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Flying with Internet of Things via Global Structure

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Abstract: *According to growth of high definition technologies and their wide applications in each part of our life, these lead to globalize a new aspect to be an umbrella to cover and connect all things in the world. Internet of things started as a hidden title through many related subjects in 1999. Many aspects and characteristics are available via new advanced high speed Internet that referred to fourth generation Internet. This work aims to introduce a brief survey of Internet of things, adequate definition, and requirement infrastructure suitable to achieve and overcome the challenges. The implemented survey indicated that Internet of Things is a big new technology that will make new future concepts and technologies.*
Keywords: *Internet of Things, IoT Structure, Cloud Computing, Future Technologies.*

I. Introduction

Recently appeared the boom of technologies such as grid computing, mobile computing and cloud computing [1],[2],[3]. These technologies are vastly growth according to their wide applications [4],[5],[6]. The big advanced in communication and Internet technologies lead to high speed and big storage environment [7],[8]. Internet of Things (IoT) is the fourth generation of the Internet, which is usually designed as the Internet of Things, which is characterized by the use of the billion integrated devices [9]. The telecommunication standard sector of ITU introduced ITU-T Y.2060 that provides the definitions that imply the Scope of IoT [10]. ITU-T recommendation Y.2060 provides an overview of the Internet of Things [11]. It clarifies the concept and scope of the IoT, which identifies and describes the fundamental characteristics and requirements of reference model IoT [12]. This model approved at 2012 and concentrated on next generation networks. Y.2060 reference model (fig.1) identifies the following aspects [13],[14]:

- Internet of Things: A global infrastructure for the information society, enabling advanced services through the interconnection of elements (physical and virtual) based on existing and evolution of interoperable information and communication technologies.
- Things: As for IoT, it is an object of the physical world (physical things) or the world of information (virtual things), capable of being identified and integrated into communication networks.
- Device: As for IoT this is a piece of equipment with the required communication capability and optional functions of detection, drive, data entry, data storage and data processing.

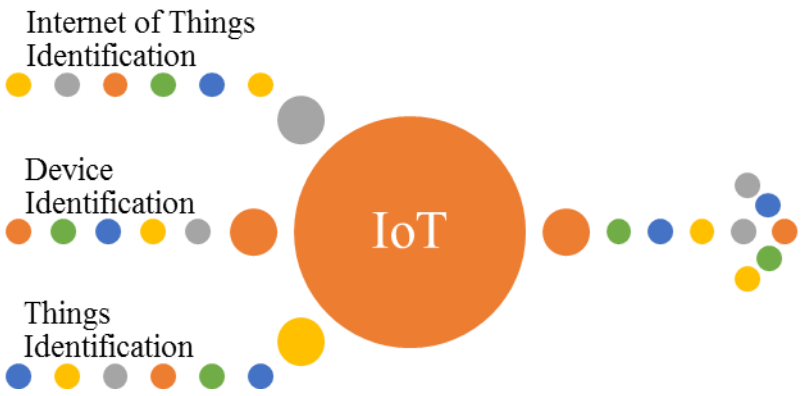

Figure 1 ITU-T Y.2060 of Internet of Things

In addition IoT can be implemented via hybridizing many fundamental requirements that are the main layers of IoT (fig.2) [15],[16]:

- High speed Internet and communication media, which is the required infrastructure for the connectivity environment, including wired and wireless media.

- High quality sensors and actuator, which represents the things or objects to generate the quantitative measures of the indicated values.
- High capacity or high speed data rate, which represented high speed data transfer in addition to high speed processing units.
- High storage environment, which including high storage devices such as cloud capabilities that have the ability to store, maintain and collect big amount of data.
- Big data analysis, which is a result of huge amount of devices that generate big amount of data and so these data needed the capability to process the flow of data.
- High equipped devices and objects, which including adapted new technologies to cover devices and objects.

