Dronamics: Navigating the Skies of Innovation

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Outline

- Introduction
- Types of Drones
- Applications of Drones
- Engineering Components
- Navigation and Control Systems
- Communication Systems
- Software and Algorithms
- Q&A Session

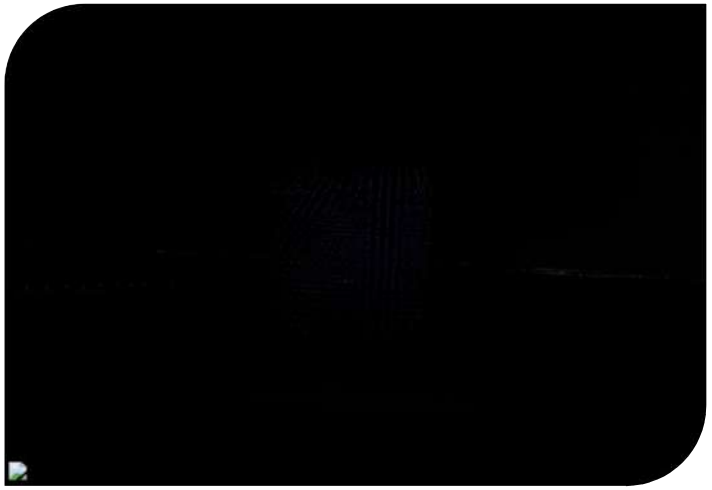
Introduction
A. Definition of Drones

1. **Unmanned Aerial Vehicles (UAVs)**
    1. Devices designed for flight without a human pilot on board.
    2. Varied shapes and sizes, designed for specific purposes.

2. **Remote-controlled or Autonomous Flight**
    1. **Remote-controlled Flight:**
        1. Operated by a human pilot using a ground control system.
        2. Common in hobbyist and recreational drones.
    2. **Autonomous Flight:**
        1. Capable of operating without direct human input.
        2. Utilizes onboard sensors, GPS, and pre-programmed algorithms.

Introduction
B. Significance in Modern Applications

1. Pervasiveness in Various Industries
    1. Entertainment, Agriculture, Military, Surveillance
2. Versatility and Adaptability
    1. Changing the Landscape of Work and Innovation
3. Impact on Efficiency and Accessibility
    1. Redefining Traditional Practices
    2. Opening New Possibilities for Exploration



Types of Drones
A. Fixed-Wing Drones

1. **Description:**
    1. Resemble traditional airplanes with fixed wings.
    2. Designed for forward motion and lift generated by the wings.

2. **Characteristics:**
    1. Longer flight range compared to multirotor drones.
    2. Efficient for covering large areas in a single flight.

3. **Applications:**
    1. Aerial mapping and surveying.
    2. Surveillance over large territories.

Types of Drones
B. Multirotor Drones

1. **Description:**
    1. Equipped with multiple rotors for vertical takeoff and landing.
    2. Achieve stability through rotor variations (quadcopters, hexacopters, etc.).
2. **Characteristics:**
    1. High maneuverability and hovering capabilities.
    2. Shorter flight durations compared to fixed-wing drones.
3. **Applications:**
    1. Photography and videography.
    2. Precision agriculture and crop monitoring.

