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Jgd A Emerging Field Iot: A Review

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Abstract:

Internet of Things (IoT) is a new revolution of the Internet. IoT connect different object / devices through sensing system which communicate, share information for enhancement of individual, social and intelligent & smart planet. In this paper mentioned, different applications of IoT as well as technology, challenges and future research areas which will help the researchers of IoT.

Keywords:IoT, RFID Radio-Frequency Identification, Sensors, Actuator, NFC, ZigBee,WSNs

Introduction:

Internet of Things (IoT) is a new revolution of the Internet. IoT connect different object / devices (IoT paradigm enables also called things.)with some sensing system through internet and communicate information about themselves with each other and access information that has been aggregated by other things.

The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone. It provides interaction among physical and digital world.

An IoT system is a network of networks where, typically, a massive number of objects /things /sensors /devices are connected through communications and information infrastructure to provide value-added services via intelligent data processing and management for different applications.

The IoT was started in the year 1998 and the term Internet of Things was first coined by Kevin Ashton in 1999.

IoT connects all the things with technology and makes a whole new separate world for them to interact with each other with the help of internet. IOT is not just a concept but can prove to be a revolution in advancing technology to change the lifestyles of humans altogether [1].

‘‘ A global infrastructure for the information society enabling advanced services by interconnecting (physical and virtual)things based on, existing and evolving, interoperable information and communication technologies”[2]

Technologies:

Technologies of IoT depends on technical innovation following fields:

- Technology used to connect everyday objects and devices to large databases and networks.
- Technology used for data collection with ability to detect changes in the physical status of objects.
- Technology to take action through embedded intelligence in objects.
- To make smaller and smaller things will have the ability to interact and connect.

Following technologies plays important role to make the effective and efficient communications on IoT.

Rfid

Radio-Frequency IDentification (RFID) technology consists of three main components such as a transponder or tag to carry data, which is located on the object to be identified, an interrogator or reader, which reads the transmitted data, and Middleware, which forward the data to another system, such as a database, a PC or robot control system. Frequencies currently used for data transmission by RFID typically include 125 kHz (low frequency), 13.56 MHz (high frequency), or 800-960 MHz (ultra high frequency).[3]

Sensors

A sensor is an electronic device, which detects senses or measures physical stimuli and responds to it in a specific way. It converts signals from stimuli into an analogue or digital form, so that the raw data about detected parameters are readable by machines and humans.
Apart from tracking and monitoring functions,
sensor-enabled RFID can take action on the basis of data collected by the sensor. These two technologies, in combination with modern wireless networks, create opportunities for a myriad of applications in national security, military field, agriculture, medicine, retail, food industry and many other sectors of the economy.[3]

Sensors and Mobile Phones

Today, mobile phones are not only a device for making calls, but it equipped with data, text and video streaming functions etc. Currently, the combination of sensors with mobile phones offers several possible applications such as device for relaying data collected by sensors, touch sensors,
movement recognition, sensing the status of their environment through small sensors, etc.

Wireless Sensor Networks (WSNs):

WSN is a network of nodes that sense and control the environment. It also enables the interaction between persons or computers and the surrounding environment. WSN includes sensor nodes, actuator nodes and so on.
Wireless Sensor Network (WSN) is one of the key parts of IoT system. It consists of a finite number of sensor nodes (mote) mastered by a special purpose node (sink) by employing multi layered protocols organization. Primarily energy efficiency, scalability, reliability, and robustness etc.
parameters are sought when designing a WSN powered system.

802.11 – WiFi

IEEE 802.11 is a collection of Wireless Local Area Network (WLAN) communication standards. For example, 802.11 a operates in the 5 GHz band, 802.11b and 802.11 g operate in the 2.4 GHz band, 802.11n operates in the 2.4/5 GHz bands,802.11ac operates in the 5 GHz band and 802.11ad operates in the 60 GHz band. These standards provide data rates from 1 Mb/s to 6.75 Gb/s. WiFi provides communication range inthe order of 20 m (indoor) to 100 m (outdoor). [4]

Near Field Communication

Near field communication (NFC) is a set of standards for smart phones and similar mobile devices to establish communication with each other by touching them together or bringing them together no more than a few inches. NFC devices can be used in contactless

payment systems, similar to those currently used in credit cards and electronic ticket smartcards, and allow mobile payment to replace or supplement these systems. The mobile OS Android Beam uses NFC to complete the steps of enabling, pairing and establishing a Bluetooth connection when doing a file transfer.[5]

ZigBee

ZigBee is a specification standard for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. ZigBee is based on an IEEE 802.15 standard. Though low-powered, ZigBee devices often transmit data over longer distances by passing data through inter mediate devices to reach more distant ones, creating a mesh network. [6]

Applications:

The Application domains of the IoT are numerous and expanded in all areas of every-day life of people which broadly classified into society, environment and industries

- **Society :** Activities related to the betterment and development of society, cities and people. Applications: Smart Cities, Smart Animal Farming, Smart Agriculture, Healthcare, Domestic and Home automation, Independent Living, Telecommunications, Energy, Defense, Medical technology, Ticketing, Smart Buildings
- **Environment:** Activities related to the protection, monitoring and development of all natural resources Applications: Smart Environment, Smart Metering, Smart Water Recycling, Disaster Alerting
- **Industry:** Activities related to financial, commercial transactions between companies, organizations and other entities.