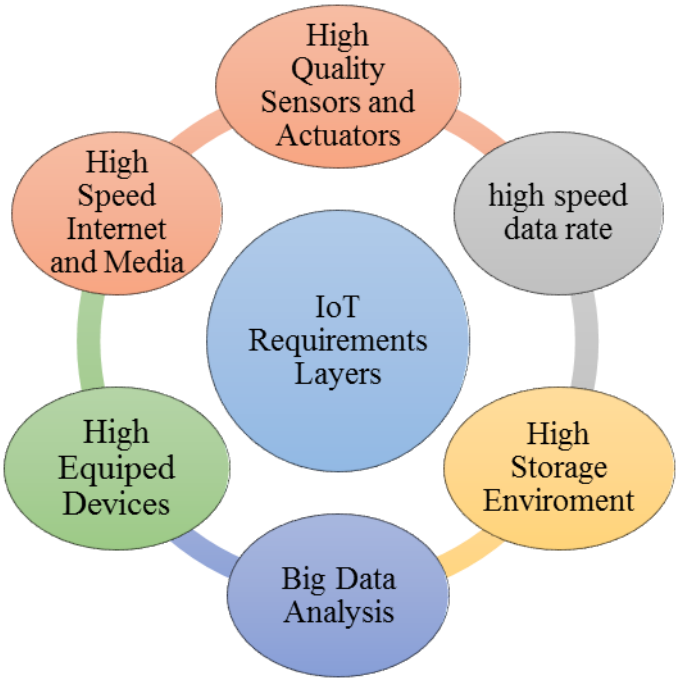

Figure 2 IoT requirement layers

II. Literature Review

According to the presented survey we can say that IoT is new field that grow vastly Depending on the urgency demand. The survey below concentrated on published works at the recent year 2017. Iman Khajenasiri et al. (2017) presented an overview of the Internet of Things (IoT). The IoT can offer a solution for the wide growth of smart cities. The main goal of IoT is to connect many disparate devices over the Internet, for which it needs a flexible layered architecture where things, people and the cloud services are combined to facilitate the application task. Such a flexible IoT hierarchical architecture model will be presented in this article with an overview of each key component for the intelligent control of energy in buildings to smart cities [17].

Li Dong et al. (2017) explained that the Internet of Things Technology provides a new line of thinking for the development of coal computerization. The mining safety monitoring and maintenance system is taken as an example in this article, and establish a predictive maintenance system based on Internet technology to change the current mode of maintenance of coal mining equipment. This model provides safe and efficient operation of mining equipment [18].

Sylwia Gierej (2017) developed the concept of a business model dedicated to companies that implement the Internet industry technology of things. The proposed concept has been developed to assist traditional enterprises in the transition to the digital market. The study was based on the available literature on the impact that Industrial Internet has on business and economy models [19].

Krzysztof Witkowski (2017) presented intelligent solutions that could be recognized as innovative solutions in the two areas: technology and organization. Previous solutions could be implemented by logistics, in the era of globalization, plays a very important role. This applies not only to the operation of individual enterprises, but also to national economies and even the world economy. The competition phenomenon can now be seen, not only in individual companies, but also throughout the supply chain. The pace of development of the modern economy means that companies are forced to constantly introduce more and more new solutions, which translates into innovation that leads to market growth. This article is part of the research, which considers the issue of the implementation of logistics IT solutions [20].

Ryan Bradley et al. (2017) demonstrated that "Big Data" approach can lead to blind astronomical costs. Therefore, this article presents a counter-approach to minimize the cost of using "Big Data" for sustainable value creation. The proposed approach is based on the knowledge of the system / expert field in combination with a machine learning algorithm to reduce infrastructure and necessary costs. Also included is a case study of the approach applied in a consumer electronics company [21].

Yee Shee Tan et al. (2017) presented Internet of Things (IoT) that provide software application for the real-time monitoring of the manufacturing stages of energy efficiency. While enabling real-time monitoring of energy efficiency, it also applies technical data envelopment analysis (DEA) to detect abnormal energy consumption and quantify differences in energy efficiency. Through a case study of a production line of microfluidic devices, it demonstrates how the application can help energy managers to incorporate best energy management practices into their daily operations and improve energy efficiency eliminating potential waste of energy in production workshops [22].

Kehua Guo (2017) proposed a solution called CSF (Crowdsourcing Semantic Fusion) that utilizes to the utmost the collective wisdom of users and introduces social computing crowdsourcing to semantic fusion. First, the intermodal semantics of correlation is undermined and semantic objects are standardized for fusion. Second, we use the approach of size reduction and relevancy of feedback to reduce non-essential components and noise. Finally, we look for the mechanism of storage and distribution. The results of the experiment demonstrate the effectiveness and precision of the proposed approach. The proposed method is an effective and practical mechanism for merging and intermodal distribution of heterogeneous social media semantics provides a new idea for semantic processing of social networks and uses an interactive visualization framework for knowledge extraction and research Social media to improve semantic knowledge and the effect of the performance [23].

