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INTERNET OF THINGS

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Abstract-The paper is all about the upcoming technology "Internet of things".As it is one of the latest trend it deals with many real time and day-to-dayobjects.Internet of things exists because it is going to dominate all the other technologies including cloud computing.There is no fields of life where Internet of Things is notapplied.In the coming years all the electronic, softwares, networks,machines and all the devices will be working with Internet of Things.

Keywords- IoT devices,Web of Things, Big Data.

I.INTRODUCTION

The network of physical objects such as devices, vehicles ,buildings and some other things including embedded systems, software, and network connectivity are collectively called as "Internet of Things".The Internet of Things becomes an instance of cyber systems, also for the technologies such as smart grids,Intelligent transportation and smart cities.

Kevin Ashton, a British entrepreneur coined the name "Internet of Things" in the year 1999.As a change IoT offers the advanced connectivity that goes beyond the machine-to-machine(M2M) communications.

II.EARLY HISTORY

In the early 1982, the concept of networked smart devices was discussed. A coke machine at Carnegie Melton university became the first internet-connected device.

Mark Weiser's seminar paper on "Ubiquitous computing" ,"The computer of 21^{st} century", also the academic venues such as Ubicomp and Percomp produced the contemporary vision of Internet of Things.

IEEE spectrum as moving small packets of data to a large set of nodes, described by Reza Raji in 1994, so as to integrating and automating everything from home appliances to entire factories.

Later, between 1993 and 1996 several industries proposedsolutions like Microsoft's at Work or Novell's NEST.

Bill Joy envisioned Device to Device(D2D) communications as part of "Six Webs" framework, presented at the World Economic Fortum at Davos in 1999.

The concept of the Internet of Things became famous in the year 1999, through the Auto-ID center at MIT and related marketing analysis publications.

TABLE 1

RANK	COUNTRY	DEVICES ONLINE
1	Korea	37.9
2	Denmark	32.7
3	Switzerland	29.0
4	US	24.9
5	Netherland	24.7
6	Germany	22.4
7	Sweden	21.9
8	Spain	19.9
9	France	17.6
10	Portugal	16.2

III.APPLICATIONS

There will be nearly 26 billion devices on the Internet of Things by 2020, according to Gartner,Inc. (a technology research and advisory corporation).ABI research estimates that more than 30 billion devices will be

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wirelessly connected to the Internet of Things by 2020.As a technological innovation, the UK government allocated £40,000,00 towards research into Internet of Things, in their 2015 budget.

IP address will be used as a unique identifier in integration with the internet. As the address space of IPv4 is limited, the objects in the IoT uses IPv6 to accomodate the extremely large address spaces. To a greater extent
the future of the IoT will not be possible without using the IPv

A.MEDIA

The media and big data are interconnected, so it is must

to provide some context in the media processing mechanism.The ultimate aim is to serve, or convey, a message or a content that is in line with the consumer's mindset.

The media industries process the Big Data in a dual and interconnected manner:

- Tragetting of consumers
- Data-capture

The IoT serves an opportunity to measure, collect
And analyse an ever-increasing variety of behavioural statistics. Cross-correlation of this data could revolutionise the targeted marketing of of products and services.

Big Data and the IoT works in a conjuctional manner.
device interconnectivity. The Internet of Things transforms the media industry, companies and governments, there by opening up a new era of economic growth and competitiveness.

B.ENVIRONMENTAL MONITORING

The applications of IoT in the field of Environmental monitoring uses sensors to assist in environmental protection by monitoring the air or water quality, atmospheric or soil conditions, and also the movements of wildlife and their habitats.Devices connected to the internet can be used to earthquake and tsunami-early warning systems.

C.INFRASTRUCTURE MANAGEMENT

Monitoring and controlling the urban and rural infrastructure like bridges, railway tracks on and off-shore wind farms is a key application of IoT. The IoT devices can be used to control critical infrastructure like bridges to provide access to ships. Even the areas such as waste management can benefit from automation and optimization that could be brought by the IoT.

D.MANUFACTURING

Digital control systems to automate the process and sec ,operator tools and services information systems to optimize plant safety and security are within the purview of the IoT.

E.ENERGY MANAGEMENT

It is expected that IoT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, television etc.,). Such devices would also offer the opportunity for users to remotely control their devices, or centrally manage them via cloud based infrastructure.
Using Advanced Metering Infrastructure (AMI)
Devices connected to the internet backbone,electric utilities can not only collect data from end-user connections but also manage other distribution automation devices like transformers and reclosers

F.MEDICAL AND HEALTHCARE SYSTEMS

IoT devices can be used to enable remote health monitoring and emergency notification systems .These health monitoring systems can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pace makers or advanced aids.

