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# A CONTEMPLATE ONREAL-TIME APPLICATIONS OF MANETAND WSN

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## Abstract

The advancement in the field of internet is giving rise to many applications. We have already seen the advancement in wireless technologies like mobile adhocnetworks(MANETS). The capabilities of mobile devices are very high which helps in the rise of internet and reduces cost by using infrastructure wireless networks and infrastructure less wireless networks(mobile adhoc networks). Along with all these there are still some challenges which we face and inorder to face these challenges some efficient algorithms are used based on the type of network. MANETS provide many applications like wireless sensors,militarypurposes,rescueoperations,exchange of data,sharing internet and so on. Usually the performance is analysed on the basis of throughput and delay. Nodes can be located anywhere in the wireless network and its topology varies because the nodes can move anywhere.

**Key words:** MANETs,Routingprotocols,Wireless sensor networks(WSNs).

## Introduction

MANET can be described as a self-up network of mobile routers. They are connected to various wireless links inorder to form a arbitrary topology. In this network the nodes can move freely and can communicate with other nodes. Every device can communicate with every other device. The network does not have a fixed infrastructure. It can be considered as an automous network. The mobile nodes can be personal digital assistants(PDA's),laptops,mobiles,personal computer,home computer,MP3 player etc.These wireless nodes can dynamically create the network instead of using the infrastruce which is already present. Many practical applicatons use adhoc networks because they can be easily applied and deployed. The communication is established between the nodes using multi-hop paths. Due to the free movement of the mobile nodes in the wireless network there is a problem of link breakage very frequently. Mobile adhoc networks turned out to be an major source of communication in this evolving technological and modern world. Based on different researches which are done a few algorithms have been classified for MANETS such as Dynamic Source Routing(DSR),Optimised Link State Routing(OLSR),Temporarily Ordered Routing Algorithm(TORA),Adhoc On-Demand Distance Vector(AODV),Destidation Sequenced Distance Vector Routing(DSDV). Routing plays a key role in this and different protocols have been proposed by many researchers. The nodes which are present in

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the MANET produce the user and application traffic and perform the network control and routing protocols. And also some problems may arise during the design of mobile adhoc networks such as

- Wireless medium which possess the sharing nature.
- Limited wireless connectivity range.
- Mobility of nodes.
- Energy constraints.

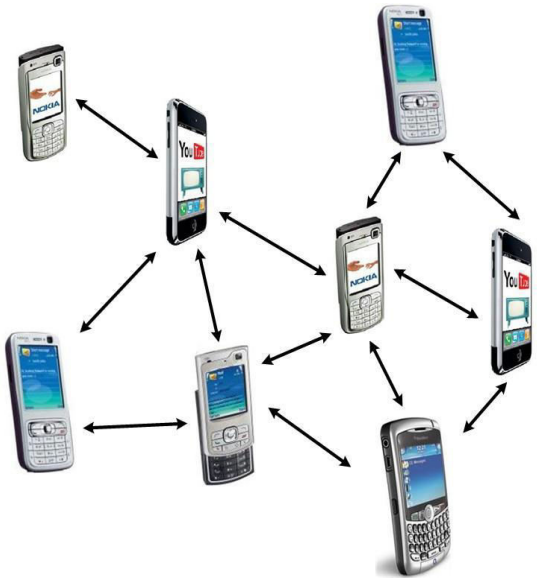

Figure 1: A Typical MANET

**Challenges**

MANET is mobile wireless adhoc network with self configuration. As it is a wireless network usually some problems in wireless networking arise.

1.Signal interference may occur.
2.Unrealiable data transmission.
3.Packet loss on the wireless network.
4.Scalability.
5.Hidden and exposed terminal problem may occur.

