INTEGRATION OF WIRELESS SENSORS NETWORKS FOR IoTS ARCHITECTURE, IT'S CHALLENGES AND FUTURE TECHNOLOGY: A REVIEW

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Abstract: **The IoTs is a type of smart network over which to connect everything with the Internet by standard protocols like IPv6 with sensing types of equipment for information exchange and communicate in order to detect physically sensed data such as light, heat and pressure that are manipulated automatically. IOT (Internet of Things) is one of most trending innovation in the latest advancement in the technologies, So that the information is received by WSNs and communicates to further systems, on the way to greatly enhance the reliability and efficiency of infrastructure. The created strategy for observing and controlling the WSN hubs by a graphical interface over an Internet association. In this paper, we briefly discussed and focused about the integration of Wireless Sensor Network for IoTs, how WSN enables with IoTs with the help of its architecture & IOT functional view & what are the challenges and future technology for IoTs.**

Index term: **WSN, IOTs, IPv6, Physical Systems, Standard Protocols.**

I. INTRODUCTION

Internet of Things is the revolutions of internet society that connects physical devices which are get accessed from the internet. the Physical gadgets may be of cellular telephones, cars, domestic home equipment, Laptops, Tablets and all items which are get embedded with electronics, sensors, actuators, software program that get sharing, changing and extraction of data **(Fig:1).** Honestly, it is the relationship of gadgets in the network on aggregation of already available wireless technologies. The communication process in IOTs is completed via assigning an IP (internet Protocol) and gateway and deal with i.e. the logical code with that related to community that has the capacity together with the data and transfer the statistics over a network and that Provide interfaces between WSN and Internet [1].

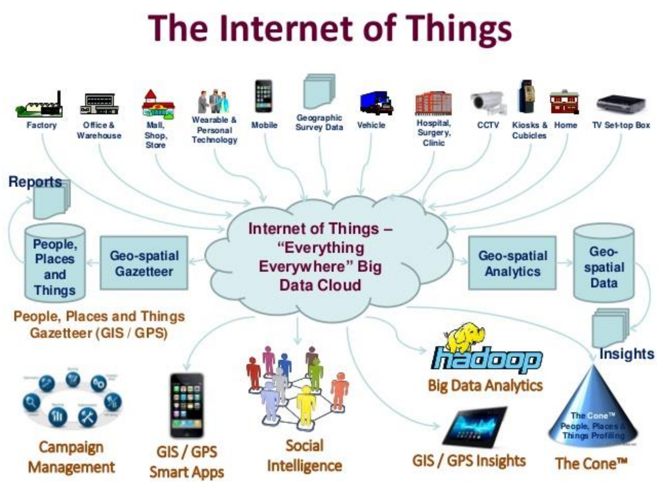


Fig: 1 Internet of things

The IOTs idea was planned by the Radio Frequency Identification (RFID) improvement network in 1999[3]. RFID labels bare electronic distinguishing proof Information of various physical articles (e.g. merchandise, autos, and even wearable sensors) and can even use to recognize individuals. RFIDs required a very small amount of energy by reflecting signs got from RFID peruses. Then again, portable and handheld gadgets (e.g. cell phone and PDAs) are changing the manner in which we get the interface with things in the Web, and are rendering the Web into a universal administration. Alongside distributed computing, the abilities of these gadgets will be additionally supported by giving stockpiling and figuring power in the cloud. The main goal of designing a WSN for IoTs is that the devices get connected in network automatically and could be managed from anywhere and every time. The new and modern WSN are designed for two way communications that are able to receive and again transmit the information to sensors networks as automatic feedback control and real-time system or react as a commander [1]. In all Smart Grids (SGs) technology and energy sensing applications, IOTs are integrated with WSNs that are used to measure energy consumption and producing the commands in order to optimize the energy usage for two way communication [1]. The Internet protocol (IPv6) can be used to identify the IOTs and also enables the integration of WSN in the IOTs [6]. The IPv6 is 128 bits Protocol that provides better data security and based on Low Power Wireless Personal Network (6LoWPAN), that should be implemented and deployed in Wireless Sensors Networks [5].

