IJIREEICE

ISSN (Online) 2321 – 2004
ISSN (Print) 2321 – 5526

International Journal of Innovative Research in
Electrical, Electronics, Instrumentation and Control Engineering
ISO 3297:2007 Certified
Vol. 4, Issue 9, September 2016

An Overview on Applications of Iot in Different Fields and the Challenges Faced

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Abstract: Internet of Things (IoT) is fast becoming a disruptive technology business opportunity, with standards emerging primarily for wireless communication between sensors, actuators and gadgets in day-to-day human life, all in general being referred to as “Things”. This offers the capability to measure for understanding environment indicators.
IoT as envisioned is billion sensors connected to the internet through the sensors that would be generate large amount of data which need to analyzed, interpreted and utilized. Context aware capturing enables modeling, interpreting and storing of sensor data which is linked to appropriate context variable dynamically. Building or home automation, social smart communication for enhancement of quality of life, that could be considered as one of the application of IoT where the sensors, actuators and controllers can be connected to internet and controlled. This paper introduces the concept of application for internet of things and with the discussion of social and governance issues that arise as the future vision of internet of things. In this paper, we present the world view of internet of things and the application of this methodology from geospatial computing to physics. We give specific details on applying IoT concept to geospatial analysis in various fields from agriculture to medicine. We also provide detailed analysis of the profound impact of internet of things on our physical world which is a vital knowledge when it comes to geospatial research.

Keywords: Internet of Things; model; Radio Frequency Identification (RFID); IoT applied Industries

I. INTRODUCTION

Internet of Things (IoT) has attracted worldwide attention rapidly. Physical device are no longer disconnected from the virtual world but it can be controlled remotely from anywhere and the capability of device and physical item can act as physical access point to the internet service provider. The objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet [1]. The IoT concept, hence, aims at making the Internet even more immersive and pervasive. Furthermore, by enabling easy access and interaction with a wide variety of devices such as, for instance, home appliances, surveillance cameras monitoring. In this respect, such a formation can be used as a model of the physical world to regulate the movements of all myriads of elementary constituents of matter and their aggregates. The IoT may be more appropriately referred to as the Internet of relating to things. But where the” things” are actually information about things (meta data). We then can say” the semantic meaning of Internet of Things is the Internet relating to information of things, and the ’relating to’ in it is to say thing’s information flows rationally and orderly on the Internet, for being shared on a global scale”. A ‘thing’ can be any electronic or smart device, 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.

Due to the vastness of IoT, it finds applications in many fields. Its reach and approach to wide range of solution to real time purposes makes it very effective in fetching the data/information, processing it and taking actions based on the real time requirement. It finds application in many different domains, such as home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others [2]. The so-called medical Internet of Things is a kind of technology that embeds wireless sensors in medical equipment, combines with the internet and integrates with hospitals, patients and medical equipment to promote the new development of modern medical model. To bridge the gap between the physical and information worlds, sensors collect data from the environment, providing information necessary for the proper responses to be formulated. Radio Frequency Identification (RFID) is a very important facilitator of IoT. RFID uses radio waves to identify items so that they can be connected [3]. RFID also provides a means of tracking items in real-time, providing location and status information. In order to communicate however, smart things must be able to also process information, self-configure, self-maintain, self repair, make independent decisions, [and] eventually even play an active role in their own disposal”. This will change communication from human-human to human-thing to thing-thing. But due to the ever increasing number of smart devices and things it is very hard to maintain homogeneity.

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II. KEY TECHNOLOGY OF IOT

EPC (Electronic Product Code): The first introduction of the IoT derives from a “things oriented” perspective where thing is considering the things were very simple items radio frequency identification (RFID) tags.

The concept of IoT architecture to several scenarios like the Auto-ID labs, EPC, object name service(ONS), all this concept has target to architect the IoT with global designed. The Aim of EPC is supporting use of RFID and spread it to the world-wide network for modern future of network and also creates the smart industry for standard global for EPC global network. EPC was developed by Auto-ID from Massachusetts institute of technology for purpose of sharing data in real time by discovering a unique identifier and use RFID, wireless communication technology through internet infrastructure and platform.

EPC: It is a 96-bit code and it’s divided into four categories, first partition is Header,0-7 bits which describe the numbers, types and length of future information, the target of header is to provide extensibility for subsequent and future information requirement.

Second partition is Manager, 8-35 bits, its defining responsibility to maintenance two scenario, object type code and serial numbers in their domin. Tired is Object Class,36–59 bits, the duty of object class ais to be used for much number otherwise any other object -grouping which is developed by the EPC manager. Fourth is Serial Number, 60- 95, its describe the encoding a unique object identification number for all types, it provide 2^{36} = 68,719,476,736, unique identifiers [4]. EPC have different element, EPC encoding, EPC tag, reader, EPC savant, ONS server, PML, EPC-IS [5].

