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A Study of Wireless Sensor Networks and Its Revolutionary Changes.

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Abstract: **- Many evolutionary changes are brought into WSN in the past few years, may be due to advancement in networking, semiconductor technologies giving a scope for low cost deployment as well as maintenance with long lasting life, giving a scope for WSN to be a part of many applications .In future WSN can be expected to grab the role of standardized mix of hardware and software giving solutions to many new upcoming applications. The embedded designers must be able to make proper choices in selecting transducer, battery technologies, frequency, networking protocols, semiconductor design, and sensor/actuator technology including energy storage.**

Keywords **:- Emerging technologies, Integration, IOT, WSN..**

I. INTRODUCTION

Sensors are devices with a capability of sensing at various locations, built with an intelligence and miniaturization of computer hardware for wireless communication. In these Wireless sensor networks, sensors are distributed in an Adhoc manner but coordinate with each other to sense the physical phenomenon, and gather information which is sent for further processing and decision making, they use broadcast communication. They have limited power, energy and computational capability, bandwidth, storage, transmission range. Sensor nodes have no global id, as they are numerous in number accounting to large amount of overhead.

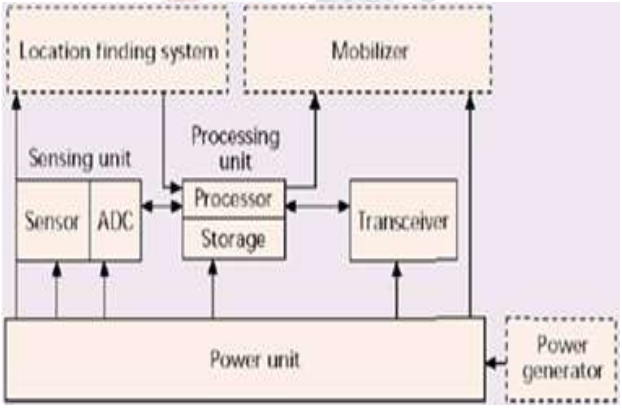

FIGURE 1 : WIRELESS SENSOR NODE COMPONENTS

APPLICATIONS OF WSNs

We can categorize WSN into 5 types

- Terrestrial WSNs usually consist of huge number of sensors , with low cost and will be deployed in a specified area, they can be deployed by dropping from a plane or even randomly.
- Underground WSNs ,here the nodes are placed underneath the ground or a mine which are used for monitoring underground conditions, and sink nodes are placed above the ground which carry the relay information from the sink to base station. Very difficult to replace or recharge batteries of sensor nodes.
- Underwater WSNs only few sensor are deployed as the cost of sensors is high, also autonomous underwater vehicles are used to collect data from sensor nodes.
- Multimedia WSNs consists of low cost sensor nodes equipped with cameras and microphones and used for monitoring and tracking of events.
- Mobile WSNs consists of sensor nodes which have the ability to move on their own and interact with the physical environment as well as communicate with static nodes.

CHARACTERSTICS OF WSN

Sensors are low powered, with limited memory, energy constrained, need to be self organized and usually face constant reconfiguration. The data gathered should be transferred efficiently between sensors, of same type or even different type even in low bandwidth that is available using centralized algorithms, The sensors that coordinate are large in numbers and should be tactfully

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used so as to produce maximum performance with very low energy usage at a very quicker pace when it comes to real time computation.

CHALLENGES OF WSNs

- Usage of energy efficiently.
- Limited storage and computation.
- Low bandwidth and high error rates.
- Errors due to communication, noise in network, node failures.
- Scalability to a large number of sensor nodes.
- Survivability in harsh environments

SENSOR TYPES

Sensors types can be categorized under three categories:

- Micro electromechanical sensors (MEMS): gyroscopes, acoustic sensors, magnetometers, accelerometers, pressure sensors.
- CMOS based sensors: temperature sensors, humidity sensors.
- LED sensors: ambient light sensors, proximity sensors, chemical composition sensors.

These sensors when combined into a network lay a path for building up emerging applications.