The integration of IOTs can be made by two ways, first is the interaction between **human-to-machine** communications and second the interaction between **machine-to-machine** communications. The **human to machine** communication is a form of communication where humans interact with a variety of devices like sensors and actuators. It will improve the quality of life through the accessibility to Smart devices, that has sensory inputs and assist with everyday tasks. An extraordinary affair can be accomplished by changing machines from such tools to specialists equipped with a level of understanding human physiology and what they desire whereas the machine to machine communication refers to direct communication between devices using any communications channel, including wired and wireless. The Machine to machine communication with IoTs can include industrial Automation enabling a sensor or a meter to communicate with outside world.

II. SYSTEM ARCHITECTURE

The system Architecture [1] for integrating WSNs into IoTs is consisting of four essential blocks.

- Wireless Sensor Network (WSN) Node
- WSN Gateway Server
- Gateway Middle-Ware Protocol
- Client Machine Server

1. Wireless Sensor Network (WSN) Node:

The WSN Node is known as backward and forwards objects integrated by the whole of sensors. The sensors are used to interconnect physical and digital worlds and allowing to real-time information brought together and processed. These sensors are used to sense the temperature, air pressure, speed, humidity, pressure, flow, movement and electricity etc[1]. These sensors are connected to the sensor gateways. The WSN Node Uses a Protocol IPv6 (128 Bit) to provide the communication between the gateway middle-ware, and the client Machine Server that based on IPv4. In figure 2, the system architecture is shown. This figure also shows the interconnection and data flow between the different components of the system.

2. *WSN Gateway Server:*

Different nonelectrical signals are sensed by various types of sensors and converted into an electrical quantity. These signals are required to getting the essential information in terms of packets and provide the path either by wired or wireless network infrastructure as a transport medium by providing a logical address. The WSN Gateway Server receives the sensor's data from the WSN Node are forwarding them to the Gateway middle-ware using IPv6 Protocol. This type of path is called as M-to-M communication. The WSN Gateway server is also responsible for receiving IPv4 packets and transforming them into IPv6 and vice versa. In case the link between the gateway server and the middleware is lost, the gateway server stores the received data in temporary data storage and communicates this data once the link is connected again.

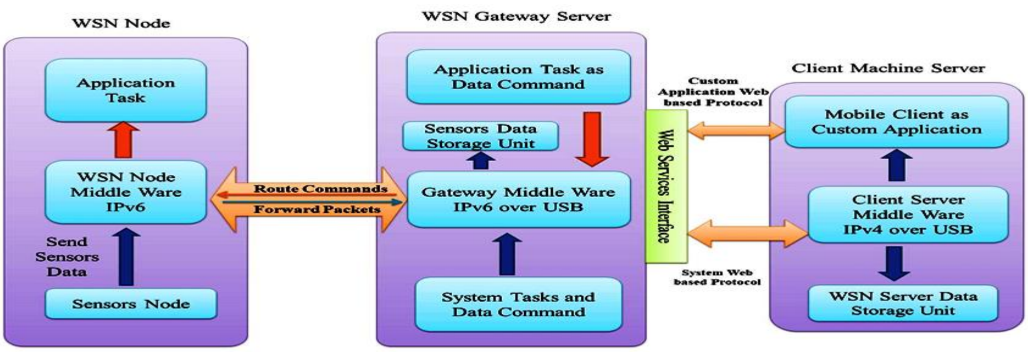


Figure: 2 System Architecture of WSN

3. *Gateway Middle-Ware Protocol:*

The Gateway middle-ware Protocol is a software component that is used to provide transparency to external users. The middle-ware also provides automation mechanisms in order to measure energy consumption and producing the commands in order to optimize the energy utilize by two-way communication. The Internet protocol (IPv6) can be used for two way communication. The principle highlights are the capacity to get information, change it and store it in a lucid manner to utilize it intelligently keeping in mind the end goal to lessen energy utilization. Moreover, the centre product gives an interface to end clients user by means of an arrangement of web service interface that empower them to get to all required data (e.g., on-going and intermittent utilization levels), and issue directions to control the machines through the WSN. The centre product additionally stores a mapping between the machines and their particular virtual IPv4 tends to which is utilized by the Mobile Client to speak with the bits.

