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Wireless multimedia sensor network

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ABSTRACT

In recent year wireless multimedia sensor network has developed so far that it has attracted various researchers focus toward itself. In wireless multimedia sensor network there are various interconnected devices such as low-cost CMOS cameras, microphone help to retrieve the multimedia content such as video streams, audio streams and scalar sensor data from the environment so in this paper we have brings out various aspects of wireless sensor network, there protocols for wireless multimedia sensor network , challenges. And their future scope. And we also hope also that it will help new research to clear their ideas among its researchers.

Keywords: *Applications of wireless multimedia sensor networks, Network architecture, Scalar sensor data.*

1. INTRODUCTION

Wireless multimedia sensor networks has grown so far that many researches, start-up companies, etc are investing their resources in this technology. This sensor are advance so much due to its feature of data-only delay-tolerant and its usage of low bandwidth. Most of the deployed wireless sensor networks focus on measure of scalar physical phenomena such as humidity, pressure, temperature, and location of object. Wireless multimedia sensor networks are becoming more low-cost, low-power, multi-functional, and variable due to the advances in micro-electro-mechanical systems. WSNs have wide and varied applications such as real time tracking of objects, monitoring of environmental conditions, monitoring of health structures. The main functionality of it is that it consist of various nodes at different location which through radio transmission or other medium abstract data and then process it and transmit it to users. It consist of smart sensor which have
Capability of low power consumption of battery, highly integrated digital electronics, and effective wireless communication with inexpensive hardware.it help us to solve various problems related to health, environment, monitoring areas etc.

2. APPLICATIONS OF WIRELESS

MULTIMEDIA SENSOR

NETWORKS

Surveillance Sensor Network:- surveillance sensor network are used to enhance the existing surveillance
Systems by providing seamless sensor video and audio sensor which helps to prevent crimes, terrorist attacks. through Multimedia content, such as video streams and still images, as well as computer vision techniques we can be used to locate missing persons ,identify criminals or terrorists,

Advanced Health Care:- WMNSs also helps in health care monitoring for patient, it consist of sensor which continuously monitor the health condition of the ill person. The patient carry a medical sensor which automatically monitors different aspects like blood pressure, sugar level, pulse, temperature etc, and sends the message to doctor the detail report of its patient. This will helps to tackle the emergency problem also.

Traffic Avoidance, Enforcement, and Control Systems:-wireless sensor will also help in knowing the traffic condition of an area, and helps to control the system also. In this it will generate the map of different areas and inform to the driver to avoid that route.it also helps in smart parking system where driver can know the empty parking space before visiting that area.it can also monitor the highway condition.

Environmental and Structural Monitoring:-In environmental and structural monitoring the video sensor or other multimedia sensor will help to tackle the problem related to environment. Smart city, smart water quality monitoring all this can be achieve easily.it can also detect the bridge conditionor to monitor civil structure.

3. NETWORK ARCHITECTURE

Now lets discuss about the network artichecture and its basic functionality as given below:-

Standard Video and Audio Sensors:-standard video and audio sensor are arrange at the first tier architecture of wireless sensor network. It is generally use to capture the still image, audio or videos with low resolution

Scalar Sensors:-scalar sensor are use generally used to sense the scalar device and also capture the physical attributes such as humidity, temperature, pressure etc. it is typically a resource- constraint device which cover aspect in terms of storage capacity, energy supply or processing capability.
Multimedia Processing Hubs:-It is typically having a large computational which collect the resources from different nodes and integrate it.it generally used to reduce the volume and dimensionality of the data to transfer it to the sink or storage hub.
Storage Hubs:-storage hub allow data mining also it helps in streaming it in real-time or further processing of data before send it to the end user
Sink.:-The sink help to integrate high level user queries and return the filter multimedia stream back to the user, many sink are used to connect large or heterogeneous network.
Gateway:-gatewayis the last portion of connectivity string in wireless sensor network, it is used to collect data from multiple sink and is only Ip-Addressable component in wireless sensor network.it also use to cover large geographical area and allocate suitable task to each sink.
User:-users are the highest end level of the wireless multimedia sensor network
And accordance to geographical area it issue the monitoring task to the wireless multimedia sensor network.

4. FACTORS INFLUENCING THE DESIGN OF MULTIMEDIA SENSOR NETWORKS

Before discussing about the factor that influences the design of multimedia sensor we must understand its working so in multimedia sensor network it consist of processing unit, communication unit, sensing unit etc. sensing unit consist of two subunit i.e sensor and ac to dc converter..