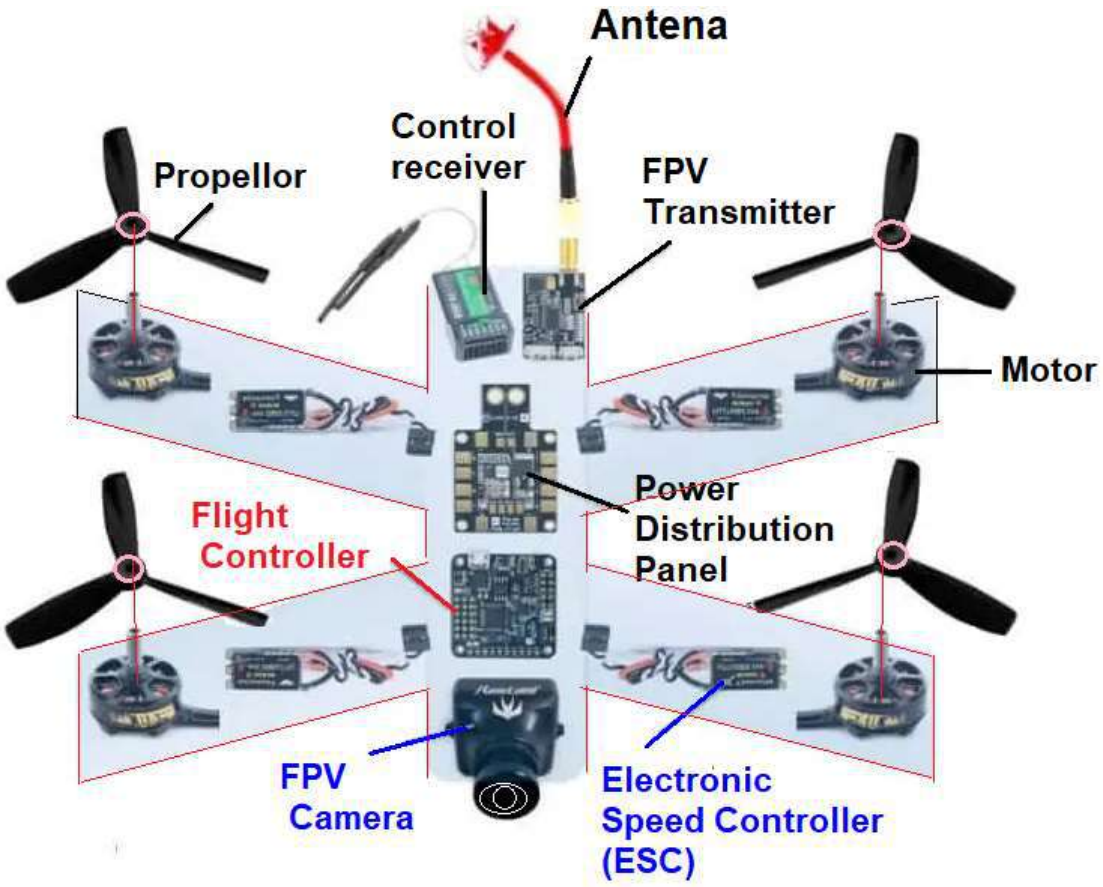
Types of Drones
C. Hybrid Drones

1. **Description:**
    1. Combine features of fixed-wing and multirotor designs.
    2. Enable both vertical takeoff/landing and efficient forward flight.

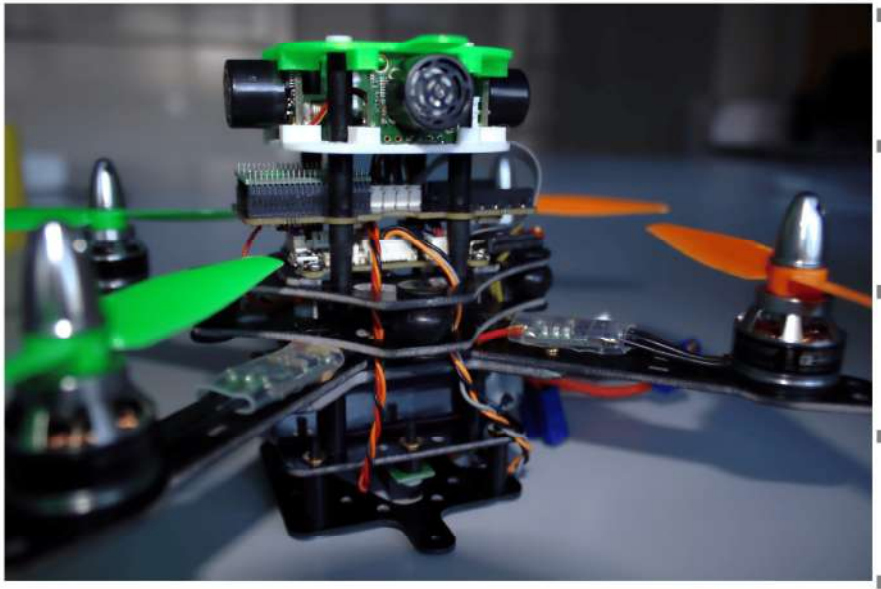
2. **Characteristics:**
    1. Versatile for various operational scenarios.
    2. Extended flight range compared to traditional multirotors.

