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Internet of Things: Applications and Future Trends

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ABSTRACT: Now a day's great trend that not only specific devices must be connected to the Internet, but anything or equipment. The home appliances, that we use day by day, for example, may have new forms of use when they are connected to the World Wide Web. The Internet of Things (IoT) arrived, driven by an expansion of the Internet in physical objects and providing smarter services. IPv6 protocol could provide a wider range of services and is a promising support resource for this connection.
Its applications could be seen in commerce, industry, public services, healthcare, in the field, in short in all the "stuff". In this context, this work has the objective to analyze the initial concepts, and that has been in practice regarding this technology. Therefore, this article will present an overview of the IoT referencing its technical aspects, the applications already available and the challenges to be faced by this technology nowadays.

KEYWORDS: Internet of things, RFI, IPv6, IPv4, Internet, WWW.

I. INTRODUCTION

Few years ago, Hollywood futuristic movies, or even animated sitcom as the family of the future "The Jetsons", displayed from 1962 to 1963 on American TV, show innovations that seemed to be impossible and / or unimaginable. In the cartoon "The Jetsons", for example, the characters live in a fully automated home where they performed functions from a simple touch buttons or voice command. Today this reality is no longer so far. All this will be possible with the use of the Internet of Things (IoT). "Things" must be considered in the broadest sense of the word as real or virtual entities that exist and evolve in a context and time and have univocal identifiers. On the other hand, the term Internet applied to them conveys the idea that all these things are fully connected and interrelated among them [1].
The Internet of Things ecosystems are composed, on the one hand, of so called smart objects, i.e., tiny and highly constrained physical devices in terms of memory capacity, computation capability, energy autonomy, and communication capabilities [2]. They say the objective of the Internet of Things is the integration and unification of all communications systems that surround us. Hence, the systems can get a total control and access to the other systems in order to provide ubiquitous communication and computing with the purpose of defining a new generation of services.
This research aims to analyze the IoT concepts and applications, ranging from health care to transportation, logistics to meters and the perspective of a "smart city". As a specific purpose, it will be analyzed also, in an overview, the technical aspects of technology as architecture, protocols, and

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II. BACKGROUND

This background work will be useful for basically knows about clarity with content of the research work using existing resources.

Theoretical Framework

IPv4

The IP and TCP protocols are the key from a set of protocols that direct the operation of the Internet and are known as the TCP / IP suite of protocols. The IP protocol is important because it is responsible for addressing and routing packets that travel over the World Wide Web [3]. The most widely used version of the protocol, so far, is the version 4, which has 32-bit addressing, which allows about four billion addresses available for devices directly connected to the Internet [3].

IPv6

The solution to the continuous growth of the network is the IP protocol in use version 6 (IPv6). IPv6 has a number of addressing that will serve for a long time the Internet needs. IPv6 has 128 bits in its address field, which brings 3.4x〖10〗^38 IP enables to allocate 340,282,366,920,938,463,463,374,607,431,768,211,456 unique addresses [6].

IoT Architecture

The architecture of IoT is a convergence of various technologies such as: Ubiquitous / pervasive computing, sensors / actuators, Information and Communication Technologies (ICT) and embedded systems [11].

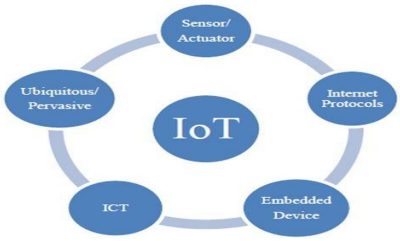

Figure: IoT Architecture

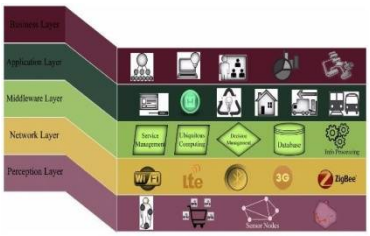

Figure: IoT Architecture and Applications

In architecture, embedded systems and sensors / actuators are components which are physically in direct interaction with users who, in turn, manipulate the data through these components. ICT, ubiquitous / pervasive computing and Internet protocols are used to create a communication between the devices and manage user interactions. Also the IoT architecture components are further classified into three functional units [12]:

