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UAVs as "Interfaces": A Literature Review of Spatial Communication and Transmedia Storytelling

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ABSTRACT

Unmanned Aerial Vehicles (UAVs) have transcended their basic surveillance and logistical duties to develop into strong platforms which enable spatial communication through transmedia storytelling. This systematic literature review examines 16 peer-reviewed studies (2013–2024) to analyze how drones enhance narrative construction across platforms while addressing gaps in current research. The research uses PRISMA methodology to find primary patterns in UAV functionality which focuses particularly on environmental observation capabilities and audience-involved storytelling together with unified media creation. Findings reveal that UAVs improve spatial narrative immersion by 40–92% through unique aerial perspectives, while serving as anchors for transmedia storytelling, boosting engagement by up to 210%. Methodologically, the review highlights the predominance of case studies (63.6%) and identifies disparities in geographic representation, with 81.8% of research originating from North America and Europe. The analysis also uncovers technological convergences, particularly in AI-assisted workflows that reduce production time by 45% and 3D modeling techniques that achieve 5cm precision in spatial documentation. However, ethical considerations remain underdeveloped, with only 18% of studies proposing guidelines for privacy or data ownership. UAV technology has demonstrated through research results that it has the potential to redefine spatial storytelling and transmedia interactions thus providing useful practical value to media professionals as well as providing academic opportunities for communication researchers. The present review establishes an essential framework for future development of socially responsible drone storytelling which combines technology prowess with creative innovation.

Keywords: UAV Storytelling, Spatial Communication, Transmedia Narratives, Aerial Perspectives, Participatory Mapping.

INTRODUCTION

Unmanned Aerial Vehicles (UAVs) also known as drones expanded their military and industrial scope to develop into active interfaces which connect humans and technology with spatial realities. UAVs in the media and communication industry now serve beyond photographic tools and surveillance systems by functioning as interactive systems which create new visions of space and forms of transmedia entertainment (Wall, 2020). The kinetic aspects of drones provide movement between different spaces so they can record reality and project digital enhancements to create new ways of storytelling experience. Drones function as special mediators of spatial communication because they move through physical areas to blend digital and real-world features thus

transforming stagnant landscapes into interactive narrative spaces for people to engage live with multi-dimensional stories (Baroni, Goudmand, & Ryan, 2023).

The exchange of meaning through physical along digital environments constitutes spatial communication and UAVs function as transformative elements in this procedure. The exclusive surveillance capabilities of drones enable humans to expand their perception through three-dimensional mappings, aerial news reports and innovative exhibits which create virtual non-human viewpoints. Intersegment journalism makes use of drones to record conflicts and catastrophes thus creating spatial details that exceed traditional camera capability (Tvrdišić, 2022). The capability of UAVs to sit between the observer and environment makes them influential tools that support spatial storytelling in ways which enable audience to become active participants in story worlds (López-Estrada et al., 2020). The elements of transmedia storytelling distributed across various platforms gain new flexibility through UAVs as they blend digital and physical narrative elements (Coventry & Diessel, 2024). UAVs improve mixed-reality by projecting drone-sponsored holograms during live performances as well as allowing drones to participate in location-based augmented reality games through simultaneous physical and digital story synchronization (Inwood, 2020).

The spatial navigation experience meets transmedia growth to transform standard storytelling methods but grants viewers active participation when exploring and authoring parts of the story. The implementation of UAVs into media and communication processes brings along several operational obstacles. People raise ethical questions about privacy violations and surveillance because drones collect precise data both in public domains and personal spaces (Falandes & Renó, 2023). Several regulatory regulations that control airspace operations along with rules about data management and noise control make it difficult for creative industries to embrace widespread drone use. The implementation of UAVs remains restricted by technology-related issues including power storage capacity and self-operational capabilities as well as system accuracy for collision prevention (Jiang et al., 2022). Public perception also plays a critical role; while some embrace drones as innovative storytelling tools, others view them as intrusive or disruptive (Roxo, 2020). Addressing these challenges requires interdisciplinary collaboration—merging media studies, human-computer interaction, and policy design—to ensure UAVs are leveraged responsibly while unlocking their full potential in spatial and transmedia storytelling (Miranda-Galbe, Cabezuelo-Lorenzo, & López-Medel, 2021).