Along with these problems/challenges a few more problems may occur-

- Every device can communicate with every other device. So detecting and managing the faults becomes more difficult. The mobile nodes can move randomly and if there occurs any link breakage,there may be possible chances of packet loss.Packet loss on the wireless network is complicated compared to wired network.
- Every mobile node in this network is autonomous. So maintain the radio interface equipment with different transmission and receiving capabilities which thus forms asymmetric links.MANET doesn't use any router inbetween.
- In the network every node is used as a router and every node passes the data to the other nodes.To implement adhoc addressing scheme in stand alone networks MAC address of the device is used.
- Also the channels may have time varying compared to wired media and asymmetric propagation properties.

## Types of MANETS

Generally there are three types of MANETS-

1.VANET-Vehicular adhoc networks
2.SPANET-Smart phone adhoc networks
3.iMANET-Internet-based mobile adhoc networks

**Vehicular adhocnetworks(VANET)**

The VANET stands for Vehicular adhoc networks. VANETs are indeed very intelligent and thus makes use of Artificial Intelligence in case of any collisions between vehicles and accidents.VANET mostly at providing information regarding safety and traffic control. VANET is robust and it directly

affects the life of the people moving on the road. With the help of emergency tools that are inculcated in the vehicle we can tackle unexpected situations(the vehicles gives us warnings about the dangers). It ensures safety and also provides connection between the vehicles which are nearby to each other. Incase if any accident or collision occurs between the vehicles,using the vehicle control information like GPS tracking,vehiclespeed,direction,path history we can easily identify that an accident has occurred and take appropriate measures before anything happens and the path history can be detected only upto 300 metres. With growing wireless connectivity we can even find security measures in some of the vehicles like cars and bikes,for instance if we connect our mobile GPS with the vehicle,there occurs vehicle to vehicle communication(V2V) which can transmit the messages between vehicles. An affective communication can be established between vehicles by using the tools as Wife IEEE 802.11 b/g, WiMAX IEEE 802.10, Bluetooth, IRA, [22].VANET also imprint adequate probability in the vehicles to transmit natural hazards,traffic conditions,regional information to other vehicles. If the security standards are poor there are more chances of threats and vulnerable frequent attacks. While transmitting the messages it ensures security through providing access only to authenticated users and also it does not transmit any personal information like name,license or anything.

**Smart-phone adhocnetworks(SPANET)**

The SPANET/SPAN stands for smart-phone adhoc networks. It can be used emergency situations like environmental hazards or natural disasaters to communicate with others. A mobile phone or smart phone is a device. If it is embedded with adhocnetworking,the smart phone can create adhoc networks even in other devices.for example consider a situation in which a natural disaster has occurred. More obviously there won't be any means of communication for help. The signals disappear due to damage of towers. In that case where the mobile network is not available we can use the adhoc mode for communication. The service provider provides internet cable for each device having adhoc networking mode on for communication. It connects people to the network and we can communicate through the network . It can also be used for informing helplines about the disaster and seek help as fast as possible. Messages,pictures and calls are passed through the mesh network. SPAN can grasp far distances of radio equipment when it is available. It can also utilize satellite network. SPAN can be used to communicate with the volunteers locally and can communicate with one another without the use of any traditional network infrastructure. It can be very useful in remote areas,military grounds etc. SPAN is of low cost,secure and provides robust communication. By this way communication is still possible in critical situations.

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**Internet based mobile adhocnetworks(iMANET)**

The iMANET stands for internet based mobile adhoc networks. It is similar to mobile adhoc networks but iMANET is used to connect the mobile nodes to the internet. Many number of mobile nodes can be connected to the internet,or the mobile nodes can be also used individually. iMANET is mainly used for widely varying applications such as in military MANETS in which a large number of devices are connected and on the other side it can also be used in embedded systems. iMANET is suitable for small as well as large uses. Many number of mobile nodes are to be connected to the wireless network,so the capacity of the wireless network must be increased for the deployment of iMANET. On the other hand address management and location management along with interoperability and security have to be increased. If all these are done properly the deployment of iMANET becomes much more easy.