- **Oriented Internet:** Represents the Internet and its technologies and acts between user and the smart things and so "is called intelligent middleware." Intelligent Middleware will enable the creation of a dynamic map of the real / physical world into the digital / virtual space using a temporal and spatial resolution and matching the network characteristics of ubiquitous sensors and others. The constructions of IP protocols to enable smart objects are connected to the Internet [14].
- **Oriented things:** They are known as smart things that represent sensors and actuators that respond to stimuli consistently environment.

***B.* Mobility**

Mobility today is coming to a point where it is possible, through a smartphone, connect to wireless companies and the next moment, to leave the place, change the connection for the network 3G / 4G phone carrier, transparently to the user. However, this network migration brings with it the problem of changing IP address of the mobile device, thereby generating possible breaks (and even fall) connection. The use of the IPv6 protocol will happen differently because the machine will switch network w h i l e preserving the address you are using, preventing connections are lost.

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C. Hardware

One of the reasons mobile computing is becoming increasingly available, no doubt, is because hardware prices are constantly decreasing. Projects like Raspberry Pi, Arduino, Fritzing, Writing provide cheap Waspmote modular hardware components that can be easily programmed and configured using Free and Open Source Software (FOSS) free and open-source software. To illustrate this reality will be presented in Table 1, an overview of these devices designed to be part of the IoT.

III. EXISTING SYSTEM

APPLICATIONS DEVELOPED FOR IoT

The IoT refers to a technological revolution that will soon connect equipment such as appliances, transportation, clothing and handles on the Internet and in others devices such as computers and smart phones. Finally, the Internet has become a fundamental part of society. It is likely a future in which the network and the computers are invisible. They will be so integrated into the daily lives of people, disguised in everyday objects, which are not perceptible. Therefore, because the importance of IoT, the National Intelligence Council of EUA (NIC) regards it as one of the six most promising civilian technologies and more impact the nation in the near future. The NIC (2008) provides that in 2025 all everyday objects (for example, food packaging, documents and furniture) will be connected to the Internet.

Figure: IoT Applications examples

For the first time in a recent event, the CES 2015 (Consumer Electronics Show), offered to the public some technology dedicated to smart homes, smart cars and wearable or wear devices. The idea is to reach the day when all equipment is controlled by intelligent devices.

A. Logistics

Transport logistics, IoT improves not only material flow systems but also the global positioning and automatic identification of freight. It also increases energy efficiency and thus decreases energy consumption [13]. The author concluded that the IoT is expected to bring profound changes to the global supply chain by intelligent cargo movement. This will be achieved by means of continuous synchronization of supply chain information and seamless real time tracking and tracing of objects. It will make the supply chain transparent, visible and controllable, enabling intelligent communication between people and cargo/goods.

B. Agriculture Applications

Internet of Things technologies has a great potential to improve the safety and quality of agricultural products. By providing near continuous monitoring from planting through harvesting and to our homes, IoT technologies are able to provide farm to fork visibility with all of the resulting benefits that accrue from that visibility [12].

IV. EXISTING SYSTEM

CHALLENGES FACED BYTHIS TECHNOLOGY

The movement towards mass adoption of IoT already seems impossible to contain. If it's good or bad, only time will tell. It is known that many challenges will be faced in the course of this the IoT deployment process, such as data storage, information security, well-trained employees, among others, as seen below.

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A. Information Storage

Systems, storage and network servers need to grow to support the transition and the massive growth of new devices. The IoT will impose new requirements on storage and this huge amount of data need to be stored somewhere to be useful [13].

B. Infrastructure

The basic IoT architecture consists of three layers: perception layer, network layer and application layer. For the authors, these layers may not be sufficient due to the rapid development of IoT. Therefore, a five layer architecture has been suggested, by adding two new layers: the processing layer and the business layer. “Fig. 2” shows the scheme with the five layer model [9].