4. Client Machine Server:

The client machine server is an application based on Android Mobile phones that enables users to access real-time energy consumption at their current location. Besides, it also remotely controls the appliances by turning On and Off. The mobile client, when wanting to turn On or Off an appliance, sends a command directly to the WSN Gateway Server for controlling the appliance and addresses by using its protocol IPv4 (Internet protocol version 4). The WSN Gateway Server is only supported to IPv6 addresses. The WSN Gateway server receiving the IPv4 packets from Client Machine Server and transforming them into IPv6. In case the link between the Gateway server and the client- server middleware is lost, the client machine server stores the received data from WSN Gateway Server in temporary storage and communicates this data once the link is connected again.

III. COMMUNICATION PROCESS

As per figure 3, there are 2 ways Communication in which Client Machine Server communicates with WSN Node or Sensor Node. The Mobile Client sends the command to WSN Node. The Mobile Client is initially connected to the Internet by using IPv4 Protocol while WSN Node uses IPv6 Protocol. The Gateway Middle Ware Provide an interface between WSN Node and client user by means of an arrangement of a web service interface. The Client User starts to send the data packets via IPv4 Protocol. The Gateway Server receives the data Packets and converts them into IPv6 address. The data packets are forwarded to the WSN Node via new IPv6 Protocol in the form of a message and execute it by turning On/Off the appliance using I^2C (Inter-Integrated Circuit).

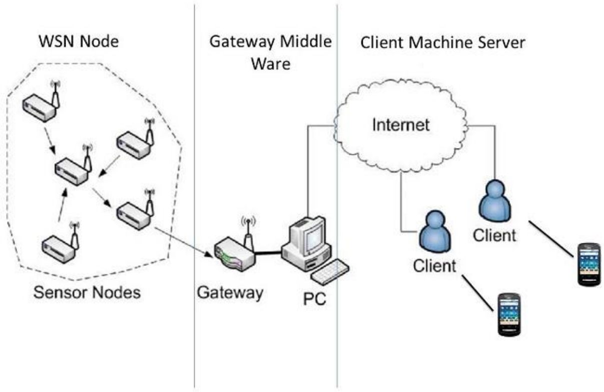


Figure: 3 Communication Process for WSN Monitoring

IV. DESIGN CHALLENGES AND ISSUES

The Integration of WSN for IOTs is making the arena greater diversified. The Massive quantity of wireless sensors and intelligent gadgets are making areas in home, workplaces, and towns and is aware of how these offerings have interaction with the environment and requiring the operation of highly dynamic relationships. The predominant issues or challenges that expected in the future are as follows.

1. ***Interoperability:*** A major challenge to the integration of WSN into IoTs is the interoperability. This problem occurs due to the devices may not be interoperable, even if they are following the same standard. Different organizations are using different standards and Protocol to support their applications. Hence future technology requires the integration of various protocols and standards that operate at different frequencies and allow different architectures whether centralized or distributed and should be able to communicate with different networks.

2. ***Security and Privacy:*** The main focus of IOTs should be on functionality and security. Issues like data theft and hacking of device, raises the data privacy issues, since a large amount of data are stored in Data storage devices. Privacy of stored data is very important, so Data Encryption and Data Authentication security to be ensured during the designing time and execution time because data collection may include personal or business data. Various Privacy Issues such as cookies, web bugs, Spyware, flash cookies etc**.** The more advanced functionality and technologies should be support and secured automatically and the IOT to be secure from malicious software.