**Routing protocols of MANETS**

Routing is nothing but transmitting the packets from source to destination. In mobile adhoc networks as the topology varies frequently because of free moment of nodes packet routing becomes troublesome at a point. The packets may get lost in the wireless network. Inorder to overcome this problem efficient routing protocols are used. These routing protocols sway the runnel of data between the systems to achieve an efficient delivery. The routing protocols are categorized into two on the basis of their topologies i.e, proactive routing protocols and reactive routing protocols.

**Dynamic source routing protocol**

The DSR protocols employs source routing. It is a reactive protocol. This protocol is designed for multi-hop wireless adhoc networks rather than hop to hop. The DSR protocol is completely self organized and self configured network of mobile nodes. It does not need a fixed infrastructure of network for routing the data packets from source to destination. It consists of two phases i.e., route discovery and route maintenance. All the recently discovered paths are stored in the cache for each node. If a node wants to transmit a data packet it first checks its cache. If the pathexists,it attaches the path and the source address to the packet and then transmits it. If the path doesn't exist the node transmits a RREQ(route request packet) to its neighbouring nodes requesting a path for the packet to reach the destination. Meanwhile the sender can perform other tasks like sending and receiving the packets. If any of the neighbouring nodes find the route to the destination node they send a RREP(route reply packet) to the destination otherwise they transmit the same RREQ packet to other neighbouring nodes. When the route is discovered the sender transmits all the packets which are to be transmitted to the destination and also it stores the discovered route in its cache for future use. If the the data packet is received by the intermediate node and the intermediate node it the destination

the packet will be received by that node or else the packet is transmitted further. As it is an adhocnetwork any link might fail any time. Therefore route maintenance process is continuously monitored and is there are any changes in the caches of the nodes,they are automatically updated.

**Ad-hoc On-demand distance vector routing**

AODV reacts to changes,it is a reactive protocol. It maintains only the active routes in their caches for a pre-specified expiration time. It performs unicast routing and maintains the routes only at a given instant. Here the distance vector(destination node) is provided on-demand through the path by the nodes. Each node has a next-hop routing table that contains the destinations to which it currently has a route. This protocol adopts the destination sequence number technique. The nodes does not send multiple RREQ's and thus it does not deploy flooding. The 1st phase in AODV works in the following manner- A node sends hello messages to its neighbouring nodes to notify its existence. The link status to the next node in an active path is monitored continuously. If there is any link disconnection in between,the node transmits a RERR(route error packet) to all of its neighbouring nodes which inturn inform the nodes whose routes might be affected due to the disconnected link. Consequently the source can also be informed. The 2nd phase works like-The source node performs the the route discovery process if there is no route to the destination in its routing table. It demands the route by broadcasting the RREQ packets to the other neighbouring nodes. The RREQ packet contains an ID and the addresses of the source and destination in its header. It waits until the acknowledgement is received from the destination. Each RREQ packet has a small TTL(Time to Live) value. If the destination is not found in the specified time the TTL value is increased with each subsequent RREQ packet. Every node deletes the duplicate RREQ packets(which are received mor than once) and thus flooding is reduced. AODV uses symmetric links and a RREP(route reply packet) follows the reverse path of the corresponding RREQ. Each intermediate node updates the routing table after receiving the RREP packet and forwards it to its neighbours in the path to the source.

**Temporally ordered routing algorithm**

TORA is also a reactive protocol. It responds to the changes and link reversals. It is mainly deployed for highly dynamic MANETs. In this protocol the network shows a topology which allows only one input path and one outgoing path. It is also known as Acrylic graph topology. In this protocol many number of nodes can send packets to any given destination. TORA supports multicast routing that is from one souce to multiple destinations. It is similar to DSR unlike AODV,supports unidirectional links and provides multiple routing paths. It promises loop-free routes. TORA utilizes three

phases,they are route creation,route maintenance and vector discarding.