C. Information Security

Compared to traditional networks, the security and privacy of Internet of Things become more prominent. Much information includes confidential and private information, so that privacy protection is an important issue to be considered.

D. Skilled Labor

The Internet of Things will provide automatic procedures that imply a reduction in the number of employees needed. Workers are replaced by bar code scanners, readers, sensors and actuators, and eventually, by complex robots as efficient as a human being. Undoubtedly, these technologies will bring opportunities for professionals because a large number of technicians will be needed to program and repair the equipment and sensors [13]. This is a new challenge for the provision of services for all workers with an opportunity to move toward these types of work.

Future Trends:

In future technology will be adopted around existing technologies such as

1. Smart home

Smart Home clearly stands out, ranking as 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 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 a number of multinational corporations like Philips, Haier, or Belkin.

Figure: Smart Home- Different levels of Portals

2. Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

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3. Smart grids

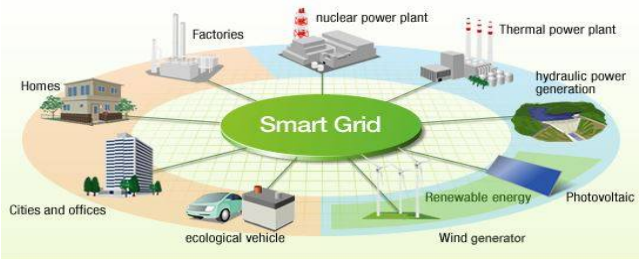

Figure: Smart grid using IoT

A smart grid is a special one. A future smart grid promises to use information about the behaviors of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlight the concept's popularity. However, the lack of tweets (Just 100 per month) shows that people don't have much to say about it.

4. Industrial internet

The industrial internet is also one of the special Internet of Things applications. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently doesn't reach the masses like smart home or wearable do. The industrial internet however has a lot going for it. The industrial internet gets the biggest push of people on Twitter (~1,700 tweets per month) compared to other non-consumer-oriented IoT concepts.

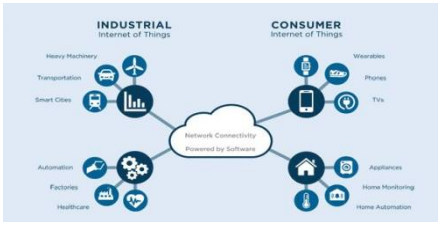

Figure: Industrial relations using IoT

5. Connected car

The connected car is coming up slowly. Owing to the fact that the development cycles in the automotive industry typically take 2-4 years, we haven't seen much buzz around the connected car yet. But it seems we are getting there. Most large auto makers as well as some brave startups are working on connected car solutions. And if the BMWs and Fords of this world don't present the next generation internet connected car soon, other well-known giants will: Google, Microsoft, and Apple have all announced connected car platforms.

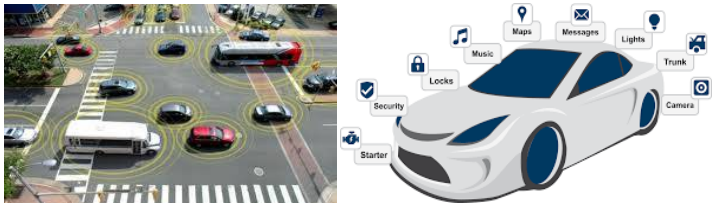

Figure: Connected car using IoT

6. Connected Health (Digital health/ Telehealth / Telemedicine)

Connected health remains the sleeping giant of the Internet of Things applications. The concept of a connected health care system and smart medical devices bears enormous potential, not just for companies also for the well-being of people in general. Yet, Connected Health has not reached the masses yet. Prominent use cases and large-scale startup successes are still to be seen. Might 2015 bring the breakthrough?

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7. Smart retail

Proximity-based advertising as a subset of smart retail is starting to take off. But the popularity ranking shows that it is still a niche segment. One LinkedIn post per month is nothing compared to 430 for smart home.