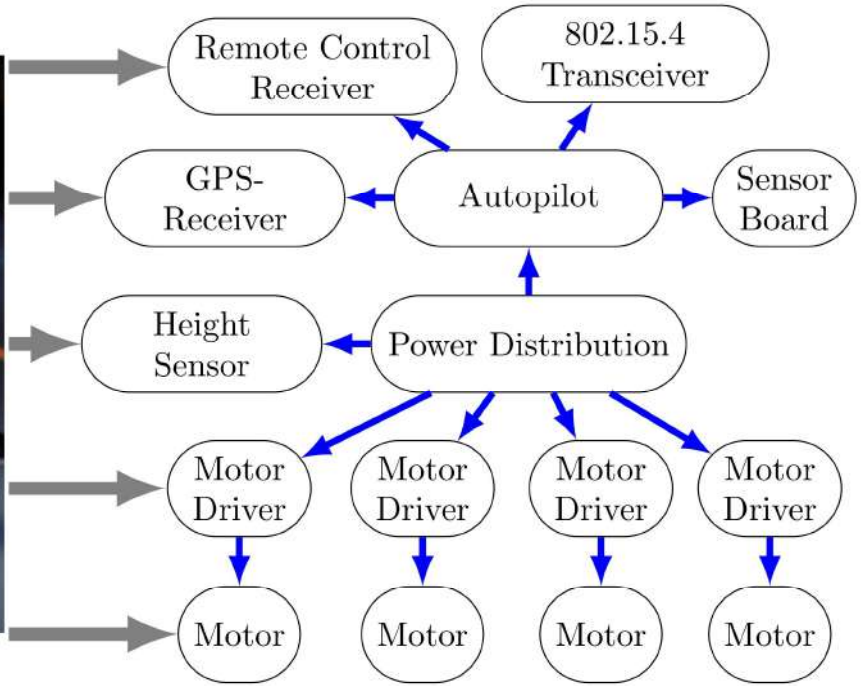
3. **Applications:**
    1. Surveillance missions requiring both hovering and long-range flight.
    2. Search and rescue operations.