**Cluster-head gateway switch routing**

CGSR is a proactive protocol and also a hierarchical routing protocol. When the source want to send a packet to the destination the routing tables are already available at the nodes. The cluster with higher hierarchy sends packets to the cluster which is having lower hierarchy. The cluster has many daughters and it can form a tree like structure. CGSR forms a cluster like structure. The clusters are formed using an appropriate algorithm. The gateway node provides the communication between two cluster heads. There are three types of nodes-

1.Internal nodes-they transmit and receive the messages and packets through cluster head.

2.Cluster head-it dynamically sets the route paths,monitors the broadcast within clusters and forwards messages to other cluster heads.

3.Gateway node-to establish communication/switching between two cluster heads.

There are 3 phases in CGSR-routing path discovery and caching,maintainingupdate,and distribution. In the first phase every node maintains its own routing tables to reach other clusters. Using an algorithm called as destination-sequenced distance vector(DSDV) the cluster member table is created using the sequence numbers in RREQ packets. The second phase which maintains the routing information uses an algorithm that is least cluster change(LCC) . When a node moves out of range from all the cluster heads in one cluster,then the cluster-head changes. Cluster-heads are given priority because it helps in utilization of the paths and for transmitting the data packets without delay. This is done by another algorithm called priority token scheduling(PTS). It gives priority to the neighbouring nodes from which the packets are received recently. The cluster member table is updated as soon as the new entry is received from the neighbouring node after successful RREP. The DSDV is used to update the cluster member table.

**Flat routing table driven protocol**

In the previous routing protocols the routing table is built by caching the RERP and RERR packets. As this protocol is a proactive protocol the routing table is already present at a node in advance. In this protocol each node contains a routing table that has the available routes to the destination from itself. The modified routes are dynamically updated in the routing tables and it contains slots for each destined targets irrespective of whether the route exists currently or not or it will be eventually needed or not. The packet does not contain the route in the header and the routes need not be discovered on demand. This protocol offers minimum delay and also an alternative path in case of route busy or link reversal.on the other hand the disadvantages of this protol include additional efforts in modifying the slots or the rows in the routing table,unnecessary computations for routes ehich are no longer required and also there may be redundant paths.

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**Optimised link state routing protocol**

OLSR has characteristics that are similar to flat routing table driven protocol but here in this protocol only required updates are sent to the routing database. This reduces the overhead. A node independently selects a multi-point node which provides bidirectional links. It also relays the routing tables. In other words the multipoint relay node must be connected to all other nodes and should also enable the routing of packets to the internet connected fixed infrastructure.

**Applications of MANET**

There are several areas where MANET applications could be found:

- Wireless sensors
- Health care
- VANETs
- Road safety
- Smart houses etc.

**Wireless sensor networks(WSN)**

WSN is a technology which is growing rapidly with a high potential and also it can be implemented in real time scenarios and can be practically deployed in many applications. WSN still faces some challenges and is establishing a significant attention among the researchers because of its robustness and versatility. WSN can be practically implemented in real time applications such as monitoring of temperature,traffic monitoring,VANETs,health care(remote monitoring of patients condition),water-level and pressure,military purposes etc. WSN works more efficiently in remote areas and will be an effective solution to the areas which are unreachable and undeveloped.

The real time sensors can immediately sense,record and send feedback to the end user for further processing. Examples of these can be FM radio or face locks on mobile phones,automatic lights and fans in modern houses etc. we can connect the computer system with the external environment via sensors and input output devices. WSN has utmost importance in computer networking and its applications can be implemented in several areas for monitoring and data storage.

The **history** of WSN-It was first introduced in 1950 and in the beginning the military used this technology. The WSN was first named as Sound Surveillance System(SOSUS) which is used to detect the condition of under water submarines(to check the amplitude of the waves).

In these days as the technology has been rapidly developed it is also used in everyday lives to detect sounds or any kind of vibrations,checking the water level/the temperature level,in smart phones and in smart houses and most importantly,some different types of sensors are also used in human body. Information is passed from one sensor to another sensor in a star or mesh like topology. A sensor node consists of a micro controller,a transceiver,external memory,power sources etc.

