Analysis Study of IoT and Its Techniques in Wireless Sensor Network

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Abstract— Background: With the advancement of wireless technology and in-build tiny electronics increase the connection between systems and humans. Development of wireless systems based on the internet of things (IOT) revolutionizes the industrial sector and transforms the traditional lifestyle into a high tech lifestyle. The wireless sensor network (WSN) is the central element of the wireless system based on IOT because it contains a number of sensor nodes interconnected with the help of wireless channels and its capability to monitor the real world objects. Being a part of wireless systems based on IOT, in particular can be employed in multiple domains such as health, agriculture and industrial domain. The wireless system based on IOT increases the instant access of data from the surrounding environment and improves the quality of human life. Hence, the attention of this review is to shine a light on WSN and architecture classification of wireless systems based on IOT. In spite of this, we highlight the challenges associated with integration of IOT to WSN.

Index Terms— WSN (Wireless Sensor Network) • IOT (Internet of Things) • Sensor node • Integration and Challenge

I. INTRODUCTION

Wireless Sensor Networks (WSNs) can be defined as a self-configured and infrastructure-less wireless networks to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location or sink where the data can be observed and analysed .A sink or base station acts like an interface between users and the network. One can retrieve required information from the network by injecting queries and gathering results from the sink. Typically a wireless sensor network contains hundreds of thousands of sensor nodes. The sensor nodes can communicate among themselves using radio signals. A wireless sensor node is equipped with sensing and computing devices, radio transceivers and power components.In the Latest Communication world the IOT plays an emerging role in many applications with Small Sensors devices capable of wireless techniques with rapid advancement in wireless technology and in-build electronics attracted the scientific community from the past few decades towards wireless sensor network (WSN). The WSN is widely employed in multiple technical domains. A typical WSN consists of minute devices nominated as nodes including in-build CPU, few smart sensors and limited computing power. Nodes are primarily employed to record the pressure, sound, humidity, temperature and vibration from the surrounding environment. The basic components of nodes in any kind of WSN comprise a power unit, transceiver unit, sensor interface, and computing unit. The WSN integrates the digital platform defines the communication with Intelligent things acutators and sensors for monitoring eg: sensors for monitoring the environment, security cameras, and home appliances) are normally equipped with multiple kinds of micro-controller equipment, transceivers and protocol for communication of sensed data The IOT with integration of wireless technology is much better in contrast to wireless and wired networking systems as the number of devices for communication is too high in IOT with wireless technology [2]. The use of IOT in traffic is not suitable as every device senses and transmits the obtained data to the respective server that collectively affects the efficiency

- Wireless sensor networks (WSN)

WSN comprises simple and economical processing devices called as sensor nodes and WSN system is made up of three components; smart sensor nodes, RF (radiofrequency) transceiver and power unit [7]. There are different kinds of WSN with different modalities like single and multi-sensing modality. A network algorithm is not able to detect any kinds of threat in case of WSN with single sensing modality while a

WSN network with multi-sensing modality is capable of detecting any kind of threat. Batteries of WSN with multisensing modality are rechargeable with heavy battery back-up in contrast to WSN with single sensing modality. There are two kinds of WSN with different networking technology

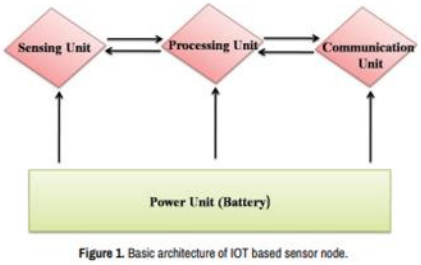

Figure 1. Basic architecture of IOT based sensor node.

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Homogeneous WSN: All nodes with similar energy efficiency and complexity of hardware are nominated as homogeneous WSN. Pure static clustering is the primary feature of homogeneous WSN where nodes of cluster head must be overloaded with transmission of long distance to remotely placed base stations and more time is needed for data aggregation and co-ordination of protocol [8]. The cluster nodes perished prior to other nodes of the sensor network. Hence, one can make sure that all nodes of the sensor network must perish at a similar time which is ensured through the rotating role of cluster head either periodically or randomly as introduced in the LEACH protocol. The most crucial shortcomings of homogeneous WSN is that all nodes of the sensor network can act as cluster head. Heterogeneous WSN: A WSN with a wide range of sensor nodes with different capabilities like different battery functionality is nominated as heterogeneous WSN. The basic concept behind the development of heterogeneous WSN is the extra battery energy and more complex hardware to decrease the overall expense of hardware. Sensors utilized two kinds of mechanisms; single hopping and multiple hopping. In single hopping, sensor nodes that are far from cluster head utilize more energy in contrast to closest sensor nodes. Heterogeneous WSN utilize multiple hopping in which closest sensor nodes have more energy burden owing to relaying as well as existence of non-uniform energy drainage pattern [9,10].