Aafaf Ouaddah et al. (2017) provided a comprehensive study of the various access control solutions in Internet of things and explain their objectives, models, architecture and mechanisms. An analysis of the security and confidentiality requirements of the most dominant IoT application areas, including staff and household, government and public services, and trade and industry are taken place. The advantages and disadvantages of traditional access control models as well as the recent IoT protocols and terms are highlighted. In addition, a qualitative and quantitative evaluation of the most relevant IoT related projects representing the majority of research and commercial solutions in the field of early access control in recent years is carried out [24].

Ray Y. Zhong et al. (2017) presented a multidimensional Building Information Modelling of IoT Platform to achieve real-time visibility and traceability in the prefabricated building. The design considerations of an RFID gateway operating system, tools, visibility and traceability, data sources and decisions of interoperability services support services are specified and developed. A case study of a real-life construction project in Hong Kong is used as a pilot project to demonstrate decision-making using the advanced concepts and advanced technologies in the environment to provide a basis for real-time traceability visibility of the all prefabricated construction process [25].

Monika Bharti et al. (2017) proposed framework in the Inquisition Smart Internet Resources that meets the challenges through its three layers, namely, perception, discovery and application. The main features that unite resources for the use of semantic description and ontology, its discovery with the semantic cross-engine through the bipartite graph and access information through the Web terminal for users. Efficiency is assessed from data collected from toll collection Ladowal toll plaza, Punjab, India. The results show that SMEBG fuzzy logic control and genetic algorithm are 47% and 57% respectively [26]. The above literature review demonstrated the Internet of things as aspects and technologies. This work will concentrated on simple survey in Science Direct database and then propose a future structure for IoT.

III. Methodology

In order to generate a benefit scope of this survey an implementation of a scientific search is done through three main keywords; IoT, IoT Structure and Internet of Things. This survey covers the years from 1999 up to 2017. This survey is shown in details in table1 and demonstrated in fig.3. It is clear that there is a little of papers published at IoT between 1999 up to 2010, then the curve will go up and reach to approximately 1240 at mid of 2017. This indicated that the term IoT at the early years is not clearly identified. On the other hand both terms “IoT Structure” and “Internet of Things” are started at 1999 with slightly high published papers values compared with the searching of the term “IoT”. The main reason of this result is beyond of the use of two common words “IoT + Structure” and “Internet + Things”, means the high values is according to mixing of both statistical measures. Anyway IoT is new powerful aspect that is tell now cannot be discovered so it is the boom of the era.

Table1 IoT survey in Science Direct

Years	IoT	IoT Structure	Internet of Things
1999	138	749	1300
2000	70	1003	1650
2001	97	1250	2080
2002	71	1434	2224
2003	84	1750	2963
2004	93	1694	2960
2005	91	1822	2447
2006	67	1883	3063
2007	110	2376	3959
2008	78	2372	3695
2009	109	2154	3494
2010	89	2474	3913
2011	149	2598	3975
2012	140	2796	4334
2013	253	3070	4602
2014	362	3452	5150
2015	689	4197	6236
2016	1335	4411	6581
2017	1240	3390	4882
All years	17188	47602	74183