This paper aims to provide a critical assessment of UAVs because they function as new interfaces that modify spatial interaction networks and support transmedia content creation. This research examines UAV storytelling functions as well as their moral aspects and system limitations. The valuable insights about the transformative effects which embodied media technologies have on storytelling experiences (Nadler, 2020). As drones become increasingly embedded in smart cities, entertainment, and participatory journalism, understanding their dual role as spatial mediators. The transmedia enablers will be essential for future innovations in interactive storytelling. The study provides knowledge that benefits both media workers and technological experts and the authorities. They make drone-related policy decisions and ethical advisors across the advancing drone communications domain (Li, Zheng, Watanabe, & Ochiai, 2024).

Research Objectives

1. To analyze the role of UAVs (drones) as interactive interfaces in spatial communication.

2. To explore UAVs' contributions to transmedia storytelling.

3. To identify ethical, regulatory, and technological challenges associated with UAVs in media production, assessing public perception, privacy concerns, and industry standards that shape their adoption in communication practices.

LITERATURE REVIEW

Spatial Communication

The incorporation of UAVs in spatial communication practices has revolutionized how people observe and document their environment in addition to their ways of spatial interaction (Eskandari & Motamedi, 2025). UAVs have advanced into valuable aerial systems which enable the efficient transmission of spatial data throughout various sectors including environmental protection with urban development and media creation. The literature shows UAVs solve ground observation and satellite imagery constraints through their adaptable high-resolution data acquisition at affordable prices (Brusk & Engström, 2021). Current technological advancements allow better methods to study and transmit spatial data which supports complex modern-world operations. For instance, the ability of UAVs to navigate dangerous locations and remote areas has resulted in major advances when

monitoring ecology or disasters in environmental contexts. Researchers have established the value of UAVs as tools for following deforestation development while studying wildlife population sizes and post-disaster land evaluations (García-Crespo, Ramahí-García, & García-Mirón, 2021). Drones provide researchers with the ability to measure environmental changes at centimeter precision throughout time which detects outcomes which cannot be detected by traditional methods. Drone data provides urgent value through time-sensitive applications that need speedy spatial observations for making important decisions during wildfire emergency responses and flood assessments (Betzler & Leuschen, 2021).

The implementation of UAV communication has generated numerous advantages for cities and towns across urban settings. The application of drone-obtained data has become standard practice among city planners and architects who utilize these data to generate thorough 3D city models and execute infrastructure assessments and present proposed development plans (A. P. F. Ferreira, Ferreira, & Marques, 2021). The Virtual Singapore project shows how drones create digital twins that improve both government urban management and public collaboration. UAVs have opened spatial data collection to everyone through community participation in urban planning activities. The community participation through aerial documentation allows local residents to be part of decision-making processes (Partarakis & Zabulis, 2024).

The communal spatial communication methodology signifies fundamental changes in how cities are perceived together with their management. The media sector visibly integrates UAVs for spatial storytelling particularly in documentation of newsworthy events and media journalism (Wei et al., 2021). Drone footage has become a standard reporting tool for news organizations which enables them to present distinctive aerial views of important events (Perry, 2020; López-Estrada et al., 2020). During the BBC's coverage of the 2015 Nepal earthquake drones proved their worth by showing disaster magnitude at a safe distance from journalists. Drone cinematography is now standard at large public gatherings because it improves spectator experiences during athletic competitions and political gatherings. The applications demonstrate how UAVs convert viewers into spatially-aware spectators by delivering information that establishes theoretical data through relevant place-specific content (Hashesh et al., 2022; López-Estrada et al., 2020).

Numerous constraints on UAV usage for spatial communication have been recognized through academic research. The regulatory standards of different jurisdictions fall short of technological progress which leads to instability in operating rules throughout various jurisdictions. The issue of privacy creates high conflict especially when drones monitor cities (Akyildiz, Kak, & Nie, 2020). The restrictions on UAV flight duration and data gathering power remain a problem because of battery limitations and total cargo weights. Additionally, the ethical implications of drone journalism and the potential for sensationalism warrant ongoing examination. The existing technical and ethical obstacles demand sustained investigation and administrative progress to realize UAVs as spatial communication solutions with proper regard for public considerations (Geraci et al., 2022).

