

Drones: Applications, Regulations, and Future Prospects

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Abstract: Unmanned Aerial Vehicles (UAVs), commonly known as drones, have become an essential part of modern technology. Their applications extend from agriculture and delivery services to emergency response and environmental monitoring. While drones offer clear benefits in efficiency and innovation, they also raise legal and ethical challenges related to safety and privacy. This paper highlights the most important applications of drones, reviews general regulations applied internationally and locally, and presents future perspectives for their safe integration into daily life.

Keywords: Drone, UAV, Regulations, Applications, Safety, Privacy.

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I. INTRODUCTION

Over the past decade, drones have shifted from being a niche military technology to a widely accessible tool used in commercial, industrial, and recreational activities. Affordable prices, lighter materials, and advances in navigation systems have made drones available to individuals and organizations worldwide. However, the increasing use of drones has raised concerns about their safe operation, their impact on civil aviation, and their potential misuse for violating privacy.

II. APPLICATIONS OF DRONES

A. Civil and Commercial Uses

In the commercial sector, drones are widely used for aerial photography, film production, and marketing. Major companies such as Amazon have tested drone-based delivery systems, aiming to reduce delivery times. In agriculture, drones play a critical role in precision farming by monitoring crops, assessing soil conditions, and applying pesticides more efficiently.

B. Public Safety and Emergency Response

Drones are increasingly deployed in disaster management. For example, after earthquakes or floods, drones can provide real-time images of damaged areas, helping authorities prioritize rescue operations. Police forces in some countries also use drones for crowd management and traffic monitoring.

C. Industrial and Scientific Applications

Engineers use drones to inspect oil pipelines, power lines, and large infrastructure where manual inspection would be dangerous or costly. In addition, environmental scientists

use drones for wildlife monitoring, mapping forests, and studying the effects of climate change.

III. GENERAL REGULATIONS

➤ *Although Regulations Differ between Countries, Several Rules are Common Worldwide:*

- **Registration:** Drones above a specific weight must be registered with national aviation authorities.
- **No-Fly Zones:** Flights are restricted around airports, government facilities, and military bases.
- **Altitude and Visibility Limits:** Drones are typically limited to a maximum altitude of 120 meters and must remain within the operator's line of sight.
- **Safety and Insurance:** Operators are required to follow safety guidelines and, in some countries, provide insurance for potential damages.
- **Privacy Protection:** Unauthorized filming of individuals or private properties is strictly prohibited in many legal systems.

In Saudi Arabia, for example, the General Authority of Civil Aviation (GACA) requires drone registration and sets clear guidelines for safe operation, aligning with international practices.

IV. CHALLENGES AND FUTURE PROSPECTS

Despite their advantages, drones face challenges related to regulation, safety, and technical limitations. Differences between national laws make it difficult to operate drones internationally. Battery life remains a major limitation for long-distance flights. Privacy and security concerns also slow down the acceptance of drones in some societies.

Looking ahead, the integration of drones with artificial intelligence (AI) and 5G networks could transform industries such as logistics and smart city management. Improved battery technology and international regulatory harmonization may allow drones to play a bigger role in global trade, disaster response, and environmental protection.

V. CONCLUSION

Drones are no longer just futuristic tools; they have become part of daily life in agriculture, commerce, public safety, and research. However, their rapid adoption requires clear regulations and responsible use to ensure safety and respect for privacy. With continued innovation and stronger legal frameworks, drones have the potential to become one of the defining technologies of the 21st century.

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