

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

IoT-Based Intelligent Wireless Network

Vivek Kinage¹

U.G. Student, Department of Information Engineering, MIT SOE Engineering College, Loni Kalbhor,
Maharashtra, India¹

ABSTRACT: Newly, Internet of things (IoT) have been widely studied and applied in many fields, as they can provide a new method and applied in many fields, as they can provide a new method for intelligent perception and connection from M2M (including man-to-man, man-to-machine, and machine-to-machine). The internet of things is based on the Internet, network wireless sensing and detection technologies comprehend the intelligent and processed on the tagged object, tracking, monitoring, managing and processed automatically. Wireless sensor networks have increasingly become contributors of very large amounts of data. Internet of Things (IoT) network contains heterogeneous resource-constrained computing devices which has its unique reputation in IoT environments. Internet of things must necessarily be the result of synergetic activities directed in various fields of learning, for example telecommunications, informatics, electronics and social science. This paper focusses around how these innovative technologies need to cooperate to give IOT availability. The primary empowering component is reconciliation of a few technologies and communication solutions, Recognition of several tracking technologies, wired sensors and wireless sensors and actuators networks (of IOT), enhanced intelligence for smart objects.

KEYWORDS: Communication, Network Protocol Communication, Wireless Network.

I. INTRODUCTION

Developments in innovation mostly rise up due the requirements of human culture. Developments in innovation mostly rise up due the requirements of human culture. The internet of Things (IoT) usually directs to the interconnection of different types of computing devices to support various kinds of control and monitoring applications. The basic idea is to increase the recognition of the variety of things such as RFID tags, mobile phone and other electronic devices. Which through unique addressing ways and techniques and are able to interact with each other and cooperate with their neighbors to reach common goals defined.

A smart network provides an intelligent way to manage components such as transport, health, energy, homes and building the environment. The data generated by these components are primarily by wireless sensors networks. Wireless sensor networks have been deployed in many industrial and consumer applications such as health monitoring systems, smart home applications, water monitoring systems and environment monitoring systems.

The clearest results will be equally be seen in fields such as automation and manufacturing in industry, business/process management intelligent transportation of people and goods. The better improvement can be put into this by introducing wireless technology, which will reduce the complexity of wired transmission. The cost and installation efforts of installing large number of sensors in old environment will be reduced almost by implementation of wireless communication medium. There are different wireless communication medium in which a wireless sensor network can be constructed according to respective applications and strengths of those applications. Home automation and monitoring systems/applications, where numerous sensors are deployed, to determine different activities of humans. Wireless sensors can be operated through batteries or via any power supply. Wireless networks are comprised of several nodes prepared through several different sensing devices (sensors, controllers and actuators) and Rf chips.

Sensor nodes associated with different applications generate large amounts of data that are currently significantly under-use. Using existing ICT infrastructure, generated heterogeneous information can be brought together [9]. Some

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

of the exiting wireless communication technologies that can be exploited to achieve this information aggregation are 3G, LTE and Wi-Fi. In the context of usage of embedded devices and existing internet infrastructure the Internet of things (IoT) encompasses PC'S and other surrounding electronic devices. The intelligent network vision is dependent operating billions of IoT devices from a common place. Actualization of the IoT idea into the real-life applications or systems can be now possible through the involvement of several enabling mediums, such as EPC, RFID, GPS, GPRS, Internet, WSN etc.

As a consequence, the number of IoT- based applications has boomed as well. All these technologies facilities the deployment of IoT devices in our environment. Some researches attempt to integrate wearable devices and system in IoT scenario to achieve better wireless networking services[10].

II. RELATED WORK

A. IoT Based Intelligent Computing Energy Management

IOT based energy management are very value-added because they providing important services in deep reinforcement learning with computing infrastructure. It is crucial component for building smart architecture which is not enables new energy-related services but also automate the operations to control the city for to making it as smart city.

A. IoT Based Node demonstrator For Devices Monitoring And Control the Oil And Gas Sector

Companies of oil and gas sector are constantly faced problem that are majorly impact on their overall value chain. Internet of things is now providing the widely solution which is now adopted to improve the oil exploration and maintain the existing facilities and also reduce no- productive time.