Engineering Components



Engineering Components





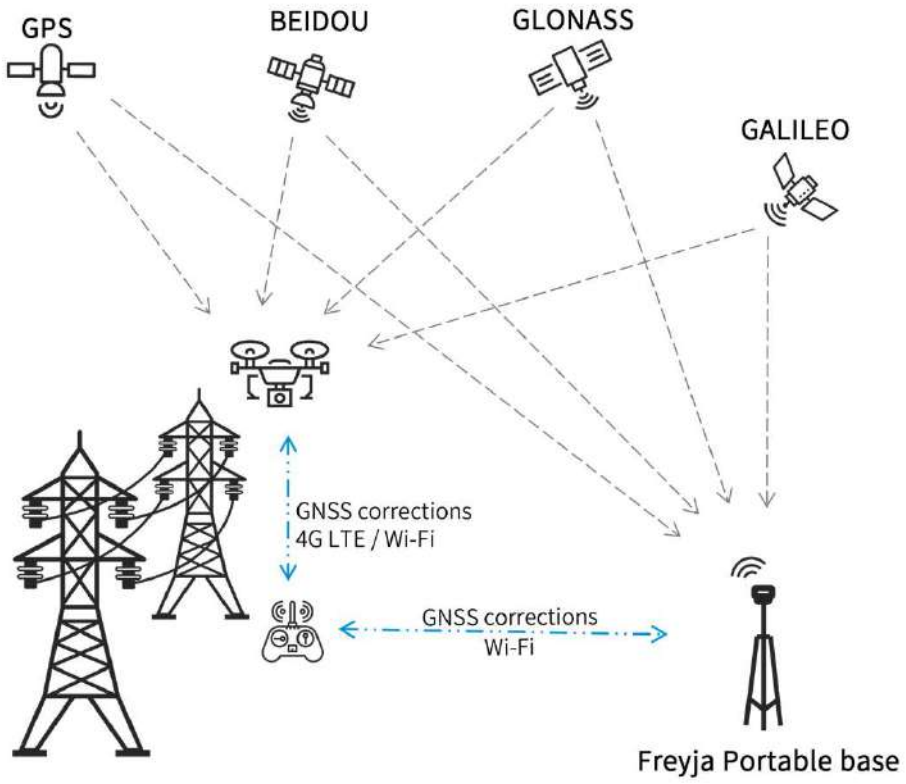
Navigation and Control Systems

1.GPS (Global Positioning System):

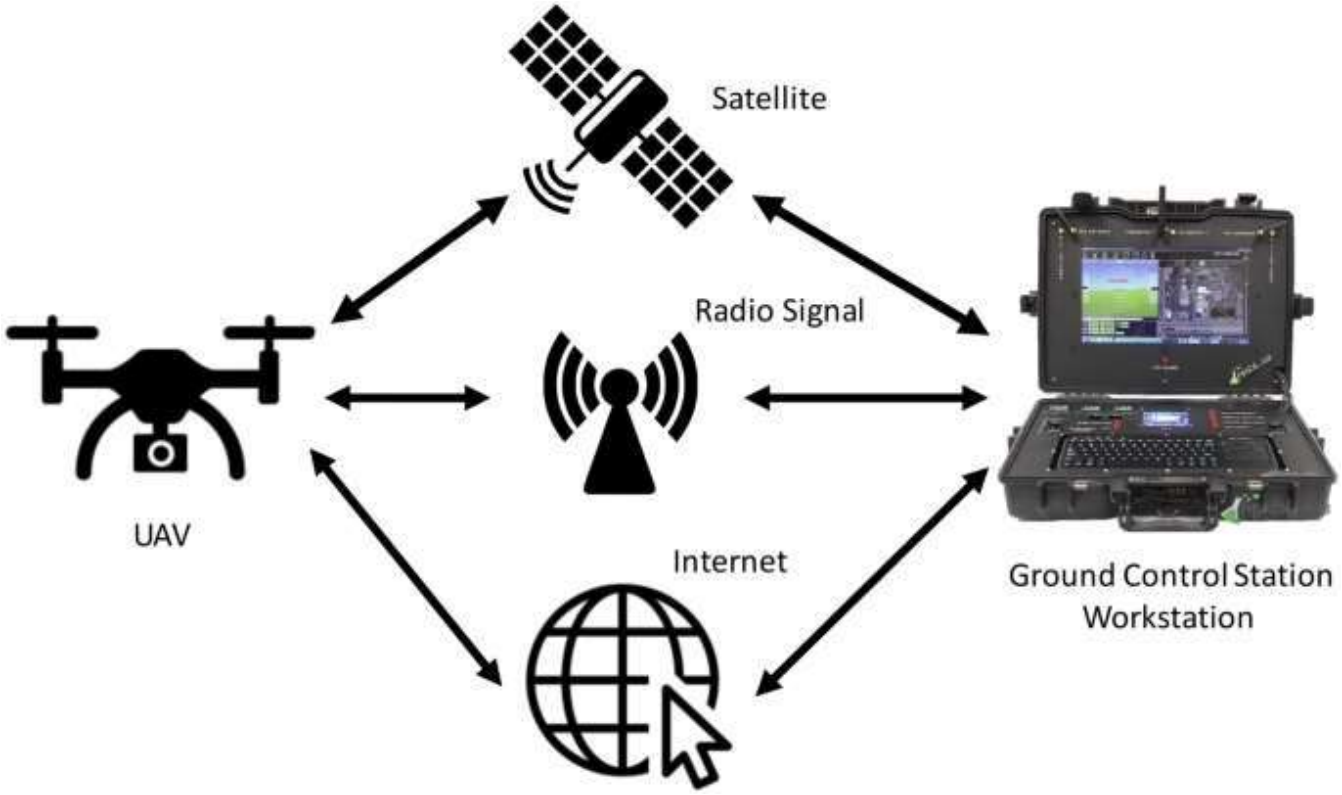
1. Determines the drone's precise location, altitude, and speed.
2. Enables accurate navigation and waypoint-based flight.