Resource Constraints:-in term of resource constraints following resource like processing unit, data rate, battery, memory etc are taken into consideration.

Variable Channel Capacity:-in WMNs multi hop the capacity of the each link depend upon number of receiver it has connected to, how it handel the distributive function of each network and due to this it increase the challenge of the quality of services.

Cross-layer Coupling of Functionality:-as we know that WMNs have nature of sharing wireless communication channel thus in multihop wireless network interdependence among the function at each layer of communication stack thus use of QoS is their.

Application-specific QoS Requirements:-this functionality exist to provide the facility of having or not having gaurented delivery of message.

High Bandwidth Demand:-in WMNS ultra-wide band technology provide a promising transmission. It provide high data rate transmission with low consumption of battery.

Physical Layer:- physical layer of WMSNs are basically use for hardware transmission such as transmitting raw bits over the connected network.it is also responsible for channel encoding, modulation and frequency selection. It also help to communicate to the other higher layer of protocol stack of WMSNs.
It helps the network to utilize the bandwidth and data rate more efficiently.
It must also provide a flexibility to remove noise and interference and also the flexibility to use different channel.It use radio frequency bandwidth for transmission and minimizes its cost of usage effectively.

Mac Layer:

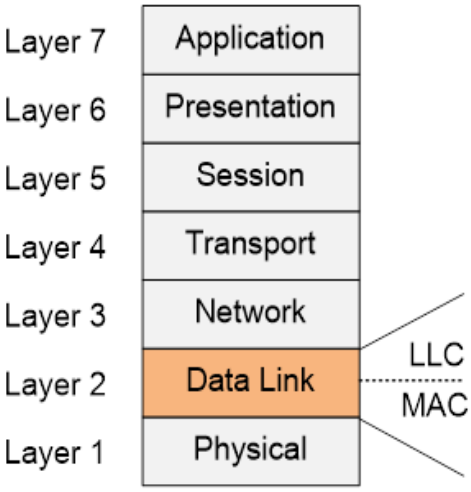
Medium access control (MAC) it consist of two sub layer(media access control sub layer) and logical link control(LLC) together makeup the data link layer within that data link layer, while the MAC provide flow control and multiplexing for the transmission medium. it also use to provide a unique identifier for each piece of hardware. this MAC protocol provide addressing mechanism that can be access by all the channels ,so all the node get communicate with each other that can be either on the same network or other network.

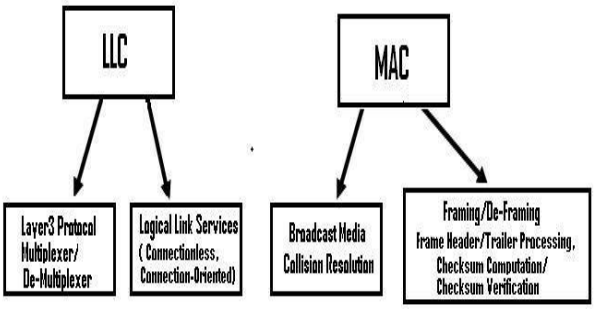
Data link layer:-

The data link layer is a second layer of OSI model of computer networking, (WAN) in this layer the protocol layer that transfer data between adjacent network .(LAN) in this layer it use to transfer a data between same nodes.
Two Sub Layer:-

- Logical link control sublayer:-the Logical Link Control is a multiplexes protocol and it is the upper most sub layer which is running at top of data link layer and it also provide a error notification and acknowledgment .

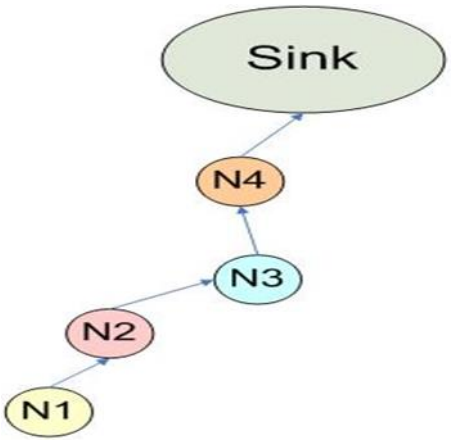
Media access control sub layer**:-**The sub layer which allow us to access this media access control any time (e.g CSMA/CD). Csma which determines the rule how to response when to or more data channel get collide with each other .Media access control sublayer also determine at start of one frame and endof another frame .this frame can be synchronized by : time based, character counting ,byte stuffing and bit stuffing