B. IoT Based in Real-Time Monitoring and Detection of “Heart Attack” using wireless Sensors

This system has the capability to supervise the multiple patient at a time, to give remote diagnosis and prescription, and also for to providing fast and effective warning to doctors, relative and hospital's staff. This system is capable of monitoring the real-time, analytical cardio vascular disease, detecting life threatening of heart attack, and propagate the alert to the nearby vehicles. The currently avail cardiac monitoring system require the connectivity either cellular network or wireless network. This is capable to find the alert to the patient through the smart watches with high beep alarms.

C. IoT Based Smart Transportation

This system uses wireless sensors for to obtain a traffic information, real-time. Conditions of traffic on each road, the condition of number of vehicles and also the average speed. Wireless sensors utilization is much arrogating due to their low power expenditure and minimum cost. In other words, to achieve a big-scale networks layout, the system uses sensor network wireless cluster. Each cluster is a set of wireless cluster network which is represented by the head node. Data as the head node set which is delivered to the backend system, by means of a mobile with sensors and GPS are capable of receiving and sending information which is travel thought out the network, that can be used for measure the speed and direction .This system use wireless sensors to obtain the traffic information, real-time. Conditions of traffics on each road and the condition of number of vehicle and the average speed.

III. IOT ARCHITECTURE AND PROTOCOLS

A. Internet of Things

Internet of Things (IoT) basically means “a world-wide network of interconnected objects uniquely addressable, based in standard communication protocols”, which is a novel paradigm that is rapidly increasing in the era of modern wireless telecommunication. The basic idea of this concept is the universal presence around us of a variety of things or objects-such as (RFID) tags, sensors, actuators, mobile vehicles, etc. which through unique addressing techniques are able to collaborate with each other and cooperate with their neighbors to reach common goals as defined. Abilities

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

offered by the IOT is to make possible the development of huge number of applications to interact with each other and work for joint goal accordingly.

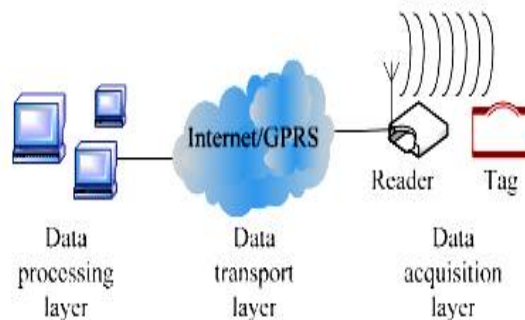


Fig 1. Three-tier architecture of Internet of Things

The bottom layer is an object-object network, a network that take use of a variety of sensors, RFID to form object identification and data reading and writing between objects. This layer is data acquisition layer contains wired network and wireless network as well, its supporting technology primarily includes GPS, GPRS, and the internet and other technologies as well. The top layer of the internet of Things (IOT) is data processing and data exchange layer, the task of this layer is to complete data exchange and data processing, data calculation, data storage and other functions defined to that specified layer respectively.

I. Data processing Layer

When you want to use data, you really save that data to find out anything juicy from that data for that you will need to process and analyze that data. A common method is by using a Map Reduce Tool essentially, this is used to select the elements of the data that you want to analyze and putting it into a format from which insights can be gleaned. If you are having a large organization which invest on its own data analysis team, they will be a part of this layer as well.

II. Data Transport Layer

The transport layer is the layer in the open system interconnection (OSI) model which is responsible for commination end-to-end over the network. This layerprovides obvious communication between the application running process on different hosts with in layered architecture of protocol and other network components. This layer is also responsible for managing error correction. Providing quality and trustworthiness to end user. This layer enable host to send and receive data error corrected, packets or messages over the network.