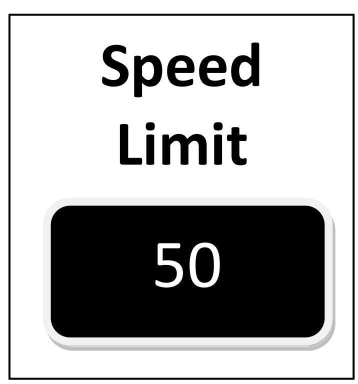
G. LARGE SCALE DEPLOYMENTS

There are several ongoing or planned large-scale deployments of the IoT. For Example Songdo,South Korea, the first of its kind fully equipped and wired city. This is implemented only with the help of IoT.

Another example of large deployment is the completed New York Water Ways(NYWW) in the New York city to connect all their vessels and being able to monitor them lively 24/7. The network is deigned and engineered by Fluidsmesh Networks. New applications can include security, energy and fleet management, digital signage, public wi-fi, paperless ticketing and others.

H. TRANSPORTATION

Fig.1: digital speed limit sign



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The IoT can assist in integration of communications, control, and information processing across various Transportation systems i.e. the vehicle, infrastructure, and the driver and user etc.,

IV. UNIQUE ADDRESSABILITY OF THINGS

The orginal idea of the Auto-ID Center is based on RFID-tags and unique identification through the Electronic Product Code however, this has evolved to objects having an IP address or URI.

From the world of Semantic Web, as an alternative view, it focuses on making all things(not just the electronics, smart or RFID-enabled) addressable by the existing naming protocols, such as URI. The objects themselves do not converse ,but they may now be referred by the other agents, such as powerful centralized servers acting for their human owners.

The next generation of Internet applications using communicate with devices attached to virtually all human-made objects because of the large addressing space of IPv6.

The combination of these ideas can be found in the current GS1/EPCglobal information services (EPCIS) specifications.

V.TRENDS AND CHARACTERISTICS

The latest trends and characteristics can be explained by means of the following figure.

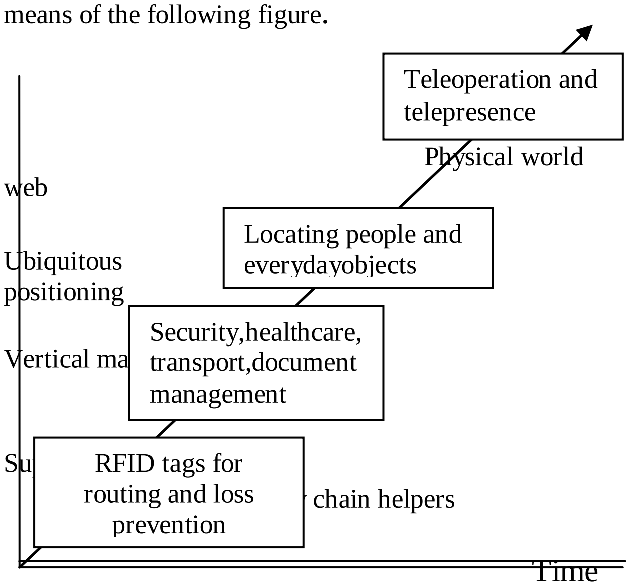

Fig.:Technologyroadmap:Internet of Things

A.INTELLIGENCE

The Ambient Intelligence and Autonomous Control are not a part of the original concept of Internetof Things. But, there is a shift in research to integrate the concepts of Internet of Things and Autonomous control, with initial outcomes towards this direction considering objects as the driving force of autonomous IoT.

In the upcoming days the Internet of Things may be a non-deterministic and open network in which auto-organized or Intelligent entities(Web Services, SOA components), virtual objects(Avatars) will be interoperable and able to act independently depending on the context, circumstances and environments.

VI.ARCHITECTURE

The system follows an Event-driven Architecture.It is Bottom-Up made and will consider any subsidiary level. Thus , model driven and functional approaches will coexist with new ones able to treat exceptions and unusual evolution of processes (Multi-agent systems, B-ADS etc.,).

In the Internet of Things, the event does not means based on a deterministic or syntactic model. Instead, event will be based on the context of the event itself, this can also be a Semantic Web.

Building on the top of IoT, the Web of Thingsis an architecture for the application layer of the Internet of Things, looking at the convergence of data from IoT devices into Web applications to create innovative use-cases.

VII.NETWORK ARCHITECTURE

The Internet of Things requires huge scalability in the network space to handle the surge of devices.IETF 6LoWPAN would be used to connect devices to IP networks with billions of devices. IPv6 will play an major role in handling the network scalability.

VIII.COMPLEX SYSTEMS

In semi-open or closed loop, it will be considered as a Complex system, because of the huge number of different links and interactions between Autonomous actors, and its capacity to integrate new actors. At the overall stage it will be seen as Achaotic environment.

