

Figure 2. Architecture of Vehicular ad-hoc network (VANET) [5]

3.3 Basic Concept of FANET

Rapid technology advances on electronic device and communication technologies, it has been probable to construct unmanned aerial vehicle (UAV) system, which can fly separately or can be manage slightly [10]. The small operating experience (adaptability, elasticity and easy equipment) usage of UAV assures the modern methods both military and civilian applications. Maintain the communication links between the unmanned aerial vehicles basically in FANET UAV is a demanding task. The topology of these networks is additional forceful than that of distinctive mobile ad hoc networks (MANETs) and of representative vehicle ad hoc networks (VANETs). FANET especially case of MANET attribute and the high degree mobility. The FANET topology change more frequently, when the ordinary infrastructure is out of service or not available [11]. The major essential component routing in FANET bandwidth play the critical role in the process of large amount of data routing decision. One of the major anxieties in FANET is to evade the crash [2]. The Fig 3. shows the basic architecture of FANET and Fig.4 show the comparative architecture overview of types of ad hoc networks(MANET,VANET,FANET).

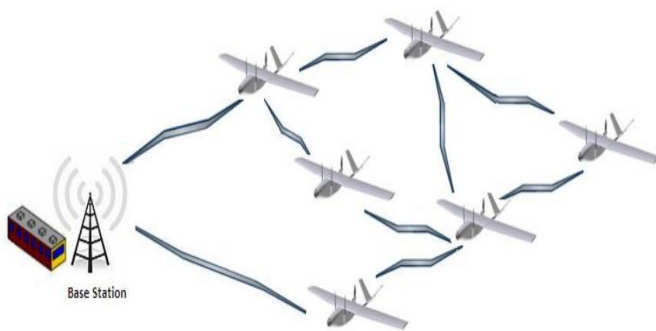


Figure 3. Architecture of Flying ad-hoc network (FANET) [11]



Figure 4. Architecture of MANET, VANET and FANET [10]

4 Security issues and Challenges

4.1 Security issues and Challenges in MANET

The Security issues and challenges in MANET are given below:-

- **Active Attacks:** Active Attack achieves the attacker for duplicate; transform and removal of exchange also try to modify the behavior of protocol. A number of times identify the active attack however active attack fewer used by an attacker. Basically active attack modifies the data packets, inject the packet and drop the packet [2].
- **Passive Attacks:** Passive attack is difficult to be identifying. Routing packet and attacker may understand about a node [12]. Passive attack objective the privacy characteristic of network and complete for distinguish the communication prototype among nodes.

Physical Layer Attacks [12]

- 1) **Snooping:** In snooping attack, attacker stabs to catch the top-secret information through communication.
- 2) **Jamming:** Jamming attack will be executed by knowing the incidence malevolent nodes sends jam signal to interrupt the communication.
- 3) **Active Interfering:** An active prying is a type of denial of service attack which alters the infrastructures.

Link Layer Attacks

- 1) **Egotistic Misbehaviour of Nodes:** In the egotistical misbehaviour nodes will achieve as selfish and will not be ready to contribute in promote process [12].
- 2) **DOS Attack:** these attacks avoid official access of capitals to the realistic node [12].

- 3) **Resource Collapse:** Malicious nodes concept frequent collision to consume the battery power [12].

Network Layer Attacks [12]

- 1) **Black Hole Attack:** In the Black Hole Attack the attacker node encourage shortest route destination malevolent node can descent packet or achieve DOS attack or Man in the central attack. Malicious nodes inserts fault routing information to the network and guide the packets in the direction of it.
- 2) **Wormhole Attack:** In this attack two attack involve one attacker delays the packet and other packet passageway and the link of attacker provide high speed communication link between them.
- 3) **Routing Table Poisoning Attack:** Attacker venoms the routing table by varying the routes in the routing table. Other way is to addition RREQ packet with high arrangement number and low sequence number packet will be deleted. Routing protocols preserve tables that embrace in the sequence concerning routes of the network.

Transport Layer Attacks [12]

Session Hijacking: Here the attacker satires the IP address and launch a variety of attacks using the accurate sequence number and control the session of hijacking.

Application Layer Attacks

- 1) **Malicious code attacks:** Malicious code attacks both operating system and user application and also includes, Viruses, Worms attack.
- 2) **Multilayer Attacks:** The DoS attacks, artificial attacks, man-in-the middle attacks, and many other attacks can purpose multiple layers.

4.2 Security issues and Challenges in VANET

The Security issues in VANET are given below [6]:-

Threats to Availability

The threats to availability of vehicle-to-vehicle and vehicle-to-roadside communication are given below [15]:

- 1) **Denial of Service Attack:** Denial service attack can be complete with approve of indoor and outdoor network. In the cause of VANET produce the artificial messages like Flooding and Jamming.
- 2) **Broadcast Tampering:** This attack is supported out by an insider. It contributes false safety messages into the VANET to impose damage or detriment to the road users. When attackers influence the traffic on a clear route then accident can happen.
- 3) **Malware:** This attack is frequently approved by insiders more than outsiders and when a firmware update is done it can be downloaded into the system.

- 4) **Spamming:** Spam messages in VANET additional problematic to control in VANET because there's no central organization.
- 5) **Black Hole Attack:** This attack is the cause of broadcasting messages and also nodes declining to contribute in the network when the nodes slump the network than all communications and links had broken.