Network Layer:-

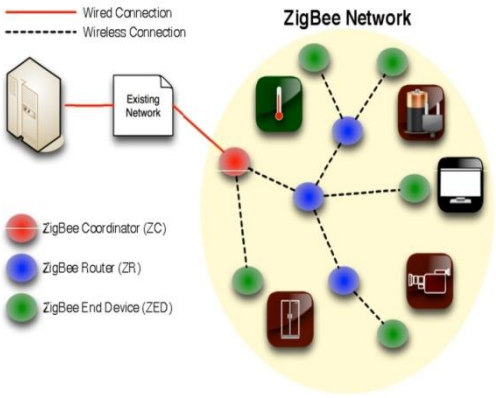
- Most of the data in the sensor network will be directed towards the sink. For wireless sensor networks we need a special multi hop and routing protocols place between sink and sensor node.
- The data which are conveyed to the sink it form a sensor node and it will pass through many intermediate nodes before reaching it the sink. It became an energy expensive if data are directly communicated from node to the sink, so multi hop communication is preferred in wireless sensor network.



- Data that are get collected by sensor nodes in a Wireless Sensor Network (WSN) is propagated toward (gateway) a base station and then links the WSN with other networks where the data can be analyzed, visualized and perform an action upon it.
- In large networks sensor nodes generate it's own information and serve as relays or forward the nodes to the other sensor nodes.

Routing:-

- It is process of establishing and selecting a shortest path through which message can be pass from source to the destination this communication protocol stacks is responsibility of the network layer.
- It also use to identify or discover the routes from a sender or source to the intended receiver. This process also used to distinguish between different types of routing protocols of network layer.
- There are the three current problem that are get arises in this network layer which are as classified:- such As Topology control, Routing, Co-ordination
- Here network topology not only use to prolong the lifetime of an network but also use to enhance the communications of data. Routing such as Quality of service (Qos) can be use with some of broadcast and the multicast can be get used to fulfill the primary goal of an given communication task which become a successful between nodes in the network coordination which not only combine actuators and sensor but also use to coordinate between all networks.



Transport Layer in WMSN

- Transport layer is a type of protocols that run over the network layer to enable end-to-end message transmission from source to destination to carry on the conversation. Transport layer aims to provide several services like reliability, hide networks, service decision, mapping, naming, same order delivery, (e.g., fairness and timing).
- There are two types of transport layer protocol which help for end to end transmission: TCP and **UDP**. These protocols cannot be directly implemented over network because WSN and WMSN have their own features, which make them different than typical Internet network, and these may have very large range of applications that need special requirements.
- Some of the features of WMSN are the following:

  • **Network topology:** Network topology is nothing but the arrangement of network and connecting various nodes.. These type of variations should be taken into account in designing a transport protocol for WMSN. There are various types of network topologies which help to connect more than one system to the other like mesh, star, bus, hierarchy topologies.

  • **Traffic characteristics:** Most of the time, the traffic in WMSN is generated from the source nodes toward the destination and, this traffic can be continues, event-driven, query-driven, or hybrid. In many cases, the source node can send its multimedia traffic using different route to the destination and this traffic characteristics can be exploited to design a suitable transport protocol to keep the quality of multimedia streaming.

  • **Resource constrains:** A device that has limited processing and storage capabilities, and that often runs on batteries .Limited processing in terms of battery power, communication bandwidth, and memory that require less expensive and more energy efficient solutions for congestion control and reliability.

  • **Application-specific QoS:** QoS (Quality of Service) is the idea that transmission rates, reliability level, error rates, real-time delivery, certain data rate, fairness, etc and other characteristics can be measured, improved, and, to some extent, guaranteed in advance. WMSN has diverse applications from surveillance and target tracking to environmental and industrial applications.

  • **Data redundancy:** Collected sensory data by neglecting the data which is not necessary or not more useful. In WMSN has relatively high data redundancy. Therefore, many WMSN applications use multimedia processing such as feature extraction, data compression, and data fusion. It reduce the amount of data and kept the important information.
- UDP (User Datagram Protocol) uses a simple transmission model without the acknowledgement mechanism to provide timeliness for real-time applications like streaming media. It does not guarantee data delivery to the destination, nor does it provide flow and congestion control. The service provided by UDP is not guarantees for delivery of packets, therefore the service is unreliable and no protection from duplication.
- And in case of TCP (Transmission Control Protocol) is connection-oriented transport protocol based on 3-way hand-shaking mechanism to provide reliable and ordered delivery of data..