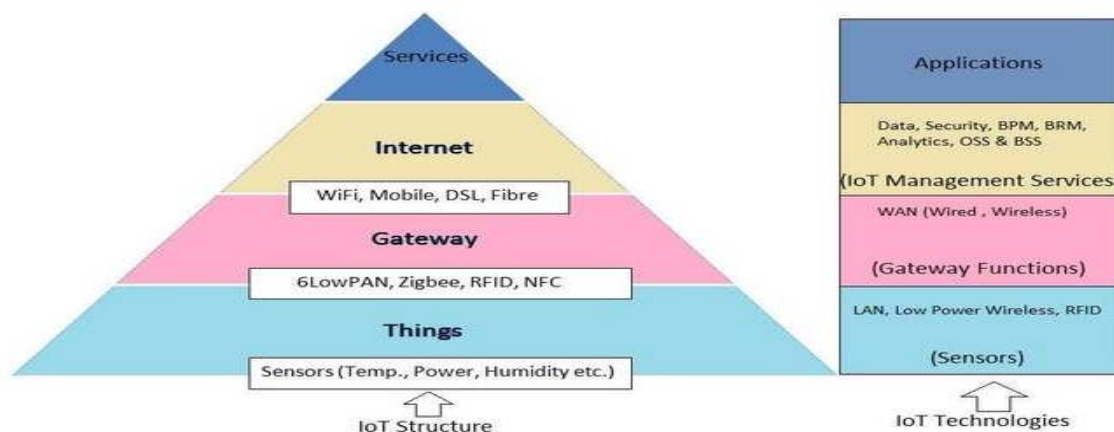
International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

III. Data Acquisition Layer



Sensors for various application are used in different IoT devices as per different application such as temperature, power, humidity, proximity, force etc.

Gateway takes care of various wireless standard interface and hence one gateway can handle multiple technologies and multiple sensors. The typical wireless technologies used widely *are* 6LoWPAN, Zig bee, Zwave, RFID, NFC etc. Gateway interface with cloud using backbone wireless or wired technologies such as Wi-Fi, Mobile, DSL or Fiber.

7) IoT Hardware Architecture

As we have seen that IoT devices consist of upper protocol stack and physical and RF layers. The system can be constructed using MCU(Micro-controller-unit). Choice of MCU depends on system on chip resources, power required, and interfaces need as per different sensors Memory requirement of IoT hardware also needed to be carefully studied. In order to finalize the hardware architecture of IOT following things need to be done. These parameters will help to finalize ideal IoT hardware prototype as well as cost of the required IoT hardware components.

- Type of sensors/actuators
- Communication interface type
- Amount of data to be captured and transmitted
- Frequency of the data transportation

This layer is where the source data is first received, as such, it represents data in its raw form. Two sectors reside in this layer, each with similar structure and level of sanitize, but ultimately serving a different purpose then each other being in same layer.

As we know that IoT devices either communicate directly with the central server (Access point) for data storage or communicate via gateway devices.

8) IoT Architecture for Software

Typically, IoT software architecture is based in open source components. Figure-3 above depicts IoT architecture commonly in use for most of the system.

Now-a-days many companies are working to provide ready to use IoT frameworks for various IoT specific application. CoAP

Protocol is used in which is unique to IoT applications and offer common mechanism to communicate with IoT devices

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

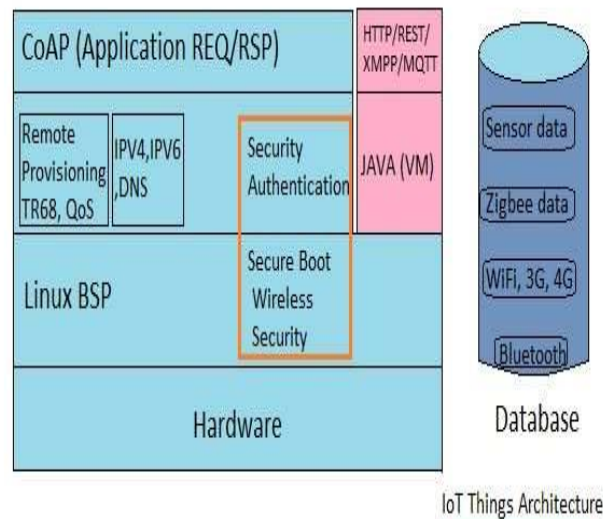


Fig 3. IoT Software Architecture

IV. WIRELESS NETWORKS PROTOCOL

The list if the Internet of things protocol

1) Bluetooth

Bluetooth is use in all over the world, it's frequency in the personal area network is 2.4 GHz, it is minimum range for wireless communication. This device-to-device file transfers, wireless speakers, and wireless headsets are sometime enabled with Bluetooth.