Threats to Authenticity

In VANET validity requirement is very important. This includes the defending of sensible node from the attackers "inner or outer" insightful the network with false classifies [14,15], such threats are:

- 1) **Masquerading:** This attack implements the justifiable vehicle in the network and creating of false message and forming of black holes.
- 2) **Global Positioning System (GPS) Spoofing:** GPS spoofing through the GPS satellite communication creates the false location and move the vehicle wrong side to ensure that this location is right one.
- 3) **Tunneling:** The attackers rapidly insert false positioning information or data in to the committed unit of the node, origin the node to assume that the information received is valid.
- 4) **Position Faking:** In blind spot attacker speedy modifies the position and unsecure communication generate the blind spot also dispatch essential and authentic security messages.
- 5) **Message Tampering:** In this attack, the attacker adjusts and exchanged the message from vehicle-to-vehicle or vehicle-to-roadside unit communication also demand or reply from other nodes.
- 6) **Message Suppression/Fabrication/Alteration:** The attackers essentially restrain the communication link between vehicles or change the application so that the vehicle cannot send or receive or return to application.

Threats to Confidentiality

Messages that are swapped between nodes (vehicles) in VANET are open to privacy threats or attack with method such as illegal variety of messages during snooping and passive attacks which are confirmed in the journalism by the investigators [15].

Security Challenges in VANET

The Security challenges in VANET are given below:-

- **Real Time Constraints:** VANET achieve the real time constraints so, required the specific timing to deliver the messages. Achieve this goal use very fast cryptographic algorithm.
- **Data consistency Liability:** Data consistency is important in VANET and avoids the unnecessary information because authenticate node execute the malicious.
- **Key Distribution:** VANET use the key to send and receive the messages encrypts the message and after procedure complete decrypt the message that's why

key distribution is an important procedure and perform the major challenge.

- **High mobility:** High mobility is required in VANET nodes are connected each other's and transfer the signals to communicate the other vehicle so very fast mobility level is required. VANET required less execution time.
- **Non- repudiation:** In this procedure node cannot refuse but does not send the messages and signals. [14].
- **Data verification and privacy:** To preserve the integrity, regular bases check the verification and privacy is very essential characteristic in VANET.

4.3 Security issues and Challenges in FANET

The Security issues in VANET are given below [16,17]:-

- **National Regulations:** UAV is used many application areas in FANET. Many countries' present the air regulation does not allow restricted UAV operations in civil airspace.
- **Routing:** Data routing between UAC major challenges the routing conventions should be able to update routing tables animatedly conferring to topology changes, so must require to develop new routing algorithms and networking modals for assemble the flexible Modal.
- **Path Planning:** Path planning is play very vital role in FANET so; acquire new algorithms methods and dynamic path planning is very essential to achieve the goals. Many case each UAV has to change its preceding path, and new ones must be recalculated animatedly.
- **Integration with a Global Information Grid (GIG):** GIG is a universal network system provide intend capabilities that collaborate the each other A FANET should connect further information grid. Grid is one of the main proposals that increase the efficiency of a UAS by using UAV.
- **Coordination of UAVs and manned aircrafts:** UAVs collaborate is necessary to maintain the FANET aircraft network environment is necessary to fulfill the flying requirement the coordination of UAV will allow the destruction of enemy aircraft with negligible losses.
- **Standardize FANETs:** To reduce the frequency obstruction issues need to use standardize communication
- **UAV mobility and placement:** Use different sensors that loaded the different, while another UAV is prepared with a high resolution camera and also allow the several images to be taken from the similar areas.

Security Challenges in FANET

The Security challenges in VANET are given below [11]:-

- **Routing:** In FANET routing is diverse from the other ad hoc network because the node movement is very high and the topology modify very frequently two major challenges are to be shown in routing:
 - Routing algorithm work high mobility
 - Routing algorithm should be quick to update
- **Security:** In FANET mange the secure routing point is: Make sure Confidentiality, Integrity and Availability of precious information in FANET so these networks are essential to mange. Lack of physical security node compromises there is another issue in FANET. Trust management is another important point. In FANET nodes leave and join very frequently [2] Accessibility routing algorithms for ad-hoc networks are unable in the opposition to frequent network topology modify and malicious attacks in FANET.
- **Quality of Service (QOS):** The parameters quality of services able is to be improved. In FANET different type of data are transformed like image, video, audios, text etc.
- **UAV Mobility and Placement:** UAV are the available various capabilities and capacities for different purposes basically the placement of UAV is appropriate the major concern in FANET [2]. Open challenges is to optimize the UAV placement.
- **Scalability:** Perfume more tasks required more UAV because singe UAV can perform restricted task. So, FANET algorithm design should be they can accommodate many UAV.
- **Reliable and Secure data transfer:** FANET application transfers the perceptive information that's why reliability of network is very elevated and defines the significant data. Table I, provides the comparison analysis between MANET, VANET and FANET with different parameters.

Table 1. Comparison different types of ad-hoc networks [11]

Parameters	MANET	VANET	FANET
Mobility	Low	High	Very High
Nodal Density	Low	High	Very Low
Mobility Model	Random	Regular	Random
Topology Change	Slow	Fast	Fast
Line of Sight	Not Available	In Cases	Some Available
Localization	GPS	GPS,AGPS	GPS,AGPS

5 Conclusion

The applications are core component of ad hoc network and basic purpose of these applications to serve the users. The behavior of the nodes in MANET, VANET and FANET are dynamic nature due to different types of topology and network nature. The applications of these networks are directly connect to the end user and security is important milestone to serve the user in dynamic environment. Attackers are also part of this network and it is very difficult to monitor the behavior of attackers and nature of attacks in network. In this survey paper, emphasis various security issues in MANET, VANET and FANET and also discuss in detail the key security challenges in the field of MANET, VANET and FANET. In future work, we will discuss in detail the security solution of security issues and challenges in MANET, VANET and FANET.

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