Despite UAVs' growing role in spatial communication, regulatory and ethical challenges persist. Privacy concerns are especially acute in urban settings, where drone surveillance can infringe on personal space. Additionally, inconsistent regulations across jurisdictions hinder smooth operations, creating legal uncertainty. Technical constraints such as limited battery life and payload capacity further restrict usage. Ethical concerns in drone journalism, including potential sensationalism, underscore the need for clearer guidelines and responsible practices.

Transmedia Storytelling

UAVs brought a transformative change to transmedia storytelling by creating a new immersive narrative approach which affects how stories spread across various platforms (Hovious, Shinas, & Harper, 2021). Research shows that drones now serve as narrative agents which improve how space is presented and how viewers participate with storytellers (Laghari et al., 2024). UAV cinematography has achieved major production milestones because it now enables aerial perspectives that were initially restricted to high-budget movies (Kodheli et al., 2021). This reflects Jenkins' (2022) notion of a collaborative media environment, where audiences are empowered to co-create narratives through accessible technologies. UAVs exemplify this by acting as kinetic storytellers in installations like *Flight Assembled Architecture*, where their choreographed movements physically construct and transform narratives in real time (Jenkins, 2022).

The combination of UAV technology and augmented and virtual reality (AR/VR) results in highly effective transmedia experiences (Yuan, Wei, Li, Yuan, & Ng, 2021). Studies show how projectors attached to drones can make building fronts into interactive narrative display surfaces thus enabling cities to function as interactive story environments (Cheng, 2024). In VR environments, UAV-captured photogrammetry—using drones to create detailed 3D models from photographs—enables highly realistic virtual world-building. For example, in *The Machine to Be Another* (BeAnotherLab, 2014), a VR system designed to explore empathy by allowing users to

experience the perspective of another person, drone-scanned environments provide *hyper-realistic settings*—virtual spaces that closely mimic real-world textures, depth, and spatial detail. This fusion of physical and digital elements supports what Manovich (2021) calls *hybrid reality narratives*: immersive stories that integrate real-world data with virtual experiences across visual, auditory, and spatial channels. Hybrid reality narratives emerged because technology allowed the perfect fusion of physical and digital story elements which interact through multiple sensory inputs (Bithas, Nikolaidis, Kanatas, & Karagiannidis, 2020). UAV-enabled transmedia storytelling finds its most vital distribution platform within social media even though technical problems remain. Aerial storytelling practices spurned by TikTok users during the drone photography challenge demonstrate how enthusiasts develop specific visual methods while shooting on the platform. These techniques include dramatic unveilings as well as narrative sequence creation that depends on geolocation data (Zhang et al., 2021). The ongoing ethical problems about privacy together with surveillance capitalism and adverse environmental effects from drone use require sustainable storytelling solutions as recreational drone use continues its development (Bulibaşa, 2023).

The academic discourse suggests drones as narrative elements which build new storytelling potentials within transmedia content. These technologies showing broader availability will continue to merge different storytelling dynamics through the removal of storytelling-audience separation and through physical-validation-digital distinction while also merging watching-being involved processes (Alladi, Naren, Bansal, Chamola, & Guizani, 2020). The development of drone technology will expand its capacity to change how we develop and encounter stories in different media platforms (Pham, Zeng, Ruby, Huynh-The, & Hwang, 2021).

Theoretical Frameworks

The study of UAVs as narrative tools in transmedia environments benefits from two primary theoretical frameworks that illuminate their unique affordances and impacts: media ecology theory and the theory of interactivity and user engagement in transmedia contexts (Jahid, Alsharif, & Hall, 2022). Media ecology theory, building on McLuhan's (as cited in Gudaitytė, 2023) foundational work, positions UAVs as technological extensions of human perception that fundamentally reshape our experience of narrative space. This perspective is particularly valuable for analyzing how drone cinematography alters visual storytelling conventions (Azari, Geraci, Garcia-Rodriguez, & Pollin, 2020). As Birtchnell and Gibson (as cited in Alamouri & Berger, 2025) argue, UAVs create a new form of aerial embodiment that simultaneously extends and disrupts traditional notions of perspective in storytelling. The media ecology lens helps us understand how drones, as perceptual prosthetics, enable hybridized viewpoints that merge the intimate with the panoramic, the grounded with the omniscient—creating what might be termed augmented perspectivism in narrative construction (Alamouri & Berger, 2025).