- TCP has some limitations with respect to WMSN, which are:
  • TCP uses end-to-end congestion control that requires longer response time and it may cause more packet loss in case of congestion.
  • The reliability mechanism in TCP is also based on end-to-end retransmission which consumes more energy and bandwidth than hop-by-hop retransmission.
  • TCP assumes that packet loss is due to congestion only and hence to adjustment process to reduce the traffic rate whenever it detects packet loss, it get triggers. By this behavior in TCP leads to decrease the throughput in WMSN because congestion is not only the reason for packet loss, also wireless link condition and bit-error level cause packet loss that cannot be solved by rate reduction.
  • Fairness is an issue in TCP, because congestion control mechanism in TCP can discriminate against sensor nodes that are far away from the destination node.

  Congestion Control
- It is nothing but a state occurring in a network layer. When the message traffic is so heavy that it slows down network response time. As delay increases, performance decreases and If delay increases, retransmission occurs, making situation worse. Congestion control is the services given by transport layer protocols to mitigate congestion in the network. In WSN there is not only wastage of energy due to a large number of retransmissions and packet drops, but it also hinders the event detection reliability and link utilization. There are two reasons of congestion cause in WMSN:

1) One is node-level congestion. This is happen due to the packet arrival rate increase the packet-service rate causing buffer overflow in the node and by this, the packet may be loss, and increasing queuing delay. This is likely happen at sensor nodes which are close to the sink, as they usually carry more combined upstream traffic.

2) Second one is link-level congestion. This type of congestion is related to the wireless channel condition. It may due to contention, interference, and bit-error rate.

There are three main steps of congestion control mechanism: congestion detection, congestion notification, and rate adjustment. There are two ways to detect congestion: active method like timer or acknowledgment, or proactive method using queue length.

Streaming- Streaming is nothing but the balancing of the stream traffic over multiple paths and reduce the traffic toward the current congested path.

Retransmitting the lost packets. If the packets get losts,it may recover properly. Loss recovery mechanism consists of three steps: loss detection, loss notification, and retransmission recovery. There are two approaches by which these steps can be done:end-to-end as in STCP approach and hop-by-hop as in RMST approach. Hop-by-hop approach is preferred because in this no need to send control messages or data packets over multiple hop, takes less response time, and requires less memory to recover the cache packets

Application Layer in WMSN

In this layer, we overview challenges and functionality at the application layer with respect to the different traffic classes that may be seen in the typical WMSN application.

- Manipulation of data in various ways is done in this layer which enables user or software to get access to the network.
- Some features of application layer are:
  - Interfacing: Terminal type translation.
  - File transfer: The Programs are able to understand the directory structures and naming conventions of the file and map them onto various systems.

The application layer in wireless network provides heterogeneous functionalities and it supports many services
1) Multimedia processing and source coding techniques that depend on the capability of the hardware and application specific requirements.
2) Effective communication with other application programs over the network.
3) Traffic Management and Admission Control.

5. FUTURE SCOPE

Parking system:

People owning vehicles face parking problems most of the time in metropolitan area, especially during peak hours. The difficulty face by the people is when they not knowing where the parking spaces are available at the given time, even if this is known This problem is overcome by using sensors technology with the help of IOT.

Industrial usage:

When we talk about smart industries, that means about manufacturing .it has been defined as the fully-integrated and collaborative manufacturing systems that respond in real time to meet changing demands and conditions in the factory, in the supply network, and in customer needs. Smartindustries usage in case of garbage collection, waste material and useless product and the automated machines which are fully functionaling .This helps to create the industrial system smart.

Traffic monitoring system:

If we talk about traffic system, currently they are needed to control flow and mitigate conflicting traffic movements. The signal lights can get control automatically by remote system. The driving of people also get monitor directly using microcontroller. Safety of people also get notice on highways and the amount of goods transfer from one place to another will also monitor.

Environment monitoring system: The success of the sensors are depend on its application in harmful situations. This is one of the major challenge. We can control the environment in many aspects like air quality monitoring. Some major sources of air pollution are large cities with high concentration of industry, intensive transport networks and high population density.

Everything on internet: The Internet of Everything (IoE) is a concept that extends the Internet of Things (IoT) .The communication happens between two different system or devices without human intervention is called as internet of things (IOT).

6. CONCLUSION

We discussed the state of the art of research on WMSNs and outlined the main research challenges. We discussed the challenges that comes in each layer and open research issues at the physical, link, network, transport, and application layers of the communication stack. MAC protocols that provide link latency bounds, and UWB technology, among others, seem to be the most promising research directions in developing practical WMSNs.

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