Figure: Smart retail using IoT

8. Smart supply chain

Supply chains have been getting smarter for some years already. Solutions for tracking goods while they are on the road, or getting suppliers to exchange inventory information have been on the market for years. So while it is perfectly logic that the topic will get a new push with the Internet of Things, it seems that so far its popularity remains limited.

Figure: Supply chain process using IoT

9. Business is the key market

While there is lots of talk about wearable and connected homes, the real value and immediate market for IoT is with businesses and enterprises. The adoption of IoT will be much more like the traditional IT diffusion model (businesses to consumers) than the Consumer-led adoption of social media and personal mobility.

10. It will be about much more than the "things"

The currency of IoT will be "data". But, this new currency only has value if the masses of data can be translated into insights and information which can be converted into concrete actions that will transform businesses, change people's lives and effect social change.

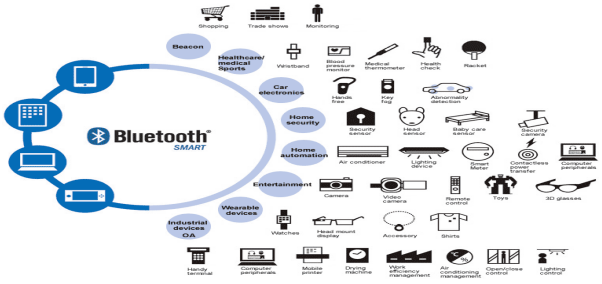

Figure: Operations using IoT

Figure: Key Features of an Industrial IoT Platform

11. All cities will be smart

With more than one-half of the world's population living cities innovative new IoT solutions, such as smart parking, connected wastes, and traffic management, hold great promise for combating the major challenges of rapid urbanization. We are unlikely to see many Jetson-like smart cities of the future appearing overnight. However, like in the past with the adoption of revolutionary technologies such as sewers, electricity, traffic lights, and the Internet,

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mayors will slowly implement IoT solutions to save money, shape the future and make their cities better places to live.

12. Intelligence: Machine to machine (M2M) communication has high priority in IoT because machine automation must be improved to minimize delay, traffic, and immediate action. Smart technologies need to be more intelligent to enable automated systems. Communication Protocol: The heterogeneous nature of IoT enabled services meet an unavoidable problem with communication protocols. Each types of device use separate protocol in terms of data communication. Standard communication protocol needs to be developed for successfully implement IoT services.

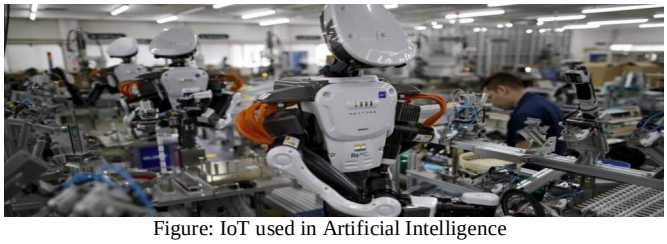

Figure: IoT used in Artificial Intelligence

13. Real-Time Solution: It will be really tough to implement the 'Anytime' concept of IoT in reality. The real-time systems need to be implemented in grass root level of the IoT things to react prominently at any time. The complexity of the existing real-time systems must be minimized, so that they could be used in nano-scopic devices.

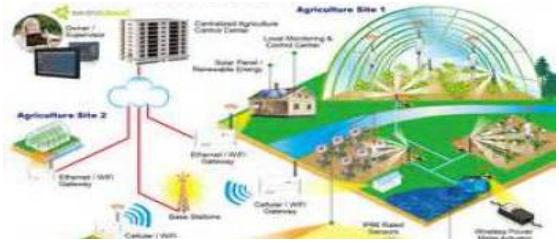

Figure: Agricultural Applications

14. Creating knowledge and Big Data: In an IoT world there exists a boundless measure of raw information being ceaselessly gathered. It can be normal that an extensive number of continuous sensor information streams exist as it is regular for a given stream of information to be utilized as a part of various routes for a wide range of induction purposes. Here, the information provenance and how it was prepared must be known, and protection and security must be connected as well. At the point when the information is enormous, challenge gets to be greater. Information mining strategies are relied upon to give the making of imperative learning from this information.