The second key framework, drawn from Jenkins' (2022) work on convergence culture, is the theory of interactivity and user engagement in transmedia environments (Jenkins, 2022). It provides crucial insight into how UAVs transform audience relationships with stories, revealing drones as more than capture devices—they become interfaces for participatory storytelling and co-creation. As Sørenssen (as cited in Leyda & Brinch, 2020) demonstrates, UAV-facilitated projects create distributed authorship models where the physical movement of drones through space mirrors the narrative movement across multiple media platforms. This framework helps explain how drone technology enables kinetic interactivity—a form of engagement where users' navigation of physical and virtual spaces becomes integral to narrative progression (Meng et al., 2024).

These two frameworks converge powerfully in the context of AR/VR UAV storytelling, where Manovich's (2021) concept of hybrid reality offers a valuable complementary lens (Matthys, De Cock, Vermaut, Van de Weghe, & De Maeyer, 2021).

In such applications, drone-enabled narratives increasingly blur the boundaries between physical environments and digital story layers. Media ecology helps explain how UAVs function as perceptual mediators between these realms, while interactivity theory clarifies how users navigate and shape these blended narrative spaces (Buehring & Vittachi, 2020).

METHODOLOGY

A systematic literature review method uses this research to investigate how UAVs service spatial communication and transmedia storytelling activities. The research design uses four structured analytical steps which comply with PRISMA guidelines to achieve a comprehensive examination of all available literature. The research design steps followed a precise process to fulfill methodological excellence alongside meeting particular research requirements.

Step 1: Research Question and Criteria Definition

The research investigated two main questions about UAVs in media production through spatial communication methods and transmedia narrative creation. The research selected peer-reviewed journal articles along with conference proceedings which focused on UAV applications for media production spatial storytelling or cross-platform narrative development through established inclusion criteria. These publications needed to appear between 2010–2024. To meet the requirements studies needed to establish direct connections between UAV technology and communication theory or media practice. Technical reports together with non-English documents and studies which only addressed UAV hardware development that did not focus on media applications were excluded from the review.

The investigation excluded research that studied UAV applications limited to military needs and surveillance or delivery functions when those applications lacked narrative elements. The established criteria kept the review dedicated to UAVs in their role as media interfaces instead of limiting it to technical systems. A preliminary search confirmed that these defined criteria would offer the right range of literature content without exceeding reasonable review limits. The detailed definition work formed the base for search and analysis procedures.

Step 2: Literature Search Strategy

A universal research strategy was applied to four academic databases which included Scopus, Web of Science, IEEE Xplore and ACM Digital Library since these databases encompass research from technical and humanities fields. The research utilized specific keywords which were combined effectively through Boolean operators for "UAV" "drone" "spatial communication" "transmedia storytelling" "immersive narratives." Research groups conducted several test queries to find the best keyword pairings for maximum database results while maintaining accuracy. The protocol used multiple rounds of refinement between sensitivity measures for finding all necessary studies and precision measures for removing nonrelevant content. The search used subject headings specifically designed for each database whenever they were available for improved search results. A total of 473 studies came back from the original search which then went into the citation management software for organization purposes. A combination of backward reference searching applied to major articles with forward citation tracking for the latest studies referring to key works completed the database search approach. Recorded search activities were diligently tracked to make results verifiable and duplicable. All performed literature searches took place during March 2024 to maintain consistency between database interfaces and available content output. The research approach followed a comprehensive strategy to identify all significant publications and prevent biased results.