WSN ARCHITECTURE

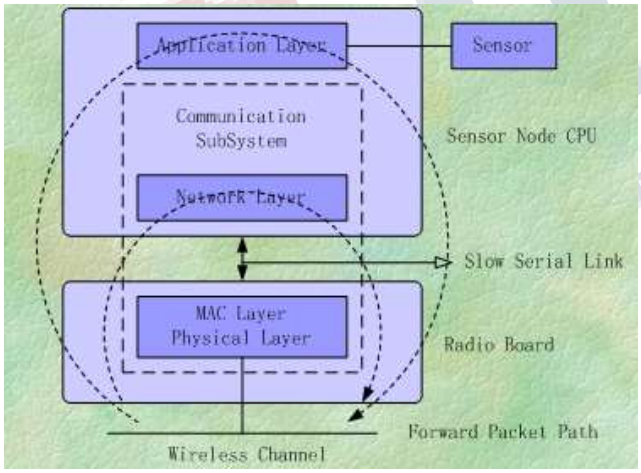


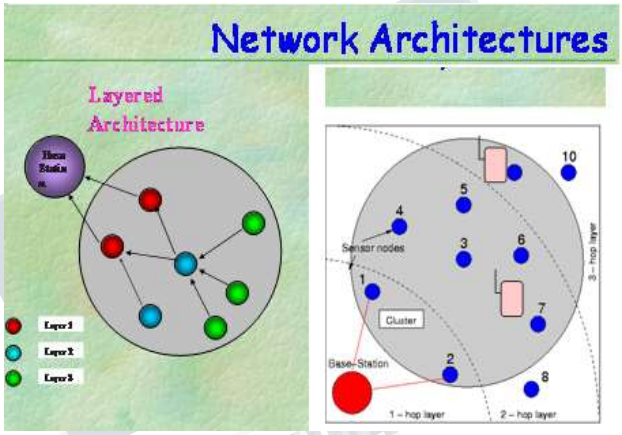
FIGURE 2 : WSN ARCHITECTURE

Sensor networks have limited resources when compared to any other wireless communication networks. WSNs have a lot of variations when compared to Adhoc networks, it is observed that in sensor network, neither sensor nodes are reached easily nor their batteries can be changed often. Since sensor nodes do not have global IDs, either identifying them is done, based on naming or clustering .There is no predetermined position fixed for a sensor node, itself organizes itself by providing data routes.In sensor network the protocol stack has layers arranged in a traditional fashion and a similar pattern with Application, Transport, Network, Data Link and Physical layer sequence.

Network Architecture are organized in layered fashion or clustered fashion:

Layered Architecture

In this architecture, there is a single base station and hundreds of nodes arranged in concentric layers. The nodes in one layer will have the same hop count to the base station. Additional mobile nodes can traverse in this network. From this point connectivity to wired world is built.



.FIGURE 3 :LAYERED WSN ARCHITECTURE

Clustered Architecture

Sensor nodes autonomously form groups called clusters, each cluster has a cluster head to which the rest of nodes in the group report and this node is called cluster head, this cluster head alone further carries the data to the base station. From this point connectivity to the wired world is established.

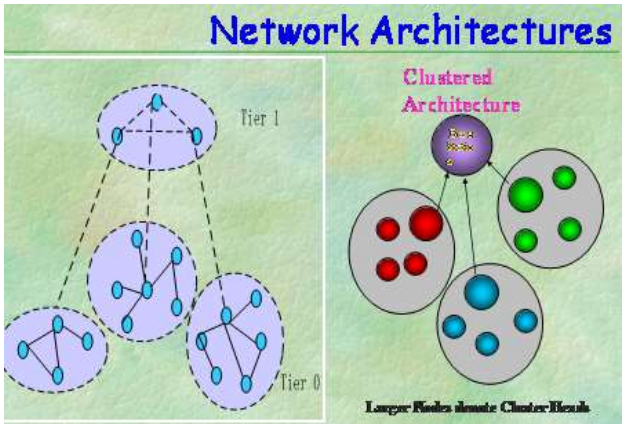


FIGURE 4 : CLUSTERED WSN ARCHITECTURE

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II. WSN IN IOT

By reducing the cost and energy per sensor with a scope of high volume deployment in industry as well as consumer applications, at the same time reducing the deployment cost due to some major developments in sensors , semiconductor devices, energy storage as well as generation methodology and networking protocols has given a new way for deployment of WSN in IOT.