IX. A BASKET OF REMOTES

According to CEO if Cisco, the remote control market is expected to be a $USD 19 trillion market. Many IoT devices have a potential to take a piece of this market. Then, there exists “ Basket of remotes” problem, where we will have hundreds of applications to interface with hundreds of devices that don’t share protocols for speaking with one another.

There are several ways to find solution for this problem. One of them is “ Predictive Interaction” where

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cloud or fog based decision makers will predict the user's next action and reaction.

This problem is also a competitive advantage for some very technical startup companies with fast capabilities.

X. FRAMEWORKS

Internet of Things frameworks helps supporting the interaction between "things" and allow for more-complex structures like Distributed system and the development of Distributed applications. Nowadays, some Internet of Things frameworks seems to be focused on real time data logging solutions offering some basis to work with many "things" and have them interact. Future developments might lead to specific Software development environments to create the software to work with the hardware used in the Internet of Things. Companies such as Tibbo Systems - AggreGate Platform, are developing technology platforms to provide this type of functionality for the Internet of Things.

The XMPP standards foundation XSF is creating such a framework in a fully open standard that isn't tied to any company and not connected to any cloud services. It provides a set of needed building blocks and a proven distributed solution that can scale with high security levels. The extensions are published at XMPP/extensions

The independently developed MASH IoT Platform was presented at the 2013 IEEE IoT conference in Mountain View, CA. MASH's focus is asset management (assets=people/property/information, management=monitoring/control/configuration). Support is provided for design through deployment with an included IDE, Android client and runtime. Based on a component modelling approach MASH includes support for user defined things and is completely data-driven.

REST is a scalable architecture which allows for things to communicate over Hypertext Transfer Protocol and is easily adopted for IoT applications to provide communication from a thing to a central web server. MQTT is a publish-subscribe architecture on top of TCP/IP which allows for bi-directional communication between a thing and a MQTT broker.

XI.ENABLING TECHNOLOGIES FOR IoT

There are many technologies that enable IOT.

1. RFID and near-field communication - In the 2000s, RFID was the dominant technology. Later, NFC became dominant (NFC). NFC have become common in smart phonesduring the early 2010s, with uses such as reading NFC tags or for access to public transportation.
2. Optical tags and quick response codes - This is used for low cost tagging. Phone cameras decodes QR code using image-processing techniques. In reality QR advertisement campaigns gives less turnout as users need to have another application to read QR codes.
3. Bluetooth low energy - This is one of the latest tech. All newly releasing smart phones have BLE hardware in them. Tags based on BLE can signal their presence at a power budget that enables them to operate for up to one year on a lithium coin cell battery.

XII.CRITICISM AND CONTROVERSIES

While many technologists take the Internet of Things as a step towards a better world, scholars and social observers have doubts about the promises of the ubiquitous computingrevolution.

XIII. SECURITY

Concerns have been raised that the Internet of Things is being developed rapidly without appropriate consideration of the profound security challenges involved and the regulatory changes that might be necessary. According to the BI (Business Insider) Intelligence Survey conducted in the last quarter of 2014, 39% of the respondents said that security is the biggest concern in adopting Internet of Things technology.[138] In particular, as the Internet of Things spreads widely, cyber attacks are likely to become an increasingly physical (rather than simply virtual) threat. computer-controlled devices in automobiles such as brakes, engine, locks, hood and truck releases, horn, heat, and dashboard have been shown to be vulnerable to attackers who have access to the onboard network. In some cases, vehicle computer systems are internet-connected, allowing them to be exploited remotely. The U.S. National Intelligence Council in an unclassified report maintains that it would be hard to deny "access to networks of sensors and remotely-controlled objects by enemies of the United States, criminals, and mischief makers. An open market for aggregated sensor data could serve the interests of commerce and security no less than it helps criminals and spies identify vulnerable targets. As a response to increasing concerns over security, the Internet of Things Security Foundation (IoTSF) was launched on 23 September 2015. It has a mission to secure the Internet of Things by promoting knowledge and best practice. Its founding board is made from technology providers and telecommunications companies including BT, Vodafone, Imagination Technologies and Pen Test Partners.

XIV. DESIGN

Given widespread recognition of the evolving nature of the design and management of the Internet of Things, sustainable and secure deployment of Internet of Things solutions must design for "anarchic scalability.

XV.ENVIRONMENTAL IMPACT

A concern regarding IoT technologies persists to the environmental impacts of the manufacture, use, and eventual disposal of all these semiconductor-rich devices. Modern electronics are repleted with a wide variety of heavy metals and rare-earth metals, as well as highly toxic synthetic chemicals. This makes them extremely difficult to properly recycle. Electronic components are often simply dumped in regular landfills, thereby polluting soil, groundwater,

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