2.GLONASS, Galileo, and BeiDou:

1. Supplemental global navigation satellite systems for increased accuracy.
2. Redundancy for improved reliability in various geographic locations.



Communication Systems



Communication Systems

1.Wi-Fi and Bluetooth:

1. Wi-Fi for data transmission and control in consumer drones.
2. Bluetooth for short-range communication with peripherals.

2.Cellular Networks:

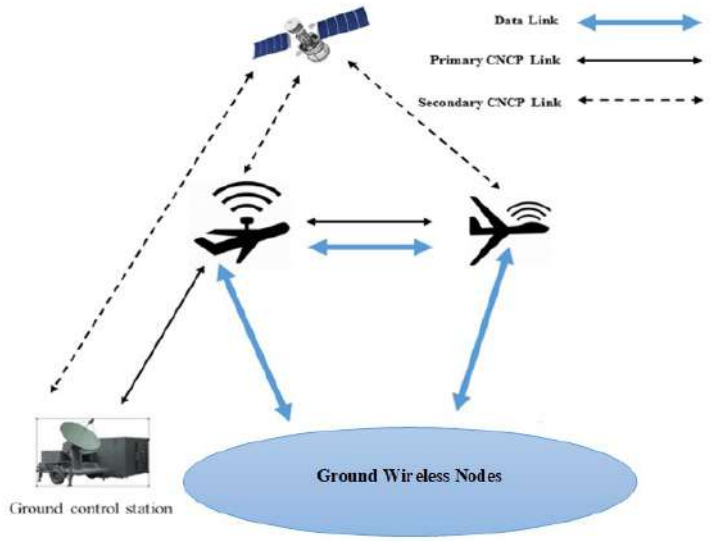
1. Integration of 4G/5G networks for extended communication range.
2. Enables long-distance control and real-time data streaming.

3.Satellite Communication:

1. Utilizes satellite links for communication in remote or inaccessible areas.
2. Ensures global connectivity for mission-critical operations.

4.Mesh Networking:

1. Network of interconnected drones for collaborative missions.
2. Redundant communication paths for enhanced reliability.



Software and Algorithms

- **A. Flight Planning Software**

1. **Definition:**
    1. Applications and tools for designing and simulating flight paths.
    2. Allows users to pre-program waypoints, altitude, and actions.

2. **Features:**
    1. Waypoint Setting: Defines specific locations for the drone to visit.
    2. Altitude Control: Plans the drone's height at different points.
    3. Mission Simulation: Simulates the planned flight for analysis.

Software and Algorithms

Mission Planner Home Screen

Software and Algorithms

- **B. Navigation Algorithms**

1. **PID Controllers (Proportional, Integral, Derivative):**
    1. Maintain stability by adjusting motor speeds based on sensor data.
    2. Proportional control for immediate response, integral control for long-term stability, derivative control for dampening oscillations.

2. **Pathfinding Algorithms:**
    1. Determines the optimal path between waypoints.
    2. A* (A-star), Dijkstra's, and other algorithms for efficient route planning.

3. **Collision Avoidance:**
    1. Algorithms that use sensor data to avoid obstacles during flight.
    2. Dynamic replanning for real-time adjustments to the flight path.