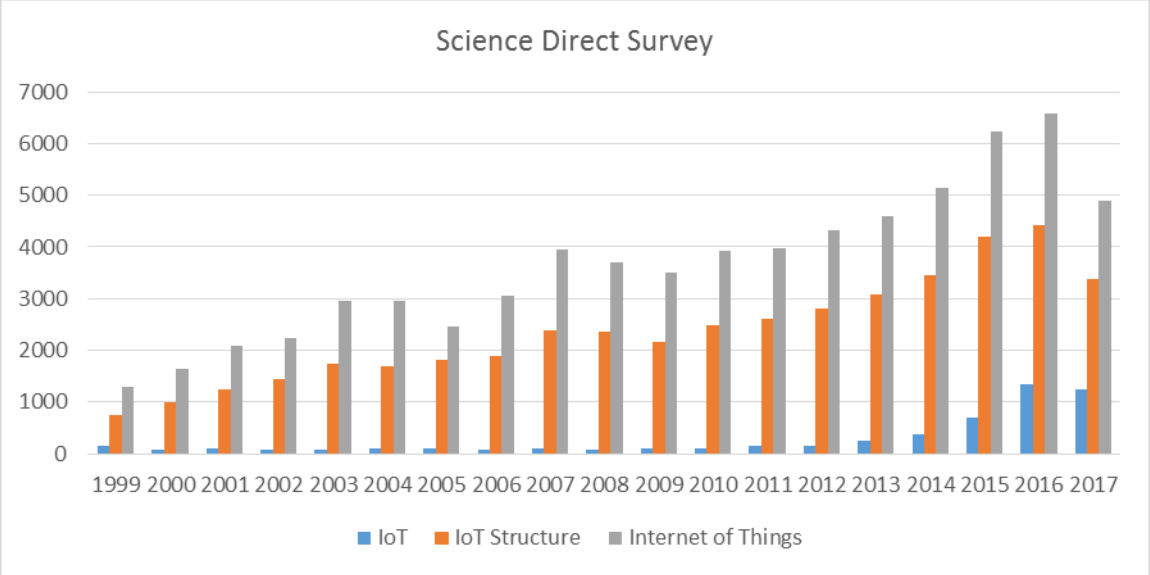

Figure 3 IoT survey in Science Direct

Proposed IoT Structure

These days Internet of Things become the powerful field that most of business looking for the future according to the change in technologies and aspects. Connecting all communications media (wired and wireless) is a big challenge of Internet of Things. The proposed idea is related to perform a covering environment media that achieve the connectivity of global devices and sensors. This structure based on hybridizing Internet technologies mobile communications, satellite communications and in addition that the intelligent sensors are adapted and synchronized to these new technologies. The principle of this structure based on that you can access anything at anytime and anyplace.

- Connectivity of anything including computers, devices, objects, things, animals, and humans.
- Connectivity at anytime including that the overall environment working 24 hours a day and 7 day a week.
- Connectivity at anyplace including at home and outside home, indoor and outdoor, statics and moving devices, inside and outside devices.

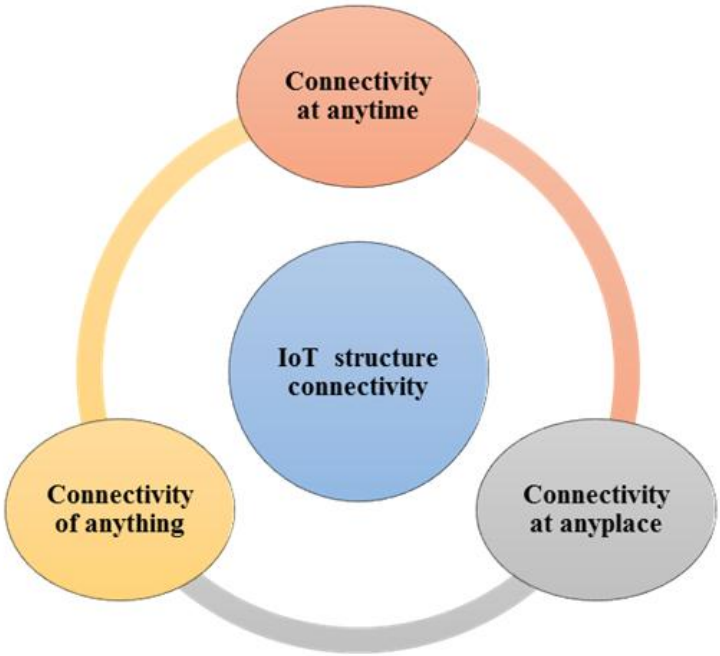

Figure 4 IoT structure connectivity

According to the global proposed structure, the global world is divided into seven continents and each continent divided into sectors depending on the size of area. The proposed structure combined four fundamental communications infrastructure environments:

- Sensor Environment including intelligent sensors that play the as interface between things and any other connected media.
- Internet environment including the fourth generation Internet and cloud computing that are able to communicate and adapt new technologies and devices.
- Mobile environment including smart advanced and future mobile generation that are able to communicate with both Internet and satellite.
- Satellite environment including geosynchronous satellites that are able to communicate with mobile environment in one side and communicate with the similar satellites in the other side.

In order to hybridize and adapt these environments, there are some proposed protocols:

- S-I Protocol which identifies all the roles between sensors environment and Internet environment.
- I-M Protocol which identifies all the roles between Internet environment and mobile environment.
- M-S Protocol which identifies all the roles between mobile environment and satellite environment.