1. EPC encoding: It has four field composed including EPC header, EPC manager, serial number, object classification the coding length should for 64 bits, between 46 bit and 256 bit which should be unique number for all goods in all of the world
2. EPC tags: It’s same as RFID tags ,it’s very simple and cheap then all data should stored in EPC tags.EPC tags can divided in two categories , read-only and read/write tags.
3. Reader: Is target is to getting and capture information from EPC tags
4. EPC savant: Is manage and will deliver information that is come to reader parts
5. Object Name service: In traditional internet any host address should identified by querying appropriate server that called domain name server(DNS).Objective of DNS provide IP address for every host from certain and unique input name, but in case of IoT communication will occur between object instead of hosts therefore the concept of ONS introduce which integration and description of specific object related to RFID tags identifier.ONS is based on EPC encoding and users, to determine which data are stored in EPC-IS .
6. PML: physical markup language is developed from XML adopted a common standard syntax to describe natural objects.
7. EPC-IS: It target is storage and provide different product information to the EPC code hence this information store in PML format.

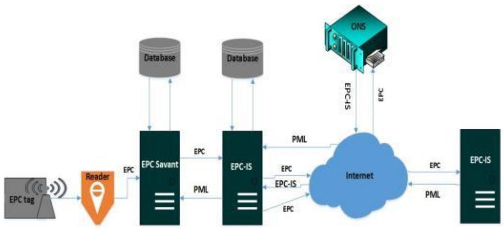

Figure1: The architecture of EPC network

The workmanship of EPC system, the reader should read EPC data in EPC tags and send it to EPC savant, after the processing and analyzing, that will occur in EPC savant for complexity, savant try to look EPC product data in local EPC-IS then if the savant find any data will directly and quickly send to EPC savant, if not the EPC-IS will send query request used EPC cods for getting keyword to the ONS serverr. When ONS returns IP address of remote EPC-IS, local EPC-IS will d it the request to the EPC-IS by query and to purpose of getting product data and will pass to EPC savant and waiting for PML cache, hence EPC savant is as core position.

RFID Technology: RFID technology is main factor in the embeddedcommunication technology,which has a simple design for purpose the of wireless data communication.RFID can help to the automatic identification of object from positional.RFID is attached for acting as an electronic barcode.RFID is the concept of using radio signals to automatically detect an object for storing and remotely retrieving data, generally component of RFID composed of:Tags, Tags Reader, Antenna, Information management software, Database

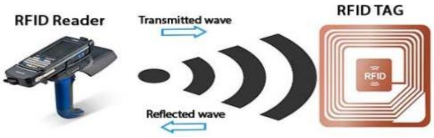

Figure 2: RFID Reader block diagram

Data is moved and transferred between data sender and data receiver device by radio waves [6]. The sender data piece is known as tags and recipient information piece is called reader or tag reader. Tags are usually placed on the objects. If we put tags in categories based on the power supply, there would be three main types of them;

Active tags,
Passive tags,
Semi-active tags.

Active and passive tags are very different, but it can be noted that active tags receive the energy needed from mobile battery, while passive tags have no power supply by them, using the energy of electromagnetic radiation emitted by the tag reader, having less range and scope reading than active tags.

DOI 10.17148/IJIREEICE.2016.4901

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Passive tags are less costly with long life, and also small dimensions. Another type of tag is also semi-active that in addition to its internal battery use, it can use the energy waves emitted by the tag reader. Antenna is used for transmitting radio signals between the tag reader and tag itself, being used for both There is information management software for data processing and data collection. This software- usually on a local server- allows the data exchanged by tag reader being collected and accepted, stored and retrieved in a database in case of any need. RFID technology can be a substitute for barcodes. In fact RFID is more than a barcode because it has an automatic system of scanner. These two technologies have major differences. The main difference is that RFID technology is capable of handling large volumes of data which necessary collected the data by tags reader.

III. ESTABLISH A 3D TECHNOLOGY MODEL TO SUMMARIZE IoT TECHNOLOGIES

General description on IoT structure & technologies

IoT is generally divided into three layers from the aspect of technology architecture, which are perception layer, network layer and application layer. The perception layer consists of various sensors and sensor gateways. Its function is like ophthalmology, otolaryngology, skin and other nerve endings used to identify objects and collect information. The network layer includes a variety of private networks, Internet, communication network, network management system, which is like nerve center and brain used to transmit and process information from perception layer. And application layer is the interface of IOT and users (including human, organizations and other systems etc.). It combines with the demands of industries to realize intelligent applications. The four-layer model is similar to the three-layer model. The supporting layer integrates the common technologies overall. It adopts unified coding, data security and privacy, data fusion, data management, and data storage cloud computing and cloud storage technology to obtain information classification [7].