TABLE I
OPTIMAL FEATURES OF BLUETOOTH

Bluetooth Versions	Optimal Features			Enhanced Data Rate (EDR)
	Basic rate (BR)	High Speed (HS)	Low Energy (LE)	
Bluetooth1.x	Yes	No	No	No
Bluetooth2.x	Yes	Yes	No	No
Bluetooth3.x	Yes	Yes	Yes	No
Bluetooth4.x	Yes	Yes	Yes	No
Bluetooth5.x	Yes	Yes	Yes	No

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

2) ZigBee

ZigBee is a mesh local area network (LAN) protocol with frequency 2.4GHz. It was firstly designed for automation and control the things like lighting system and like wireless thermostats often use ZigBee.

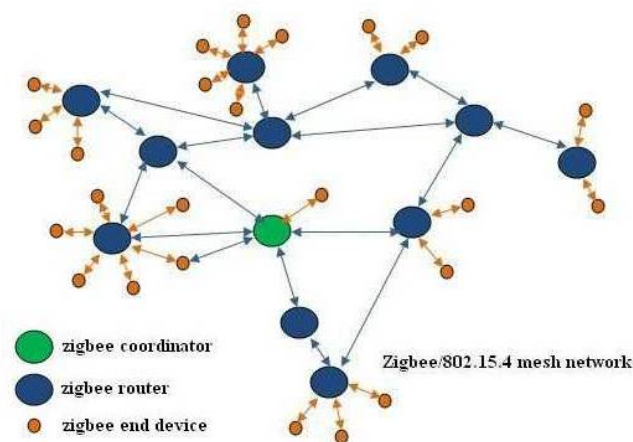


Figure 4. ZigBee Network Overview

As network in the diagram, zigbee network is comprised of and end devices (E), coordinators(C), and router (R) Zig bee supports mesh-routing. For descriptive information on routing protocol in zigbee one may refer AD-hoc-on-demand, distance Vector Routing protocol (AODV protocol).RFC3561

7) 6LoWPAN

The term above is referred to WPAN network having IPV6 based protocol. Most of the networks deployed are based on IPV4 because they need to interoperate legacy IPV4 with latest introduced IPV6 network.

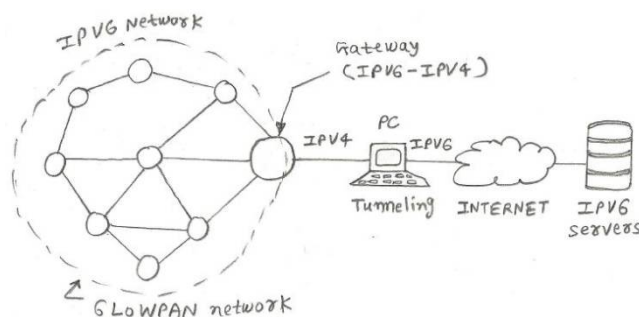


Fig 5. 6LoWPAN Network Overview

Communications is based on IP to travel over lower data rate networks. It is an open IoT network protocol like ZigBee, and it is initially used for home and building automation.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

7) Thread

It is an open excellence built on IPv6 and 6LoWPAN protocols. People could generally think of it as Google's version of ZigBee. We can literally use some of the same chips for Thread ZigBee because they're both on 802.15.4. The thread technology is extensively targeted for M2M and IoT market. It is majorly based on exiting 802.15.4 standard. A ameliorate software to exiting 802.15.4 products can add thread features.

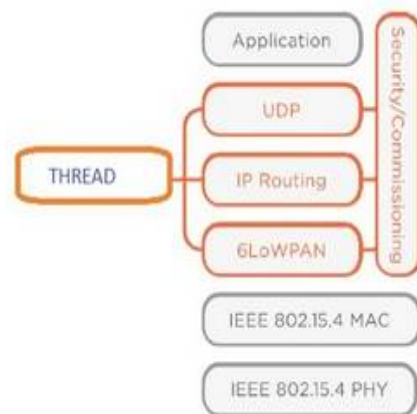
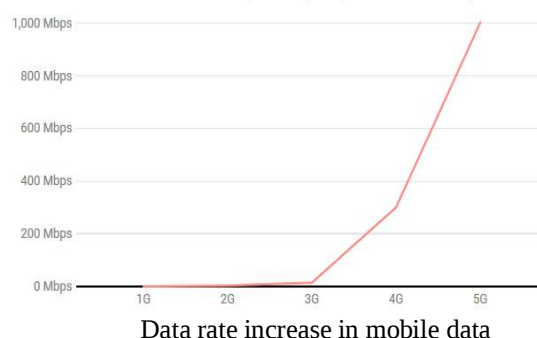