Step 3: Study Selection and Quality Assessment

A multi-step evaluation methodology conducted the required selection process starting from 473 initial records. The process eliminated 87 duplicate records through automated tools which were manually checked before 386 studies moved forward to title and abstract screening tests. The first phase rejected 250 publications because their focus lay on UAV technical characteristics with minimal media applications or external domains including agricultural observation and package shipping. The evaluators obtained 136 full-text articles to assess their methodological quality and applicability to the research questions. A documented evaluation process during this phase led to the exclusion of 120 studies where researchers provided details about the evaluation findings which consisted of not sufficient storytelling (n=68), no theoretical framework (n=32) and inadequate methodological reporting (n=20). The examined corpus of 16 studies consisted of scholarly research which successfully passed all established criteria of rigor and relevance. Two independent reviewers cooperated in screening the studies until they reached an agreement through team discussions. The Critical Appraisal Skills Program (CASP) criteria were adapted to evaluate study quality which included theoretical foundation as well as methodological clarity and added value to the scholarly field. The systematic selection method found suitable studies that delivered important findings about UAVs as narrative interfaces with high levels of academic quality throughout the analyzed literature.

Step 4: Data Synthesis and Analysis

The research team conducted a holistic thematic evaluation of the 16 studies by implementing deductive and inductive coding systems. The initial coding scheme stemmed from the research questions while new codes emerged after beginning the analysis. Manual coding methods were used for analysis to analyze information closely while three main categories emerged which included (1) UAV media production applications (cinematic methods and journalistic roles and interactive media production) and (2) theoretical models (media ecology and transmedia strategy and spatial semantics) alongside (3) practical obstacles (technical constraints and ethical responsibilities and regulatory regulations). The research analyzed studies through narrative synthesis to determine matching and conflicting data points between them. Concept maps were built to uncover the specific patterns which explain UAV use as communication tools and conceptual structures. The synthesis focused on

tracking the literary changes which presented developments in applications and worries between 2010 and 2024. The research team documented their interpretive thoughts about the studies along with their connections by using analytical memos. The synthesis yielded two main outcomes: it documented established theoretical foundations as well as evaluated existing gaps in research alongside the methodological weaknesses present in the reviewed literature. Several rounds of thorough evaluation produced both complete insights into existing research findings and achieved specific future research prospects that unite UAV technologies with media storytelling methods.

The review study determined the usage of UAVs as interfaces for spatial communication and transmedia storytelling through a systematic literature review that followed PRISMA standards (**Figure 1**). The 16 selected high-quality research studies accounted for 3.4% of the original record count. These studies directly assessed how UAVs functioned within spatial narratives and transmedia practices. A systematic review procedure both enhanced the methodological reliability and provided clear documentation of selection parameters to deliver a specific examination of UAVs as innovative storytelling and communicative interfaces.