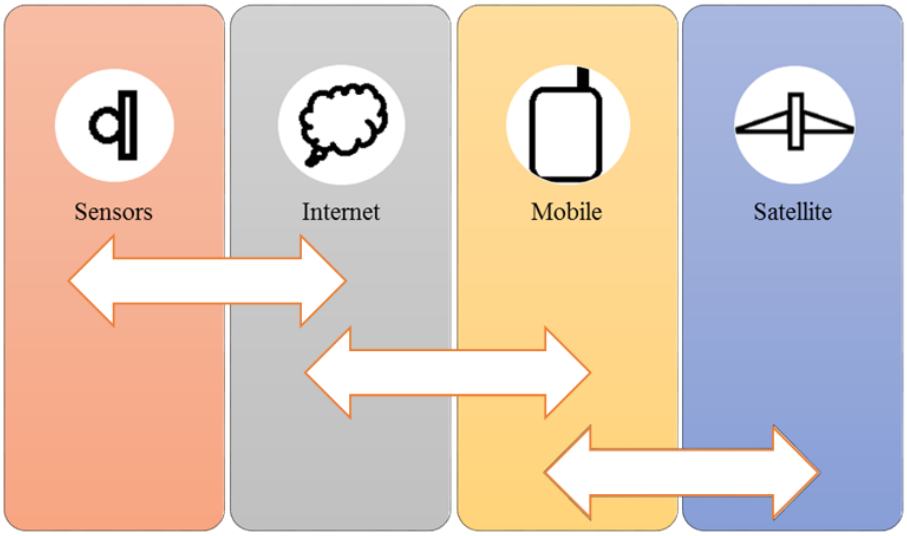

Figure 5 proposed structure

Authentication Procedure

It is difficult to apply the traditional encryption and authentication on the IoT environment. These two aspects are big challenges by adapting these new technologies. A specific gateway should be introduce to perform the authentication process. This gateway is inserted between each two different environments. This gateway is responsible of the authentication center that have two main jobs:

- Giving an authentication ID for each sensor, mobile and satellite depending country and continent.
- Generation authentication key depending on authentication ID and serial number.

The authentication process should be implemented via applying the conformation of each layer; sensor-Internet, Internet-mobile, mobile-satellite. These are the main connectivities between layers or environments. In addition it is possible to go internal-layer and external-layer. The authenticated center is inserted between layers to perform the authentication process. The authentication process conform the communication link between IoT servers and IoT devices or things as shown in fig.6.

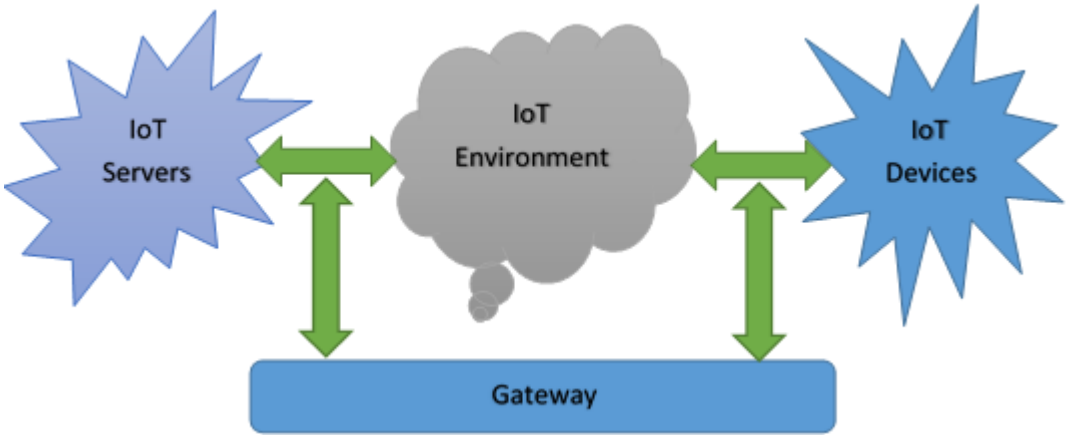

Figure 6 Authentication process

IV. Conclusion And Recommendation

The concept of advanced Internet started as a concept at 1999 to perform some idea of Internet of things. IoT is the new environment that can adapt and object or device including humans and animals via a smart connectivity of intelligent sensors. IoT is the boom of era and it will change the future aspect and technologies. The proposed structure combine sensors, Internet, mobile and satellite to perform new aspects of IoT. An authentication center is introduced between layers to identify and authenticate the operation of the overall environment structure. The proposed structure including the IoT environment inserted between IoT servers and IoT things. This approach can be adapted for human and nonhuman and it is working for anything and at anytime and anyplace. As a recommendation issue this work can be extended to include a real encryption and authentication for all layers. In addition this work can be realize as a prototype project to overcome the appeared challenges.

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