Figure 6.Thread Basic M2M IoT

7) 3G 4G and 5G

Initially there are any version , the first generation is called 3G and after there so are some series of generation may come which 2G,3G,4G and till 5G, The third generation 3G was the first “high speed” cellular network and is a name that refers to a number of technologies that met IMT-2000 standard, 4G is the generation of cellular standards that followed 3G, You can use 3G and 4G for IoT devices, but the application need a constant power source or must be able to be recharged regularly. Technical improvements that brought data rates up from 200 kilobits, 5G is expected to transmit 1 gigabit per second

Technology is change day-by-day and that's why they a complete power in any time because of the latest version of the applications. Technical improvement, data rate and expected transmit data 1 gigabit per second has high rate.



From the year 1980s to what's we expect for 2020,each and every generation of wireless transmission has received and send more data in less time, with major improvement in recent years.

5G system offer the may providing the reliable connection to huge numbers of wireless devices at a time. The number of “internet of things” are used in devices tracking, nutrients in soil for farmers, packages locations

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

for shipping companies and vital signs for hospital patients and for instance.

6) Wi-Fi (wireless Fidelity)

Wireless Fidelity is famous by the name Wi-Fi or wifi is a local area wireless technology, it helps an electronic devices to transfer the data wirelessly. Many electronics devices use Wi-Fi like PCs, video games, cameras and digital audio players. Wireless router and wireless Adapter help in the Wi-Fi operation.

Wi-Fi is defined as any Wireless Local Area Network (WLAN) support the product by the 802.11 standards of IEEE. Wi-Fi technology uses wireless adapter which translate data in radio signal and transmits them to air. Transmitted radio signals are receiving by the router, it decodes and transmits the data to internet. The entire process is reversed when data from internet. Wi-Fi uses high frequency when is compare to other wireless communication techniques, which lie in the range 2.4GHz or even high frequency ,5Ghz signal can carry more data. It use 802.11 standards in which Wi-Fi is defined has a few version.

1) 802.11a

Transmission frequency of 802.11a is 5GHz. It improves the data speed up to megabits per second. It uses orthogonal frequency-division multiplexing (OFDM). In this technology the radio frequency is divided into many sub signals before it reach to a receiver.

2) 802.11b

It is the least expensive and slowest method. In 802.11b has a data rate of 11 megabits per second. It is the cheap and slowest method.

3) 802.11g

802.11g uses the similar frequency as that of 802.11b that is 2.4GHz. The data rate is very high since it uses OFDM and its data rate is 54 megabits per second.

4) 802.11n

802.11n is the most widely used standards. It support a data rate of 140 megabits per second. The technology is backward compatible with all the standards.

7) LiFi

LiFi , the next revolution wireless technology .Light Fidelity(Li Fi) is a ground breaking technology that utilize the visible light spectrum to unlock capacity of data transmit at 10 times, the speed of wireless fidelity is operated the radio spectrum and radio wavers to process the data while the LiFi is ubiquitous system technology with innovative networking capabilities. Those application which are universal provide a variety of devices platform for fast-speed internet communication. It provides users with better security, capacity and availability as compared to Wi-Fi. In future Li-fi include its application in different fields such as education. Medicine. Industries and other regions requiring further exploration.

8) EcOcean

Ecocoean is a wireless technology compliant to energy harvesting. It delivers high data rate at low energy consumption. It takes care of multiple simultaneously transmitting devices. Up to 50 manufacturing companies have already created about 200 EnOcean compliant products. it is specified in International Standards ISO/IEC 14543-3-10

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

TABLE 2
EnOcean FEATURES

Specification/feature	EnOcean support
Frequency range	868.3 MHz or 315 MHz(world wide)
Radio regulation	R&TTE EN 300220, FCC CFR-47(part-15)
Transmit power	6dBm typical. at antenna input
Receiver sensitivity	-97dBm typical
Modulation scheme	ASK
Data Rate	125(Kbyte/Sec)
Channel Bandwidth	280KHz
Min. telegram length(ms)	0.6
Energy need	extremely low (including startup)
Risk of data collision	Very low
Battery less radio transmitter	Yes

9) RFID

RFID is a radio frequency identification technology. It uses the electromagnetic fields to transfer the data. The RFID is helping to identify, and track tags attached to the objects. It is method for Data Capture and identification.