Applications: Retail, Logistics, Supply Chain Management Automotive, Industrial Control, Aerospace and Aviation

Smart Cities

The IoT play a vital role to improve the smartness of cities includes many applications to monitoring of parking spaces availability in the city, monitoring of vibrations and material conditions in buildings and bridges, sound monitoring in sensitive areas of cities, monitoring of vehicles and pedestrian levels, intelligent and weatheradaptive lighting in street lights, detection of waste containers levels and trash collections, smart roads, intelligent highways with warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams. Some of IoT smart cities applications are smart parking, structural health,noise urban maps, traffic congestion, smart lightning, waste management, intelligent transportation systems and smart building. These smart cities IoT applications use RFID, Wireless Sensor Network and Single sensors as IoT elements and the bandwidth of these applications ranges from small to large. The already developed IoT applications reported on the literature are Aware home[7], Smart Sanitation [8] and City sense [9].

Smart Agriculture and Smart water

The IoT can help to improve and strengthen the agriculture work by monitoring soil moisture and trunk diameter in vineyards to control and maintain the amountof vitamins in agricultural products, control micro climate conditions to maximize the production of fruits and vegetables and its quality, study of weather conditions infields to forecast ice information, rail,

drought, snow orwind changes, control of humidity and temperature level to prevent fungus and other microbial contaminants. The role of IoT in water management includes study of water suitability in rivers and the sea for agriculture and drinkable use, detection of liquid presence outside tanks and pressure variations along pipes and monitoring of water level variations in rivers, dams and reservoirs. IoT can also be used in the detection of environmental issues. This kind of IoT applications use Wireless sensor network and single sensors as IoT elements and the bandwidth range as medium. The already reported IoT applications in this kind are SiSviA[10], GBROOS[11] and SEMAT[12].

Health Care

Many benefits provided by the IoT technologies to the healthcare domain are classified into tracking of objects, staff and patients, identification and authentication of people, automatic data collection and sensing [13].

The identification and authentication includes patient identification to reduce incidents harmful to patients, comprehensive and current electronic medical record maintenance, and infant identification in hospitals to prevent mismatching. The automatic data collection and transfer is mostly aimed at reducing form processing time, process automation, automated care and procedure auditing, and medical inventory management. Sensor devices enable function centered on patients, and in particular on diagnosing patient conditions, providing real-time information on patient health indicators.

The elements of IoT in Health Care are RFID, NFC, WSN, WiFi, Bluetooth, etc. significantly improve the measurement and monitoring methods of vital functions such as temperature, blood pressure, heart rate,cholesterol level, blood glucose, etc.

A generic Internet of Things architecture for **smart sports** "Internet of Things Sport" has been proposed to facilitate integrated interactions between sports persons, sports objects, team owner, medical teams, and followers[14]

Smart Home

Television is a media of entertainment at home. A group of researchers have developed a system for generating lightning fast reports from intelligent IoT based network communication platform, correlating the real-time DSL access line and IPTV together.[15]

IoT enabled real-time multimedia often use User Data Protocol (UDP) for transmission of data which makes huge amount of packet loss due to network congestion and channel noise. To counter this has developed an IoT oriented architectural platform to solve the front end bandwidth using a novel multimedia transmission protocol over UDP. [16]

An open source solution has also been proposed where Arduino based hardware platform is used for proper functioning of a smart home, which is an example of a typical cyber physical system, consists of input, output and energy monitoring activities. IoT cloud platform is also integrated with the implemented setup.[17]

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. Smart Home products are promised to save time, energy and money. With Smart home companies like Nest, Ecobee, Ring and August, to name a few, will become household brands and are planning to deliver a never seen before experience.

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

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 machine 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.Networked Toys is one application of IoT which will change the playing experience of your kids.

Security & Emergencies

The IoT technologies in the field of security and emergencies are tremendously increased in which few are listed; perimeter access control, liquid presence, radiation levels and explosive and hazardous gases, etc. The perimeter access control is used to detect and control the unauthorized people entry to restricted areas. The liquid presence is used for liquid detection in data centers, warehouses and sensitive building grounds to prevent break downs and corrosion. The radiation levels application used to measure the radiation levels in nuclear power stations surroundings to generate leakage alerts and the final IoT application is used to detect the gas levels and leakages in industrial environments, surroundings of chemical factories and inside mines.