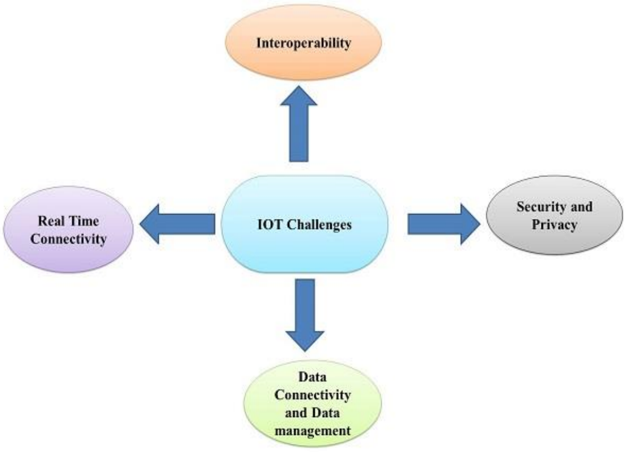


Figure: 4 IOTs Challenges

3. ***Data Connectivity and Data management:*** To provide the good data connectivity and management between Client User and WSN is a biggest challenge, because of IoTs devices are using in a large amount, those are connected to large no of Wireless Sensor Networks. The major solution is expected to have the peer to peer communication, where authentication and identification of devices done directly and exchange of information without connection breakdown. The sensor nodes should be able to handle different tasks like managing their network configuration for new node joining the in the network [10] and ensuring self-healing capabilities through detection and elimination of faulty nodes and address administration to ensure scalable network constructions, etc.

4. ***Real-Time Connectivity:*** The real time data monitoring system and acquisition system is highly required in Tele-diagnostic in medical field or Health Care Applications. Sensor devices are implanted in the human body they continuously monitor to the patient against the disease. The Collected Information communicated to Remote Healthcare Unit via WSN that should be operating in real time, so that immediate action can save the patient life[20]. It is very difficult to maintain the real time interconnectivity between WSN Node and Client uses, but by using Real Time web technology the information can be transmit and receive in Real Time.

V. FUTURE TECHNOLOGY

Graphene for IoT: ***A Latest Internet Technology:*** Graphene is consists of a single layer of carbon atom and also known as 2D hexagonal (Fig:5) lattice material[3] which has higher tensile strength than steel[7] as well as the world's most conductive material, also flexible and light weight. This very low effective mass is responsible for a very high electron and hole mobility in excess of 100,000 cm^2/Vs at room temperature [18], the highest ever reported for any semiconductor. Graphene offers a wealth of potential future applications; in composites, solar cells, sensors, superchargers, medical devices, stretchable and flexible electronics etc, the list is endless. This course takes a closer look at the particular potential graphene offers within electronics, e.g. optoelectronic devices that produced via chemical vapour deposition (CVD) that is an industrially compatible technique [2]. Graphene and sensors are a natural combination, as graphene has large surface area (2600 m^2/gm), so it can be used to make fire fighting appliances[8], unique optical properties, good electrical conductivity, high carrier mobility and density, high thermal conductivity and many other properties may be greatly beneficial for sensor functions. The large surface area of graphene is able to enhance the surface loading of desired biomolecules, and excellent conductivity and small band gap can be beneficial for conducting electrons between biomolecules and the electrode surface.

1. Graphene ink printing technology for WSN Connectivity and RFID applications:

Graphene ink Printed technology offers an advanced achievement in the information technology for everyday life. The printing electronic circuits will further develop the spread of the Internet of Things applications. Printing with graphene ink results in very high conductivity (7.13 × 104Sm−1) devices, which allows us to produce wireless connectivity antenna [11] that operates at a frequency from MHz to GHz range, it can be used for wireless data communication and energy harvesting application. It is reported that the Graphene ink printing technology may be environmental friendly [16] and it is suitable for screen-printing technology [14-15] in RFID & WSN Application. To investigate the RF properties of the Graphene material, a printed graphene laminate dipole antenna on a paper substrate has been fabricated and the measurement results have been determined in all aspects i.e. impedance matching, gain, and radiation pattern [19]. These results expose its valuable consideration in RFID and other printed RF applications.