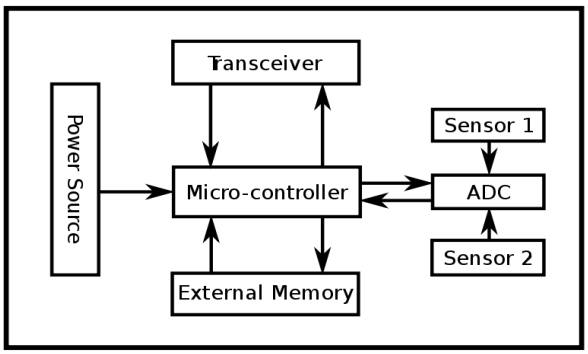


**Figure 2: Parts of a sensornode**

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The WSN **architecture**consists of sensor nodes which communicate with each other and send the processed data to the sink node. The sink node then transmits the data to the end users through internet. A highly intellectual system can be able to process and send huge amounts of data which inturn reduces the human effort in an efficient way.

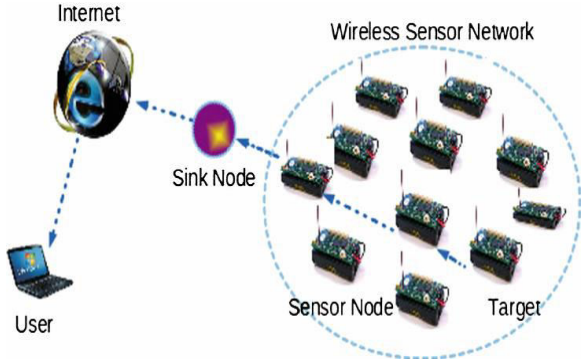



**Figure 3: WSN system architecture**

## Types and requirements of WSN

Different types of sensors are present to be used in different areas such as underground WSN,underwaterWSN,multimediaWSN,mobile WSN, and terrestrial WSN.

**Terrestrial WSN**

It consists of many small sensor nodes that are connected to each other through wireless links. All the nodes are randomly deployed and these nodes are used to know the effect of weather such as heavy rainfall or snow and the conditions which vary day to day. As this is a wireless communication link there may be damage to the nodes due to the weather conditions.

**Underground WSN**

The under ground sensors are used to measure the conditions in the under ground and is also used for collecting information(about the resources). But the drawback is the limited battery power which cannot be changed or recharged. To avoid these drawbacks some efficient routing algorithms can be used to maintain the WSNs accuracy during the routing process. The underground environmental framework can be monitored such as soil composition and the soil moisture.

**Underwater WSN**

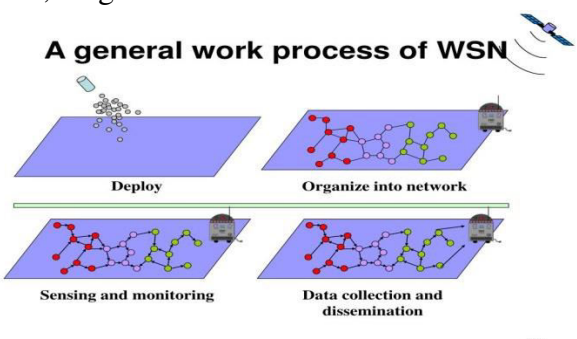
The sensors which will be used under water are very expensive. They are placed under the water for gathering information about the under water situations. They are used to measure the level of depth,the amplitude of the waves and the condition of the underground submarines. The drawbacks of this include limited bandwidth and poor signal range.

**Mobile WSN**

The mobile wireless sensor networks are able to connect to the environment. They can also connect and communicate with computers. The examples of MWSNs can be face locks on mobile phones,google maps which tracks our current location and navigates to any other places.

**Multimedia WSN**

The multimedia wireless sensor networks are composed of minute sensor nodes which can sense,compute,activate and communicate. The examples for these include minute cameras that are able to receive and transmit videos and audios,images etc.