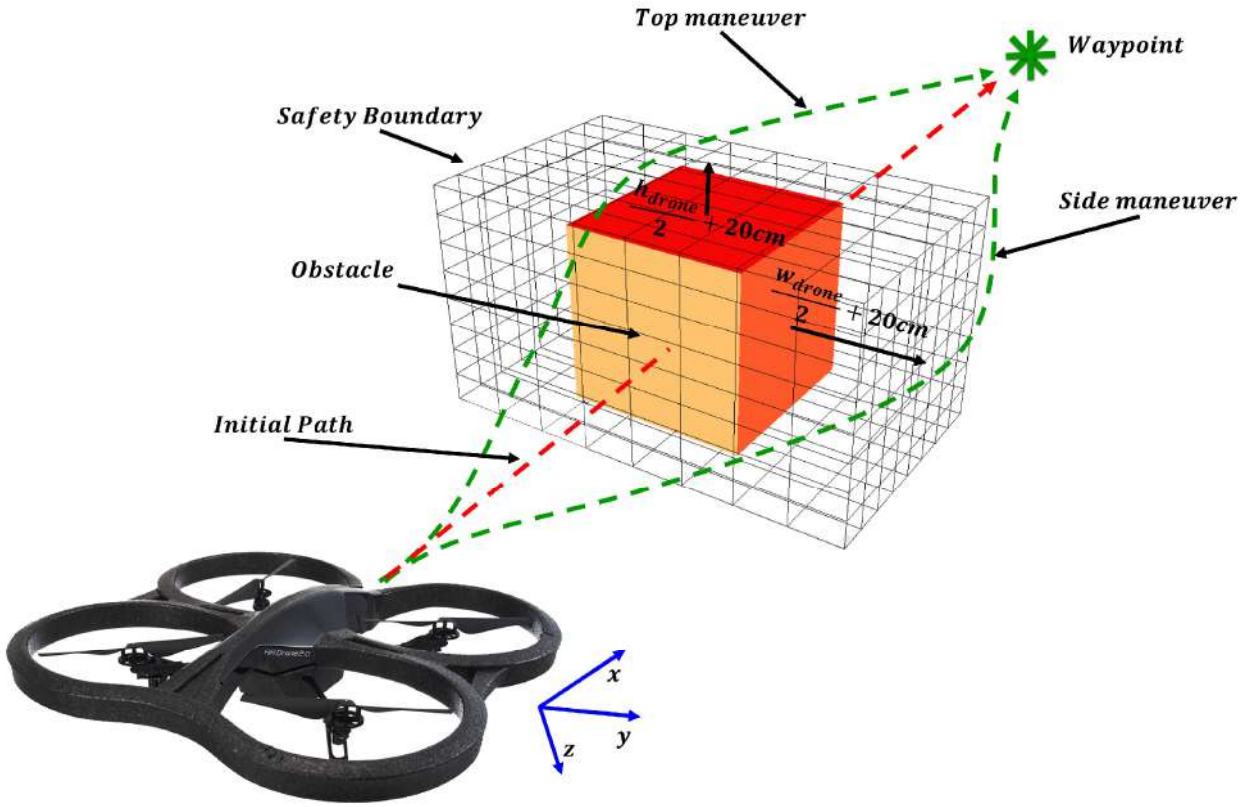
Software and Algorithms

- **C. Intelligent Behaviors and Decision-Making**

1. **Autonomous Decision-Making:**
    1. Drone's ability to make real-time decisions based on sensor input.
    2. Responds to changing environmental conditions or unexpected obstacles.
2. **Swarming Algorithms:**
    1. Coordination of multiple drones for collaborative missions.
    2. Communication and behavior algorithms for synchronized actions.
3. **Machine Learning and AI:**
    1. Integration of artificial intelligence for adaptive learning.
    2. Enhances capabilities like object recognition, pattern detection, and anomaly identification.

Software and Algorithms

Collision Avoidance:



Q&A Session

Thanks for your attention