Challenges of IOT:

Although there are lot of development in the area of IoT still large research effort is still required in this direction, in this section review technical problem associated with IoT.

Technical challenges

There are still many research challenges for industrial use such as technology, standardization, security and privacy and also industrial characteristics and requirements on factors such as cost, security, privacy, and risk.

(i) Design of Service oriented Architecture (SoA) for IoT is a big challenge. SoA needs to handle a large number of devices connectedto the system which phrases scalability issues. At this moment, challenges like: data transfer, processing and management become a matter of burden over headed.

(ii) IoT is a very complicated heterogeneous network platform.This, in turn enhances the complexity among varioustypes devices through various communicationtechnologies showing the rude behavior of network tobe fraudulent, delayed, and non-standardized.

(iii) As of now, IoT is degenerated on a traditional networkoriented ICT environment. Here, a need of unified informationinfrastructure is to be sought. Huge number of connected devices shall produce real-time data flow whichmust be governed by high band width frequency path. Hence, a uniform architectural base is to be created tocater the infrastructure needs sophistically.

(iv) The originated data may be too much large in size that current database management

system may not handle inreal-time manner.

(v) Different devices attached to the IoT will put down data of variety in type, size and formation. Researcher should come forward with novel Big IoT Data specific design where these data can efficiently handled.

(vi)Big data problem is sufficient for handling similar regression. Relevant architectural framework is

in evident that can hale data mining, analytics, andhence decision making services. Big Data approach could be aggregated herewith.[21]

(vii) In addition, industries must seek the challenges of hardware software coexistence around IoT.

(viii) The IoT is visualized to include an incredibly high number of nodes. All the attached devices and data shall be retrievable; here in such context, the unique identity is a must for efficient point-to-point network configuration.

(ix) Securitystandards, communication standards and identificationstandards need to be evolved with the spread of IoT technologies while designing emerging technologies at
a horizontal equivalence.

(x) The widespread applicability of IoT and associated technologies shall largely depend on the network cum information security and data privacy protection. Beinghighly complex and heterogeneous in nature, IoT always faces severe security and privacy threats due to it IoT is not fully safe. Deployment, mobility, And complexity are the main challenges [18]

Lack of standardization and mobility, weak infrastructure, security and privacy issues, poor internet connectivity, limited labor force skill and low share of value-added products are main challenges for usability of IoT in developing countries.[19] How to efficiently integrate these protocols into the IoT architecture are also open issues.[22][23]

Future Research Areas of IoT:

Internet of Nano Things

Internet of Nano Things (IoNT) as a type of IoT with small networks comprising extremely small devices in personal area. In the IoNT, by embedding nano-sensors to the various objects anddevices that surround users, it becomes possible to add anew dimension to the IoT. Such miniature sensors, interconnected through nano-networks, could provide data from the things (i.e., devices) deployed in hard-to-access areas. The IoNT is expected to lead to the discovery of novel insightsand applications in the IoT field.[20]

Data proccessing

for controlling bigdata as the requirements for the future IoT system. In the integrated IoT system, since various kinds of data arecollected from many systems, huge quantities of data are needed to be controlled. In the future integrated IoT system, not only the amount but also the number of varietiesof data is also quite large, which causes the difficulty of the data management in the existing system.[21]

The Io<*> refers to Internet of Any architecture Io<*> is completely a hypotheticalconcept that must be tracked on. Analog, digital, and hybridobjects shall be the 'things' part. Not only solid but also liquid,semi-liquid, and crystallized type of materials may be thepart of it. Integrated chips (IC), system on lab, lab on chip, FPGA, ASIC, and flexible electronics elements shall miniaturizethe distance between digital and pure digital mechanism.

Conclusion:

The IoT promises to individuals to provide quality, easier and comfort of life. For society, the IoT has the potential to enable extensions and enhancements to fundamental services ineducations,health, agriculture, transportation, logistics, security, utilities, and other areas. At country level provides security, productivity, proper management of resourcesand so on.

