ASSIGMANT - I

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Topic ÷

Drone Communication In Logistics.

Drone communication in logistics

scenario : A delivery company uses drones for urban logistics.

a) Identify suitable frequency bands for drone control.

1). 2.4 HZ ism Band

→ widely used for command and telemetry.
→ Global license-free use.
→ Moderate range (1-5km).
→ prone to interference from wifi / bluetooth.

2) 5.8 GHz ISM Band.

→ Used for video transmission (FPV) and back up control
→ Higher data rates but shorter range.
→ less crowded than 2.4 GHz.

3). 433 MHz / 868 MHz (Sub-GHz ISM Bands)

→ suitable for long-range telemetry and RC links
→ lower frequency = better penetration and range
→ region-specific availability.

4). C-Band (5030 - 5091 MHz)

→ reserved for UAV communication.
→ requires licensing from aviation authorities.
→ secure and interference-free.

6). Evaluate interference issues in urban skies.

1) RF Congestion

→ Over crowded 2.4 GHz & 5.8 GHz bands due to wifi, Blue tooth, etc.

→ Causes signal drops and latency in drone control.

2) Multipath Interference

→ Signal reflection off buildings distort communication and GPS accuracy.

3) GPS signal loss

→ Tall structures block (or) reflect satellite signals, affecting navigation.

4) Cellular Network Overload

→ Heavy mobile usage can reduce 4G/5G reliability for BVLOS drone links.

5) Electromagnetic Interference (EMI).

→ Power lines, transformers disrupt sensors and compasses.

6) Illegal Jammers (or) Strong RF sources.

→ Can cause total loss of signal (or) force drone to crash / fly away.

c) Recommend a protocol for command and control messages.

Micro Air Vechiles Link (MAVLink)

1) Low Latency & Bandwidth - Efficient
→ Ideal for real-time control and telemetry on limited-bandwidth links.

2) Reliable Communication
→ Includes checksums and message IDs to ensure integrity and order.

3) Supports Encryption & Authentication
→ Optional support for secure communication

4) Cross-platform & open source
→ Works on various operating systems and hardware platforms.
→ Easily extensible for custom messages.

5) Compatibility with C2 link Technologies.
→ Works over serial, UART, USB, UDP, or even cellular (4G/5G) and RF modems.

d) suggest a topology to manage multiple drons.

1) Star Topology (Recomended):

→ All drones connect to a central Ground control station (GCS).

→ simple to manage and monitor fleet operations.

→ Best for delivery, surveillance, and mapping missions.

2) Mesh Topology (Advanced)

→ Drones communicate with each other

→ Suitable for swarm operations and remote BVLOS missions.

→ More resilient but complex to implement.

3) Hybrid Topology

→ combines star for control and mesh for inter-drone communication.

Ideal for large-scale, intelligent drone systems.