3D technology model

For so many technologies involved in IoT, here we divide technologies into three dimensions (3D). Fig.3 shows the detail in each dimension.

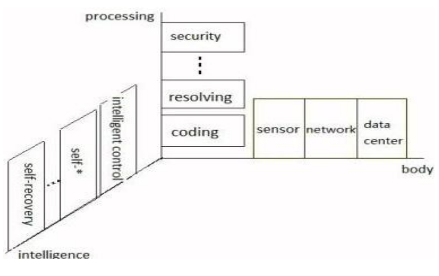

Figure 3: The IoT characters and technologies in three dimensions. Self-* means any intelligent activities made by the IoT itself, such as self-configuration, self-management and so on.

1) First Dimension: Body IoT body, like hardware engineering, includes all kinds of sensors, networks and data centers. Besides the physical devices, the character of this dimension also addresses device performance, network access, interoperability, flexibility and reliability. What's more, meeting the insufficient developing infrastructure in the underdeveloped regions around the globe is a must.

2) Second Dimension: Processing Processing means software engineering. Many functions are included here: identifying, coding, resolving, transmitting, storage, searching, security, and so on. IoT processing shall focus on requirements from thing's intrinsic existing and mankind's will, not devices.

3) Third Dimension: Intelligence Intelligence includes advanced network management, intelligent control, automatic decision making, manlike perception and others. "Self-" is its characteristic, such as self-recovery, self-organization, self-recovery, self-management and so on.

IV. APPLICATIONS IN THE FIELD OF MEDICAL AND HEALTH CARE

In the field of medical and health care, major applications of the Internet of Things include medical equipment and medication control, medical information management, telemedicine and mobile medical care, personal health management, which can be further explained as the following.

Medical Equipment and Medication Control

With the help of visualization technology of material management, we can monitor the whole process of production, delivery, anti- counterfeit and tracing of medical equipment and medication to safeguard public medical safety. Specifically, the application of the Internet of Things in the monitoring and management of medical equipment and medication includes the following aspects.

1) Constant Real-time Monitoring

In the whole process of medication research, production, circulation and use, RFID tags can be used to carry out all-round monitoring. Especially, when medicines are automatically packed, the readers installed in the production line can automatically identify the information of each medicine, and then transmit it to the database. In circulation, the readers can record all the information in the process at any time and carry out all-round monitoring. The medication quality can be guaranteed by monitoring medicine delivery and storage environment. When medication quality problems occur, we can trace back the defective medicine according to its name, category, origin, batch, processing, delivery, storage, sales and other information.

2) Medical Refuse Information Management

With the cooperation of different hospitals and transport companies and the help of RFID technology, a traceable medical refuse information system can be established,

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which can track the medical refuse during the whole process of transport from hospitals to refuse processing plants, and avoid illegal disposals of medical refuse. Currently, Japan has launched researches in this area and has made some achievements.

3) Information Sharing

Through the sharing of medical information and records, an advanced comprehensive medical network can be formed. On one hand, by using this network, authorized doctors may look over medical records, medical histories, medical treatments and insurance coverage of patients, meanwhile, patients can also freely choose or change their doctors or hospitals. On the other hand, this network support complete exchanges of information between town and community hospitals and central hospitals, and can also help town and community hospitals constantly receive treatment suggestions of medical experts, transfer treatment and medical training.

4) Telemedicine

Telemedicine [8] is a kind of new medical service, which through the combination of computer technology, communication technology, multimedia technology and medical technology, aims to improve the diagnosis and medical level, reduce health care costs, meet with the health requirement of people and construct a patient-centered service system to carry out remote consultation and continuous monitoring of critically patients. With the progress of the remote technology, advanced sensor has been able to effectively communicate within the Body Sensor Networks [9] of patients. Telemedicine Monitoring has also gradually changed from focusing on improving peoples' lifestyle to providing life-saving information and timely exchange of medical programs [10].

V. SMART CITY WITH IoT

Smart City is the product of accelerated development of the new generation information technology and knowledge-based economy, based on the network combination of the Internet, telecommunications network, broadcast network, wireless broadband network and other sensors networks where Internet of Things technology (IoT) as its core. The main features of a smart city include a high degree of information technology integration and a comprehensive application of information resources. The essential components of urban development for a smart city should include smart technology, smart industry, smart services, smart management and smart life.