**Applications of wireless sensor networks**

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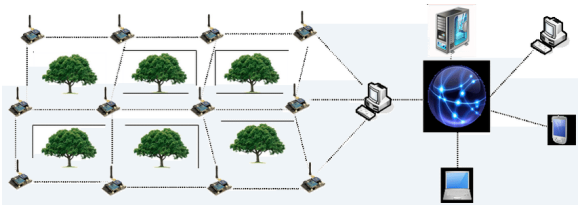
Due to the rapid urbanization,WSN is used every where in the modern society. It has been implemented in various fields such as military,healthcare,business,industries and so on. Some of the applications have been described below.

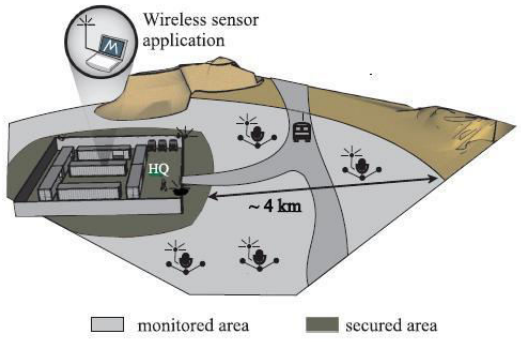
**Enviromental monitoring**

The sensors are deployed in almost all the cities. This includes the tracking of the movements of birds,insects or animals in forests. Sensors are installed in the environment to detect the weather conditions,to estimate the pollution or to monitor different changes in the climate for citizens. For an instance let us assume a forest is on fire. When the forest is installed with a network of sensor nodes,the sensor can detect the temperature,humidity,gases which are produced by the fire. They can send a message to the base station(along with the location).



**Military surveillance**

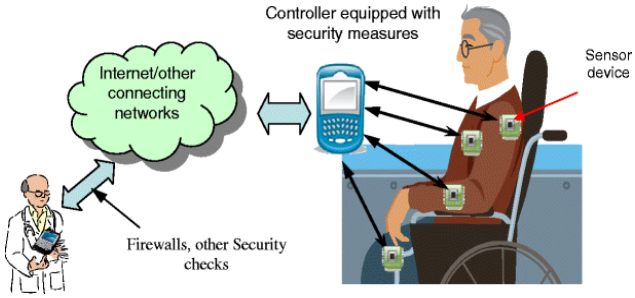
WSNs are used for military surveillance in the early stages(1950s).




The sensor nodes are deployed in the military grounds to monitor the presence of enemies or vehicles and to track their movements.

**Health care**

WSNs are able to track a patients health condition and send the information to the doctors.




For example let us consider a patient with all his health conditions connected to a monitor(in his house). The sensors deployed in his housemonitors the behavior of the patient and informs the doctor or the hospital in case of emergency. Immediate health care can be taken in these cases without any delay.

**Home intelligence**

The sensors can be used to provide more luxurious and convenient living environments for human beings. These sensors can be deployed in home to control the things by connecting the sensor nodes to the mobile phone.

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This makes our work easy to be done from anywhere and anyplace. Ability to control everything through the mobile phonereduces the human effort and provides a more comfortable living.

**Industrial process control**

WSNs can be used to monitor the manufacturing process or observe the manufacturing equipments. For example oil refineries can use the sensors to measure or monitor the conditions of pipelines. These sensors can be used to detect any pipeline failures.

**Agriculture**

Wireless sensor networks are also deployed in the agriculture field to sense the real time environment. The sensors are used to collect the data like soil moisture,soil temperature,water level,humidity,wind speed,wind direction,rainfall etc.


The collected data is sent to the server where the analysts analyse the data and take decisions accordingly. The collected data is very useful for taking decisions regarding agriculture. If this process is done properly and accurately this will definitely become an advantage to the farmer as well as optimal quality can be achieved.