The IoT has added a new potential into internet by enabling communicationsbetween objects and human, making a smarter and intelligentplanet. IoT has the vision of ‘‘anytime, anywhere,anyway, anything” communications

References:

1. Li, S., Da Xu, L., & Zhao, S. The internet of things: a survey. Information Systems Frontiers,2015,17(2), 243-259
2. ITU work on Internet of things, 2015.ICTP workshop.
3. Internet of Things: Wireless Sensor Networks, IEC WP IoT:WSN:2014-11(en).
4. P.P. Ray, “A survey on Internet of Things architectures”, Journal of King Saud University – Computer and Information Sciences,2018, 30, 291–319
5. Dr. V. Bhuvaneswari, Dr. R Porkodi“The Internet of Things (IoT)Applications and Communication EnablingTechnology Standards: An Overview”2014 International Conference on Intelligent Computing Applications Conference Paper · March 2014DOI: 10.1109/ICICA.2014.73
6. S. Marksteiner, V. J. Exp´ositoJim´enez, H. Vallant, and H. Zeiner, “An Overview of Wireless IoT Protocol Security in the Smart Home Domain,” 2017 Joint 13th CTTE and 10th CMI Conference on Internet of Things Business Models, Users, and Networks, Copenhagen, 2017, pp. 1-8. doi: 10.1109/CTTE.2017.8260940. http://ieeexplore.ieee.org/document/8260940/
7. Kidd, R. Orr, G. Abowd, C. Atkeson, I. Essa, B. MacIntyre, et al. The Aware Home: a living laboratory for ubiquitous computing research,in: Lecture Notes in Computer Science, 1999, pp. 191–198.
8. J. Domingue, A. Galis, A. Gavras, T. Zahariadis, D. Lambert (Eds.), The Future Internet,
9. Springer-Verlag, Berlin, Heidelberg, 2011, pp. 447– 462.
10. R.N. Murty, G. Mainland, I. Rose, A.R. Chowdhury, A. Gosain, J. Bers, et al., CitySense: an urban-scale wireless sensor network andtestbed, 2008, pp. 583–588.
11. System of monitoring and environmental surveillance, 2011. http://www.dimap.es/
12. enviromental- agriculture-services.html.
13. S. Bainbridge, C. Steinberg, M. Furnas, GBROOS—an ocean observing system for the Great Barrier Reef, in: International Coral ReefSymposium, 2010, pp.529–533.
14. R. Johnstone, D. Caputo, U. Cella, A. Gandelli, C. Alippi, F. Grimaccia, et al., Smart environmental measurement & analysistechnologies (SEMAT): wireless sensor networks in the marine environment, Stockholm, 2008.
15. A.M. Vilamovska, E. Hattziandreu, R. Schindler, C. Van Oranje, H. De Vries, J. Krapelse, RFID Application in Healthcare –Scoping andIdentifying Areas for RFID Deployment in Healthcare Delivery, RAND Europe, Feb 2009.

16. Ray, P.P., A generic internet of things architecture for smartsports. In: Proceedings of IEEE International Conference onControl, Instrumentation, Communication and Computational Technologies,2015b, pp. 405–410. 2015.
17. Kos, A., Sedlar, U., Sterle, J., Volk, M.,. Networkmonitoring applications based on IoT system. In: Proceedingsof 18th European Conference on and Optical Cabling and Infrastructure (OC&i) Network and Optical Communications(NOC), 2013pp. 69–74.
18. Jiang, W., Meng, L., Design of real time multimedia platformand protocol to the internet of things. In: Proceedings of IEEE 11th International Conference on Trust, Security and Privacy inComputing and Communications (TrustCom),2012, pp. 1805–1810.
19. Lin, H.T., Implementing smart homes with open source solutions. Int. J. Smart Home,2013, 7 (4), 289–296.
20. S. Marksteiner, V. J. Exp´ositoJim´enez, H. Vallant, and H. Zeiner, "An Overview of Wireless IoT Protocol Security in the Smart Home Domain" ,2017 Joint 13th CTTE and 10th CMI Conference on Internet of Things Business Models, Users, and Networks, Copenhagen, 2017, pp. 1-8. doi:10.1109/CTTE.2017.8260940. http://ieeexplore.ieee.org/document/8260940/
21. EgemenHopalı, ÖzalpVayvay, Internet of Things (IoT) and its Challenges for Usability in Developing Countries, International Journal of Innovation Engineering and Science Research 26 January 2018,https://www.researchgate.net/publication/322714582
22. Yuichi Kawamoto, Hiroki Nishiyama, Nei Kato, Naoko Yoshimura, andShinichi Yamamoto, "Internet of Things (IoT): Present State and FutureProspects", IEICE Transactions on Information and Systems,Oct. 2014, vol. E97-D, no.10, pp. 2568-2575.
23. Marjani, M., Nasaruddin, F., Gani, A., Karim, A., Hashem, I. A. T., Siddiqa, A., &Yaqoob, I.,BigIoT data analytics: Architecture, opportunities, and open research challenges. IEEE Access,2017, 5, 5247-5261.
24. Falguni Jindal1, Rishabh Jamar2, PrathameshChuri, "FUTURE AND CHALLENGES OF
25. INTERNET OF THINGS", International Journal of Computer Science & Information Technology
26. (IJCSIT), April 2018,Vol 10, No 2,
27. IoT 2020: Smart and secure IoT platform, IEC WP IoT Platform:2016-10(en).