Figure: IoT used in BigData

Figure: IoT Applications in Space

15. Heterogeneous Things: An IoT empowered framework keeps running with a few heterogeneous gadgets those are diverse to each other as far as correspondence convention, information position, information accumulation, and information storage ability and so forth. This is a challenging task to develop communication protocols supported by all devices. Standard information configuration is required to empower machine to machine (M2M) correspondence all the more productively.

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V. CONCLUSION AND FUTURE TRENDS

This paper presents an overview based in several researches of authors that presents the technical aspect, existing applications and the challenges to be faced by IoT day-to-day. Due to technical evolution, is possible to believe in the potential applications of this new technology. Among others, the IoT won't come back. As the Internet gained strength at the time that it did connects computers around the world, the IoT is emerging as a promise of applications that will help human beings in daily tasks [1][2].

The IoT will bring also the possibility of working to various sectors, especially application developers to the connected devices and telecommunication engineers, which should well plan the infrastructure that will support the network. But it is important to remember the need to study the safety of the data. Security it is a subject which requires a more thorough research. Assuming that the database will be stored on servers that are physically located in different places (in the cloud) and even in the user equipment. This makes security is crafted with all those who use the network and its equipment, with the possibility of having their data captured for possible people who use it in the wrong way.

It could be perceived that the IoT is still a great promise. Although the concept is no longer so new, dated in 1998 by Kevin Ashton, the devices are gradually adapted to be used within this concept. With the advent of IPv6, this reality changes, because the new protocol brings the possibility of exponential growth of network equipment. Among the works of the newly launched line of research - Fumec of Things - created in Fumec University, this first article presented an overview of the IoT. No doubt those as previously, the subject still demand more studies, especially for the area of infrastructure and network security. Therefore, in future studies will be carried out thorough research into these issues in order to design the first application of Internet of Things of FoT.

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This research paper is Heartily Dedicated to my beloved parents, my family members and my life Inspirer Eminent Scientist Sri. Dr. A.P.J.Adbulkalam.

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He has 6 years good teaching experience with taught various subjects on good knowledge on EDC, RVSP, SS, ECA, PDC, EMWTL, AC, DC, STLD, DSP, OC, VLSI and along with ECE subjects. His Qualified GATE-2008 and published 3 research papers in reputed International and national level conferences\Journals\Magazines, 1 book are processing on publishing. He is Participated and active member in academic, curriculum and administrative works in various organizations. He is the member of IEEE, IAENG.

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He has 4 years good teaching experience and having a good Knowledge on Space Research, Future Internet Architecture, Cloud Computing, Internet of Things/Services/Data, Data Analytics, Computer Network and Hacking along with Computer Science Subjects.

He is Published 18 Research Papers in various reputed International and national Journals, Magazines and conferences. He is participated 4 international and 3 national conferences. He is Participated 1 national Workshop and 2 FDP.

He is filling and processing 1 Patent application in Patent Office, Chennai and He wrote 2 Textbook in Computer Science stream and have 2 Copyright and Secured 6 Certifications from NPTEL-IIT's various specifications like Algorithms for BigData, C++ Programming, Introduction to Research, Wireless Sensor Adhoc Networks, Internet Architecture, Internetwork Security, and Computer Architecture, Cloud computing etc..

He is the member of SERB, Indian Science Congress, W3C, INTERNET SCOCIETY, W3C, NASA (Student), Springer, Elsevier, Science Alert, IEI, Editorial Manager, MECS-PRESS-IJMECS/ IJCSIT, W3C, Manuscriptcentral, TUBITAK-GIRIS, Internet Society, IAENG, IAAET, IJMETMR, IJECSE, IJCST, IJECSE and editorial / review member in ACM, IJMETMR, and Springer- Journal of Big Data.