**Structural monitoring**

Wireless sensors are deployed in structural monitoring to detect the conditions of the bridges,flyoversbuildings,tunnels etc. It is a network of tiny computers linked to the sensors. They provide the information about the operation conditions and perform remote supervision. This provides quantitative information about the performance under operative conditions. This reduces the need of site visits and we can have the advantage of daily data. The performance can be measured accurately in this way more than any other inspections.

**Challenges**

Sensors have a very high potential in collecting and extracting vast amounts of data. They help to monitor and interact with the physical world remotely. Along with all the advantages there are still some disadvantages of wireless sensor networks which have to be overcomed.

**1.Energy**

The first and foremost design challenge for WSNs is its energy efficiency. Sensing,communication and data processing are the 3 functional domains which require power. The constraints associated with the sensor nodes is that,they have a very low battery power and limited energy. Basically sensor nodes work with batteries,which should be recharged or replaced when they are damaged. For non-rechargeable batteries,the sensor nodes must be able to work until the mission gets completed. The mission length(time) depends upon the the application type.

**2.Limited bandwidth**

In WSNs,more power is consumed for transmitting data than processing the data. The data rate for wireless networks is 10-100kbps. The limited bandwidth affects the exchange of messages or data between the

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sensors. If the messages are not exchanged between the sensors,synchronization fails. This is the major drawback related to bandwidth.

**3.Node costs**

A WSN consists of large number of sensor nodes. The cost of an individual node is critical than that of the entire network. The global metrics will be acceptable if the cost of the sensor nodes are kept low.

**4.Node deployment**

Node deployment is a complicated issue in WSNs. To solve this,a large number of sensor nodes must be deployed properly using special techniques. One is static deployment that chooses one best location according to the optimization strategy. In static development there will be no change in the life time of the WSN. Whereas in dynamic deployment the nodes are throwed randomly for optimization.

**5.Design constraints**

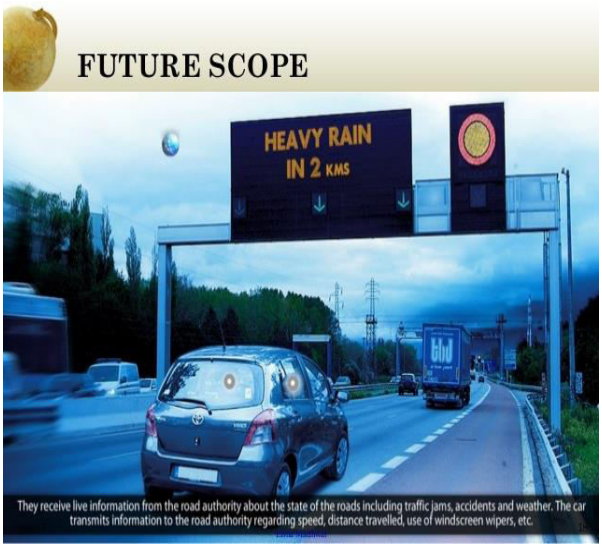
There are restricted constraints on software and hardware design models which are challenges for the WSN. The main goal of the wireless sensor design is to create much cheaper,smaller and efficient devices.

**6.Security**

Security is one of the challenges in WSN. The wireless sensor networks need high security requirements to provide confidentially and authentication to the sensor nodes. The sensor nodes collect sensitive information which has to be kept secretly and safely from intrusions and attacks. The network should be highly secured and reliable.

## Conclusion

In this study I had observed how the wireless networks can be applied in real life situations. A list of routing algorithms are classified which contributes to the efficiency of the adhoc networks. A great development can be seen among the wireless networks and mobile adhoc networks. The wireless sensor networks(WSNs) play a major role in this modern world. The practical implementation of its applications can be used to enrich the human life and can reduce the man power. But still there are a set of challenges associated with both the adhoc networks and wireless sensor networks which have to overcomed further.If the challenges could be reduced the WSNs can be improved and used for various other purposes which results in improved food,intelligentbuildings,good health care,detecting disasters etc.

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