensors and softwares which collect data and information about the users. This data is later pre-processed to extract essential insights about user.

These devices broadly cover fitness, health and entertainment requirements. The pre-requisite from internet of things technology for wearable applications is to be highly energy efficient or ultra-low power and small sized.

3. Connected Cars

The automotive digital technology has focused on optimizing vehicles internal functions. But now, this attention is growing towards enhancing the in-car experience.

A connected car is a vehicle which is able to optimize it's own operation, maintenance as well as comfort of passengers using onboard sensors and internet connectivity.Most large auto makers as well as some brave startups are working on connected car solutions. Major brands like Tesla, BMW, Apple, Google are working on bringing the next revolution in automobiles.

4. Industrial Internet

Industrial Internet is the new buzz in the industrial sector, also termed as Industrial Internet of Things (IIoT). It is empowering industrial engineering with sensors, software and big data analytics to create brilliant machines.

According to Jeff Immelt, CEO, GE Electric, IIoT is a "beautiful, desirable and investable" asset. The driving philosophy behind IIoT is that, smart machines are more accurate and consistent than humans in communicating through data. And, this data can help companies pick inefficiencies and problems sooner.

IIoT holds great potential for quality control and sustainability. Applications for tracking goods, real time information exchange about inventory among suppliers and retailers and automated delivery will increase the supply chain efficiency. According to GE the improvement industry productivity will generate $10 trillion to $15 trillion in GDP worldwide over next 15 years.

5. Smart Cities

Smart city is another powerful application of IoT generating curiosity among world's population. Smart surveillance, automated transportation, smarter energy management systems, water distribution, urban security and environmental monitoring all are examples of internet of things applications for smart cities.

IoT will solve major problems faced by the people living in cities like pollution, traffic congestion and shortage of energy supplies etc. Products like cellular communication enabled Smart Belly trash will send alerts to municipal services when a bin needs to be emptied.

By installing sensors and using web applications, citizens can find free available parking slots across the city. Also, the sensors can detect meter tampering issues, general malfunctions and any installation issues in the electricity system.

6. IoT in agriculture

With the continous increase in world's population, demand for food supply is extremely raised. Governments are helping farmers to use advanced techniques and research to increase food production. Smart farming is one of the fastest growing field in IoT.

Farmers are using meaningful insights from the data to yield better return on investment. Sensing for soil moisture and nutrients, controlling water usage for plant growth and determining custom fertilizer are some simple uses of IoT.

7.Smart Retail

The potential of IoT in the retail sector is enormous. IoT provides an opportunity to retailers to connect with the customers to enhance the in-store experience.

Smartphones will be the way for retailers to remain connected with their consumers even out of store. Interacting through Smartphones and using Beacon technology can help retailers serve their consumers better. They can also track consumers path through a store and improve store layout and place premium products in high traffic areas.

9. IOT in Healthcare

Connected healthcare yet remains the sleeping giant of the Internet of Things applications. The concept of connected healthcare system and smart medical devices bears enormous potential not just for companies, but also for the well-being of people in general.

Research shows IoT in healthcare will be massive in coming years. IoT in healthcare is aimed at empowering people to live healthier life by wearing connected devices.

10.IoT in Poultry and Farming

Livestock monitoring is about animal husbandry and cost saving. Using IoT applications to gather data about the health and well being of the cattle, ranchers knowing early about the sick animal can pull out and help prevent large number of sick cattle.

CONCLUSION

IOT is implemented everywhere which is like smart environment ,Smart city,, security and emergencies, smart business process, smart agriculture, domestic and home automation and healthcare. In this paper, we presented the specification technologies and ittechnologies that can be used to make Internet of Things a reality. We also discuss some open issues which are still to be solved before the wide acceptance of this technology.

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