V. APPLICATION OF IOT

IoT originated from the radio frequency identification devices (RFIDs) system proposed by MIT and auto-ID Labs in 1999. In this Tunis world summit on information society in 2005, the international telecommunications Union (ITU) enlarge this concept largely in "ITU INTERNET REPORTS 2005 EXECUTIVE SUMMARY: The Internet of Things" provide the explanation of this concept: "the intelligent connectivity for anything at any time"[5]. With IoT, most of the data required can be acquired in real time by RFID techniques, infrared sensors, global position system(GPS) sensors, gas sensors, laser scanner, and other devices. Under the influence of related researches and developments nowadays IoT has developed from connecting things to things to the combination and integration of information space and physical world.

The management, Internet and applications of the ever-present services in different industries based on web services, CC and other related techniques.

Although, it is used in most of the application backgrounds: for instance, the application of smart home or smart building or smart city, smart business smart inventory and product management, healthcare, environmental monitoring, social security and surveillance and so on [10]

VI. EMERGING TRENDS IN WIRELESS NETWORKING

This year, like past year, I have a few predictions. But I'd also like to focus on a wish list for trends in wireless networking technology -here we go and discuss some wireless networking trend for future.

It is a time that of year again, time look back and forward at the network industry and in specific area of expertise.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

Wireless networking technology give strong transmission by the use of these technologies. Interference is avoided by wireless technologies. Ethernet protocol is possibly too manipulated to get more reliable and efficient. Better supervision and collaboration, better range and efficient security and integrity.

1. Millimeter wavers

Frequencies above than 30 GHz- and specifically the big watch of unlicensed spectrum round 60 GHz—remain under used today. The prices for component have fallen, and ease of use has improved still have high hopes for 802.11ad and its successor, 11ay which could result in 100 Gbps wireless LAN. The expected range is point-to-point, point-to-multipoint and mesh services net year and mainly the 5G mobile services next year is the highway wireless and we can't afford to ignore it any more.

2. Built-in performance evaluation and management tools

This drives me crazy , I want to measure the performance of a given link between a Wi-Fi client but there's no way to do so need to go through the APA across another link and into server there by .This seems like no-brainer and yet it remains to be invented here by putting all patient rights in the public domain.

3. System-independent, edge-to-core analytics

Analytics based on AI and machine learning are essential and increasing day-by-day. Networks today are simply too complex for mere mortals to understand, configure, optimizes and troubleshoot, while also maintaining ROI. Analytics that run across the entire network and across products from multiple vendors, we need the proper record of that analytics. In other words, we need end-to-end analytics. But it is typical and tough nut to crack, just like cross-vendors unified management has been. However, we need it, and someone is going to do very well here over the next few years.

4. One-stop wireless security as a service

No one is ever done with security; it's always evolving and considering the range of potential threats will remain vast, an end-to-end cloud service could be the best way to address this challenge. We're making progress here but again we're never done.

1. Carrier-independent services

A competitive market boos performance reliability and availability, while driving down costs. Sure, the carriers will continue to push into value-add, and that's fine. But all services ultimately need to be independent of carrier

2. 'Get smart' replaces 'get more; for network performance issues

Historically, the blueprint for dealing with performance issues, such as system-wide measures , has been to update for the upcoming generation of technology—like 10,000 or 1,000 Gigabit Ethernet and 802.11b/gn/acax and that's fine, but the more important Trent going forward will be to apply more intelligence and nor more brute-force. Consider, for example AI machine learning, software-defined anything and networkfunctions implemented in software, with less specialized hardware. These networks have more flexibility and adaptability thanks to software running on high-performance, in expensive processors in all networks.

VII. CONCLUSION

The internet of things has changed drastically the way ,In recent decades, there is fast growth in the population which increase the rate of IOT devices, now IOT devices are used in everywhere and in every field , IoT network can be integrated with low energy network for to minimize the consumption power like Bluetooth, ZigBee and 6LoWPAN and strong strength the 3G,4G,5G Wi-Fi in future the Li-Fi is may commonly use for the better wireless communication , it need a fast communication , In the year 2020 summer Olympics in Tokyo ,they are ambitions to market their 5G tch capabilities at the mega event ,they basically want to boots up this technology and in future all over the people permissive to use this 5G networking, Tokyo is the smart city and 5G's has the potential for traffic management. We are seeing that car will change more in the next decade as compare to past centuries, the ever growing internet of thing

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 6, June 2019

are becoming the central for these cars, these IoT are integrate in to the car for the communication .Sensors designed to recognized and communicate with upgrade road sign, making network of cameras, synchronies their movement and so on these all things are relay on the IoT based technologies.