The Internet of Things is about installing sensors (RFID, IR, GPS, laser scanners, etc.) for everything, and connecting them to the internet through specific protocols for information exchange and communications, in order to achieve intelligent recognition, location, tracking, monitoring and management. With the technical support from IoT, smart city need to have three features of being instrumented, interconnected and intelligent. Only then a Smart City can be formed by integrating all these intelligent features at its advanced stage of IOT development. The explosive growth of Smart City and Internet of Things applications creates many scientific and engineering challenges that call for ingenious research efforts from both academia and industry, especially for the development of efficient, scalable, and reliable Smart City based on IoT. New protocols, architectures, and services are in dire needs to respond for these challenges.

The motivation of the special issue is to bring together scholars, professors, researchers, engineers and administrators resorting to the state-of-the-art technologies and ideas to significantly improve the field of Smart City based on IoT.

VI. APPLICATION IN INSTRUMENTATION

The information from the network in this application domain is almost for service operation and optimization of consumer for customer. Rather than it was by used of utilities organization such as (smart metric) for calculate of the optimize cost. Utilities have several extra expenses about the reading and analyzing the consumer and management because the monitoring is the strength and efficient resource of management. Measuring, monitoring by control remotely it can case of saving time.

Recently smart Grid and smart metric are one of the potential IoT applications. Efficient energy consumption by smart metric can be achieve the by several monitoring in the house for electricity point and modify the utilities consumption by the owner [11].This data is useful for power plant and utilities organization with load balance of energy in the city for ensuring the high quality of customer and service. One of the important points in the IoT is monitoring of drinking water. Sensors measuring the external parameter are installed at necessary location to order ensuring the supply quality of the water. The same network can be using in agriculture for saving money and time by looking grading or grass remotely. By monitoring solid and humidity can prevent contamination and avoid on-watering with the help of IoT [12].

VII. GEOSPATIAL DATA COLLECTION AND ANALYSIS

Thousands of satellites and millions of sensors collect geospatial data around the world. According to our recent study [13], several variations occur on earth like changes in radioactive decay rates, changes in energy levels (Lamb's shift), and Josephson tunneling based on the earth's (or solar system's) galactic coordinates in space. These variations could be revealed to affect the geospatial variables around the globe. The enormous and unexpected power of the hurricane Sandy which hit the north east coast of the United States on October 22, 2013 is an example of the uncertainty of geospatial variables. The hurricane created enormous and powerful ocean waves which created seismic waves across the United States [14]. So understanding the quantum mechanics based on calendar variations becomes vital to the proper gathering of geospatial data around the world. Parameters like energy levels and radioactive decay rates not only affect the instruments but the geospatial location itself. By creating the internet of geospatial sensors and satellites, we can classify the patterns of geospatial variations connected to quantum mechanics.

VIII. 3D PRINTING AND SELF-REPLICATION OF MOLECULES

The organization of the physical world as an Internet of Things allows Big Data configurations produced not just for informational structures but for material constructions as well. The former are being developed through joining the Cloud Computing process, while the latter making use of quantum mechanics provide what can be called quantum ”3D printing”.A vital Big Data operation in living systems is selfreplication of macromolecules. This is largely related to the creation of proteins in morphogenesis and metabolism. The regular way of protein production according to the Central Dogma of molecular biology: DNA—mRNA— protein is not sufficient. Two main reasons can be pointed out. First, it is not feasible to have bulkiness fabricated step-by-step. And second, in many circumstances the proteins are to be exactly reproduced with their folding structures, like prions in the case of ”Mad Cow disease”. The Big Data malfunctions associated with protein reproductions constitute for the brain ”hardware” problems—neurological diseases, while above mentioned disruptions associated with the creation of contextual background constitute for the brain ”software” problems—mental disorders.

Another dimension includes human science, geography,science, building science and military science. We have known IoT is aimed to free human from mental labor and human characteristics are also needed to do identification in IoT. Human science is related to closely. Geography science is also concerned as geography information is significant to be used for positioning in IoT. And one of the application areas of IoT is intelligent building, so building science is essential IoT . From these aspects we can see all of the four sciences in this dimension are also related to IoT. The suggested procedure of self-replications of macromolecules is depicted in Fig. 4. It is

Is based on our interpretation of quantum mechanics behavior as a result of interactive holography [15]. The involvement of the holographic mechanism directly exposes the dominant quantum property of nonlocality that otherwise appears inconceivable. The specifics of the quantum mechanics behavior are essentially determined by the interaction of two entities: the actual particles and their holographic feedback images. It has been shown that quantum transitions as random walks of these entities are described by Schrdinger’s equation. The imprecision in localization of a particle between actual and virtual entities leads to the fundamental quantum principle of uncertainty. In relation to macromolecules this produces mesoscopic displacements of their components that leads to an effective algorithmic procedure for reproduction of the ”Big Data” structures.