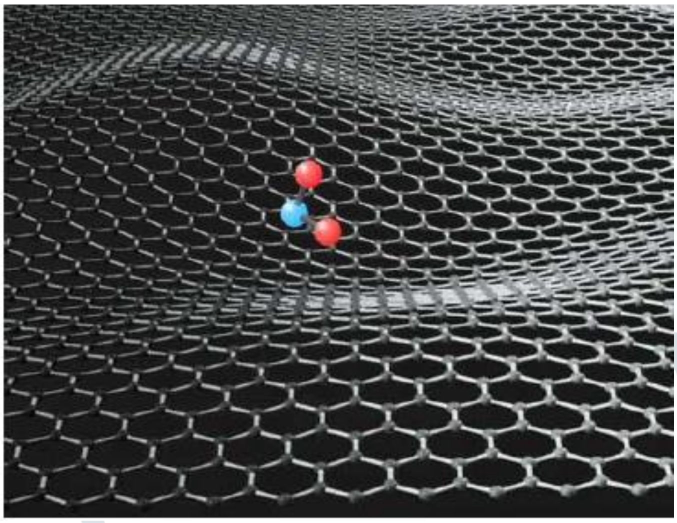
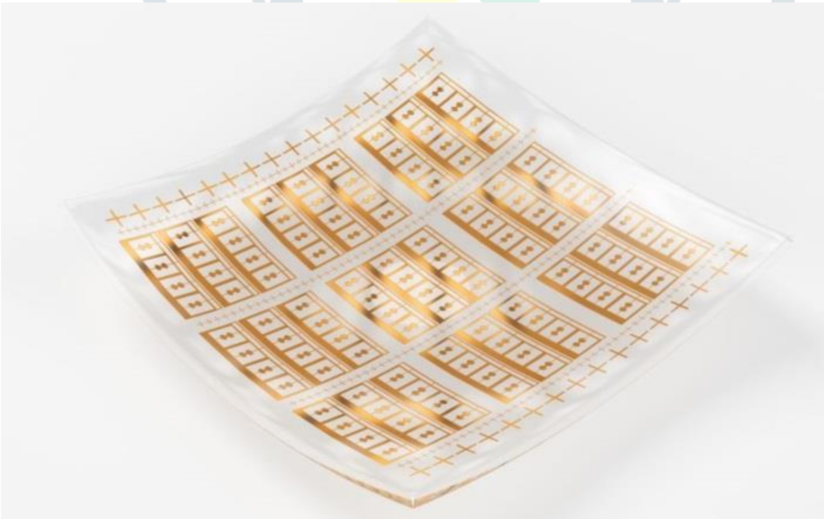


Figure: 5 Graphene Structure

2. Graphene as high-speed Electronics on flexible Material:

A Graphene-based Detector for terahertz frequencies has been developed by Chalmers researchers [17] using graphene transistors on plastic substrates. It is the first of its kind **(Fig: 6)**, It can be extend the use of terahertz technology to applications that will require flexible electronics, such as wireless sensor networks and wearable technology. The detector has extraordinary features, at room temperature it detects signals in the frequency range 330 to 500 Gigahertz [17]. It is flexible for surveillance and security screening such as real-time imaging, biomedical & material diagnostics, wearable smart electronics and multiple transmit and receive antenna systems (MIMO) and uses for numerous applications [17].



Source: www.chalmers.se/en/departments/mc2/Graphene- enables-high-speed-electronics-on-flexible-materials.

Figure: 6 First Graphene-based Flexible Terahertz Detector

VI. CONCLUSION

The aim of this paper is to discuss the few importance of WSNs. IOT is capable of interconnecting each and every intelligent gadgets in order to have interaction between peoples, share information, manage things, improve the quality of services. WSN provides us a new opportunity to handle every activity in a smarter way and gives us smart interaction standards which empowers setting up a smart network capable of managing applications that evolve from user requirements. Sensor network will grow in future lives with a wide range of applications. Thus new security structure will improve into WSN integration and IoTs and also it will help to put a great impact on our daily life.

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