- Integration of IOT with WSN

IOT comprises a wide spectrum of physical devices like laptops, mobiles, television and other home appliances employed for precise processing and calculation in the industries like measurements of temperature, density of fluids, mapping. These physical devices help humans in different ways. To enhance the liability and smartness of these physical devices, researchers integrate these devices with sensors which are feasible owing to integration of IOT with WSN. Several companies supported the integration of WSN with IOT [11] like Smart Planet: IBM initiated this project to make an intelligent cities and management of water by use of smart sensors, CeNSE (central nervous system of earth) is initiated by HP labs that focus on to develop worldwide sensor network and 6LowPAN standard constructed by IETF that focuses on to transmit the IPv6 in to computationally restricted network [12]. Several kinds of approaches are proposed for architecture for integration of WSN with IOT like basic sensor node architecture, stack based approach, topology based approach, WSN based architecture, independent network, hybrid network) Basic sensor node architecture: This type of integration of WSN with IOT is also nominated as SSNA (smart sensor node architecture). This architecture needs to redesign some components i.e. cluster and sensor node. Sensors are usually used to aggregate data collected from various sources like temperature, pressure, sound, vibration. The node either formed of single or multiple sensing elements and number of sensors differs in their functionally and energy efficiency that depends upon the applications. Basically it is advised to use not more than two sensors but a number of sensors can be used on the node if the application is large. For a large number of sensors on nodes, each node must have its own powerful battery and signaling processing mechanism via microprocessor and microcontrollers.
(ii) Stack based approach: In this approach, the degree of integration between WSN and internet is depends upon the resemblance their network stacks like:

a. Gateway (exchange of information with internet host): In this approach, the base station acts as an application layer that interfaces the protocols of the below layer from one point to another. Hence, internet and sensor nodes are interconnected to exchange of information without direct access.

b. Front end (a WSN that is completely separated from the internet): In this approach, a sensor node directly interacts with the internet via hosting applications. WSN is totally independent and has its own sets of protocols. Communication is monitored by a central base station between the sensor node and the internet [13].
c. TCP/IP (transmission control protocol/internet protocol): It is a compatible network layer protocol. In this approach, sensor nodes implement TCP/IP stack that provides direct communication with the internet without use of WSN protocol.

SENSOR NODES Sensor nodes are used to monitor environmental conditions like

1. Temperature, pressure, humidity, sound, vibration, position etc. Each and every node is capable to perform data gathering, sensing,
2. Processing and communicating with other nodes. The sensing unit senses the environment
3. The processing unit computes the confined permutations of the sensed data.
4. The communication unit performs exchange of processed information
5. Among neighboring sensor nodes. Mostly ATMEGA 16, ATMEGA 128L, MSP 430 controllers are used in commercial motes.

It is Capable of executing data processingϖ data gatheringϖ communicating with additional associated nodes in the network.

III. Topology-based approach: In this approach, the integration degree depends upon the exact location of the sensor nodes that contribute to access the data [14].
a. Hybrid: In this approach, a group of sensor nodes that are placed at the edge of the network contributes to direct access of data from the internet. These sensor nodes are capable of mapping the central base station and vice-versa.
b. Access point: In this topology, WSN is structured in the form of a tree having multiple roots. The leaves of this tree are sensor nodes while roots are internet empowered nodes and through we confirm the onehop mediated internet access.
(iv) WSN-based approach: This system of integrating WSN with IOT composed of four components
WSN: WSN allowed possible employment of ZigBee that acts as a communication medium and also employed IPv6 in the network layer. IPv4 based communication occurs between gateway server, middleware and mobile clients over Wi-Fi. It allows the interaction of all devices of a system with other devices in an independent manner of communication medium.

Sensor node topology

- Connection between sensor nodes follows some standard topology.
- The WSN should have the capability to work in the dynamic topology.
- If any node in the WSN fails to exchange data with other nodes, it should be informed without delay to the base station or gateway node

The WSN should have the capability to work without any central control point

- Sensor Node Special Features
- Technical advancement in processor Communication
- Usage of low power embedded computing devices.
- Sensor nodes are used to monitor environmental conditions like temperature, pressure, humidity, sound, vibration, position etc.

CONCLUSION

In this research the impact of the IOT in Wireless Sensor Networks communication with sensors devices of monitoring and the transmitting Relay should follow certain Revolutionary evolution in computational technology enhances the development of WSN that are capable of sensing the requisite surrounding parameters. The wireless system based IOT has attracted researchers from the past few years; however it suffers from additional need of energy supply, data privacy and security. In this review, the existence work focused on WSN, architecture classification of wireless based IOT and challenges associated with wireless based IOT is reviewed.

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