With the emerging semiconductor technology advancement into the market where in wireless MCUs made available along with SoCs (system on chip) devices that contain MCU and RF transceiver in a single chip, These devices with the help of peripherals like amplifiers, ADCs, DACs are capable of handling both application processing and protocol stack and simultaneously provide RF link to the network.

With the already existing WSN applications in market, with the idea of IOT, potentially new applications can be identified and developed to meet up with future needs of market like smart grid, smart water, smart home and smart transportation. Looking into the Synergy between sensor networks and other technologies, and bringing out how sensor networks achieve their full potential.

As IoT connects various heterogeneous devices including sensors, RFID devices, Smartphone's, wearables which produce and/or consume information in real time. When connecting IoT to the cloud, information collected from various devices from various locations can also be processed and analyzed and made useful for many applications which are the new brands available in markets (smart grids , smart homes, smart cities). IoT cloud in smart cities is one example proving its potentiality. It connects wired and wireless devices and provide services in benefit of humans, the smart cities provide many city services like health monitoring, traffic monitoring, and waste management.

WSN and their efficient integration with IoT-cloud has augmented the computing resources of sensors by extending their battery life, also different sensors used for gathering data by sensing under various platforms can be shared on a bigger scale enabling a chance for higher performance by meeting user requests ,network resource capacities and minimizing overall network cost.

III. MOBILITY IN WSN

We define "Mobile Wireless Sensor Networks as Sensor Networks where in the nodes are Mobile". The launch of MWSN is growing day by day where mobility is playing key role in the upcoming applications. Their decrease in cost and increase in capability is making MWSNs popular possible and practical. Point of discussion for static sensor nodes to switch over to mobile node has many reasons. Within a Sensor network, nodes are deployed for sensing the area, it so happens after a period of time these deployed nodes die due to power exhaustion or hardware failure. New nodes are chosen to be placed in their positions. This way of replacing/or this type of moving the nodes called WEAK MOBILITY. If within a network, if sensor nodes happen to move physically or literally built with capability to move, the mobility would be defined as STRONG MOBILITY [3][5].By including the concept of mobility to some nodes or all nodes depending on application needs, we will be able to enhance capability, ability, flexibility and durability of static sensor nodes.

IV. POTENCIAL SYNERGIES

A phenomenon which integrates WSNs with existing wireless and mobile communication technologies as well as emerging technologies like robotics, RFID , cloud computing ,cognitive radio and content centric networking is known as potential synergy .

There are many applications where both sensing of environment as well as object identity or location are needed .when it comes to WSN it is capable of using a variety of sensors to provide information about the conditions of the objects as well as the environment .therefore by using RFID which is one of the technology used in object identification but in short range ,does the actual detection and identification of objects but this technology does not provide information about the condition of the object it detects ,hence by integrating WSN-RFID technology we are able to provide a solution for such applications and serving the purpose capability wise and even cost wise. Such integration benefits and synergy between the two technologies by converging sensing capabilities of WSN with RFIDs identification capabilities is one example

V. CONCLUSION

WSN earlier were assumed to be isolated networks that were meant only for collecting specific data, which would be sent further to a central server for taking some action or no action based on the analysis made on the data gathered. Today WSNs are seen with a different perspective altogether .With the advancement in technology in hardware developments, network programmability and virtualization wireless sensors can be integrated into IoT cloud networks as distributed sensing and computing resources as well as integrating sensors with heterogeneous devices and building up a

smart new application with a whole new setup of a network which in turn is sweeping the markets at a larger scale.

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