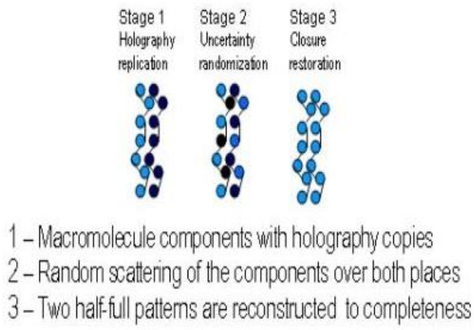

Fig.4: The Algorithm for macromolecules

The facilities for self-reproduction possibility of macromolecules should reveal new yet not recognized properties of the physical world as anticipated by P.L. Kapitsa [16]. The surmised algorithm for self-replication of macromolecules develops by means of swapping of particles with their holographic placeholders as illustrated and explicated in Fig. 4. The suggested selfreplication algorithm can be figuratively imagined as ”Xerox” copying.

IX. SIGNIFICANCE VISION

The IoT is not a single of novel technology for instance, ther are several inter-corporation technological developments which taken together to help and take the bridge between the virtual world to the physical world, such as:

1) Communication: object has to capability to network Resource to make use of data, and upgrading that states, wireless sensor technologies, such as actuators, Wi-Fi, GSM, Zigbee, all these technology recently are under the development and standard for a particular purpose of IoT.

2) Addressability: IoT object can be addresses by discovery object-name-service (ONS) and have remotely integrated together.

3) Identification objects: Objects have unique identification, such as RFID, EPC, NFC, and automatically read the labels or bar codes, which technology even the passive and active actuators. Identification can be linked to information that achieved by sensors and can be send data to the server or capturing the data by sensors or controllers.

4) Sensing: Sensors should collect the data from the objects and forward if the readers.

5) Embedded processing: Smart objects processing or micro controllers, this device can be used to process sensor information or product a “memory” of how they should be.

6) Localization objects: smart things location is the

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physical location. Mobile or any satellite (GPS) is more suitable to achieve this (ultra, wide band), radio frequency (WSN, RFID reader).

7) User interface: The target of smart object is to communicate with the people in a appropriate way (voice display, image). Most application need a subset of this capacity because the implementation of all is expensive and often required significant technological and technical effort.

X. CHALLENGES FACED BY IoT

A Coordination Layer within the IoT architecture is proposed which would" process the structure of packages from different application systems and reassemble them to an unified structure which can be identified and processed by every application system". With the growing popularity of IoT, more and more smart products or devices are involved, resulting in the problem of heterogeneity among different devices, which brings more complexity to management in IoT. In order to improve the efficiency of IoT management, heterogeneity among different devices should be encapsulated. A widely adopted way is to encapsulate heterogeneous devices by web services, which regards all different components as uniform service modules with input and output interfaces [17]. Besides heterogeneity, another challenge that IoT currently faces is the rapidly increasing number of devices. It has been reported that the Internet of Things (IoT) is forecasted to reach 26 billion installed units by 2020, up from 0.9 billion in 2009 [18]. Even though heterogeneous devices are encapsulated as homogeneous web services for better efficiency, the management of the services still needs to be treated accordingly, because of the following reasons. The traditional triangular SOA operational model is commonly used in most of service systems to manage web services, in which services are registered in a centralized Universal Description, Discovery, and Integration (UDDI) registry [18]. With exponentially increasing number of services added into the single UDDI registry, the efficiency of service management and service search decreases dramatically. Hence service management scheme should be designed from centralized to distributed, and thus brings about scalability and robustness. Also, according to the characteristics of distributed system, it should appear to the applications and users that the system with independent service management nodes is a single coherent one [19].Hence heterogeneity is the biggest obstacle to the implementation of IoT.

XI. CONCLUSION

Internet has changed forcefully in the way of we live, and interaction between people at virtual level in several context of professional life to social relationships.

IoT has potential to new dimension by enabling the processing communication of the smart objects, to achieve the vision of ", anywhere, anything, anytime, any media" communication. In this paper we trying to show absolute of the IoT should be as important part of future. In this paper we effort to show the comprehensive vision of application domain that is in IoT as well as Ring in our daily lives. We show the important vision as capability the gap between the virtual and physical world.

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