Finally, the diverse variety of services for IoT has been described. A particular description of each services is has been developed concluding with a summary of those services and their opportunities.

REFERENCES

- [1] Luigi Atzori, Antonio Iera and Giacomo Morabito , "The Internet of things: A survey", October 2010.
- [2] Jangili, Srinivasa & Syamala, Mamatha. (2017). Internet of Things (IoT) based Smart City Architecture and its Applications.
- [3] X. Li, R. Lu, X. Liang, X. Shen, J. Chen, and X. Lin, "Smart community: an internet of things application," IEEE Communications Magazine, vol. 49, no. 11, pp. 68-75, Nov. 2011.
- [4] F. Tao, Y. Zuo, L. Xu, L. Lv, and L. Zhang, "Internet of things and BOM based life cycle assessment of energy-saving and emission-reduction of products," IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1252-1261, 2014
- [5] L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A survey," Comput. Netw., vol. 54, no. 15, pp. 2787-2805, 2010
- [6] D. Bandyopadhyay and J. Sen, "Internet of Things: Applications and challenges in technology and standardization," Wireless Pers. Commun., vol. 58, pp. 49-69, 2011
- [7] L. Atzori, A. Iera, G. Morabito, and M. Nitti, "The social Internet of Things (SIoT)—When social networks meet the Internet of Things: Concept, architecture and network characterization," Comput. Netw., vol. 56, no. 16, pp. 3594-3608, 2012
- [8] F. Tao, Y. Zuo, L. Xu, L. Lv, and L. Zhang, "Internet of things and BOM based life cycle assessment of energy-saving and emission-reduction of products," IEEE Trans. Ind. Informat., vol. 10, no. 2, pp. 1252-1261, 2014
- [9] Bradley, C, Reberger, A. Dixit, and V. Gupta, "Internet of Everything: A \$4.6 Trillion Public-Sector Opportunity," Cisco, White Paper, 2013.
- [10] Bradley, C, Reberger, A. Dixit, and V. Gupta, "Internet of Everything: A \$4.6 Trillion Public-Sector Opportunity," Cisco, White Paper, 2013.
- [11] . Vermesan and P. Friess, Internet of Things - Global Tech-nological and Societal Trends From Smart Environments and Spaces to Green ICT. River Publishers, 2011.
- [12] ZigBee Alliance, "ZigBee specification: ZigBee document 053474r13 Version 1.1." Dec. 2006.
- [13] I. Vázquez, Social Devices: Semantic Technology for the Internet of 1710 Things, Week@ESI, Zamudio, Spain, June 2009.
- [14] . Welbourne, L. Battle, G. Cole, K. Gould, K. Rector, S. Raymer, M. 1756 Balazinska, G. Borriello, Building the internet of things using RFID: 1757 the RFID ecosystem experience, IEEE Internet Computing 13 (3) 1758 (2009) 48-55
- [15] I. Demirkol, F. Alagoz, H. Deliç, C. Ersoy, Wireless sensor networks for 1848 intrusion detection: packet traffic modeling, IEEE Communication 1849 Letters 10 (1) (2006) 22-24.
- [16] X. Li, R. Lu, X. Liang, X. Shen, J. Chen, and X. Lin, "Smart community: an internet of things application," IEEE Communications Magazine, vol. 49, no. 11, pp. 68-75, Nov. 2011.
- [17] Z. Pang, "Technologies and Architectures of the Internet-of-Things (IoT) for Health and Well-being," PhD Thesis, Royal Institute of Technology (KTH), Stockholm, Sweden, 2013.
- [18] [15] C. Yulian, L. Wenfeng and J. Zhang, (2011)—Real-Time Traffic Information Collecting and, Monitoring System Based on the Internet of Things, 6th International Conference on Pervasive Computing and Applications (ICPCA), IEEE.