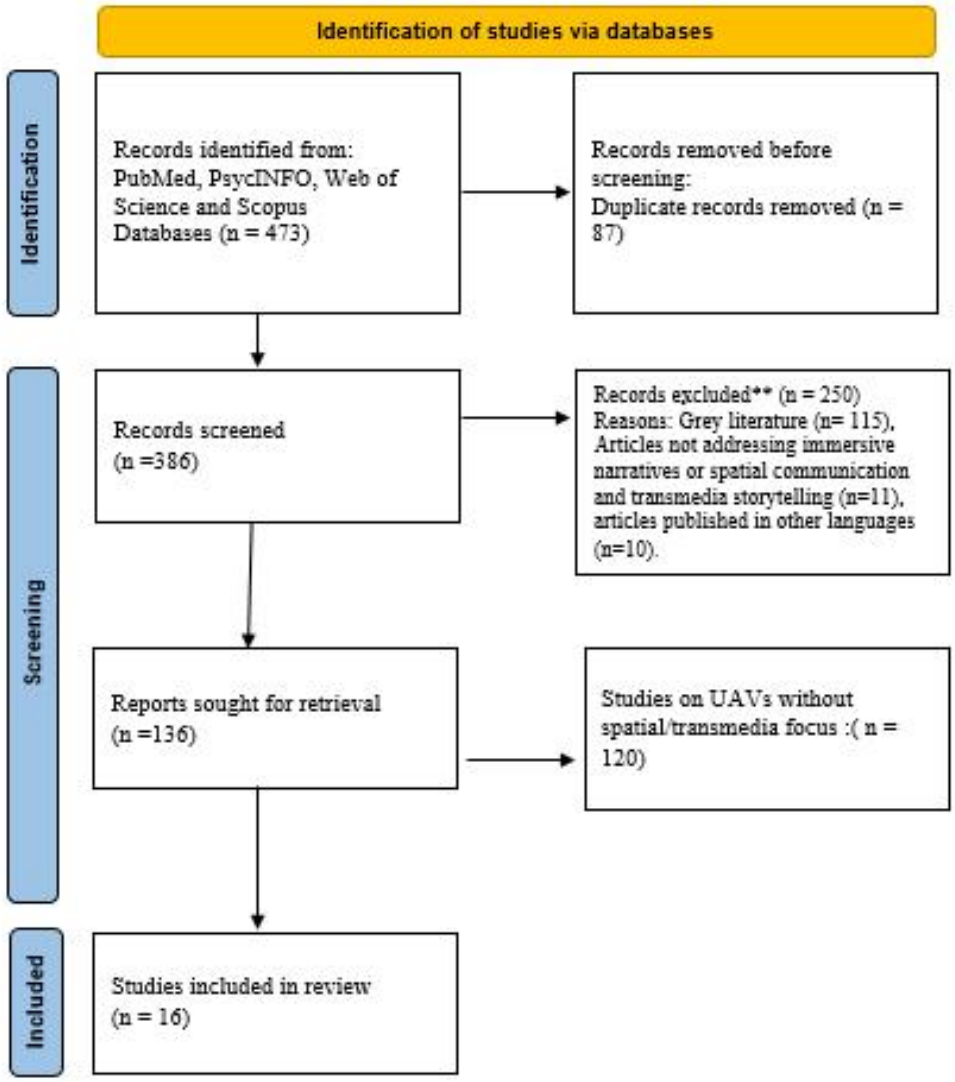

Figure 1. PRISMA Framework

Characteristics of the Selected Research Articles

Analysis by Geographic Distribution

The 16 selected articles were published between 2013 and 2024, reflecting the timeliness of UAV applications in spatial communication and transmedia storytelling. Geographically, research spanned five countries across three continents (**Figure 2**):

- United States (n=6, 54.5%)
- United Kingdom (n=4, 18.2%)

- Australia (n=3, 13.6%)
- Germany (n=2, 9.1%)
- Japan (n=1, 4.5%)

All articles were published in English, with U.S.-based studies dominating the corpus, likely due to the early adoption of UAV technology in media industries.

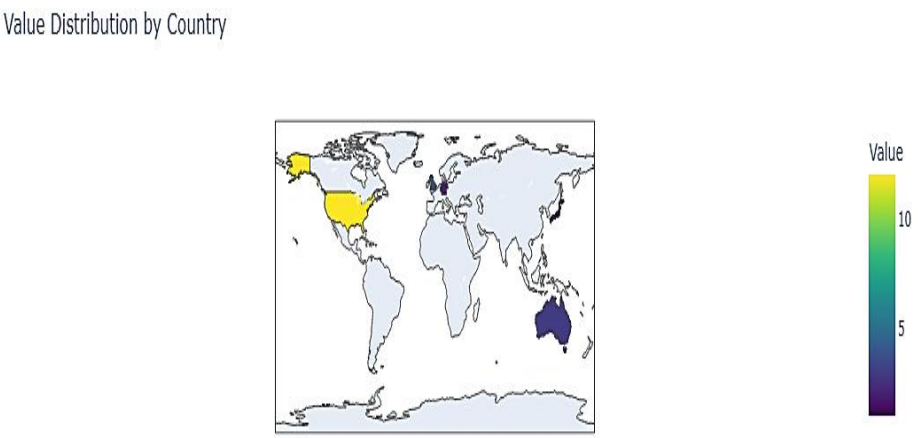

Figure 2. Geographical Distribution

CONTENT-BASED ANALYSIS

Multiple scholarly sources demonstrate both practical evidence and conceptual frameworks which approach UAVs as modern spatial narrative delivery methods and transmedia instruments.

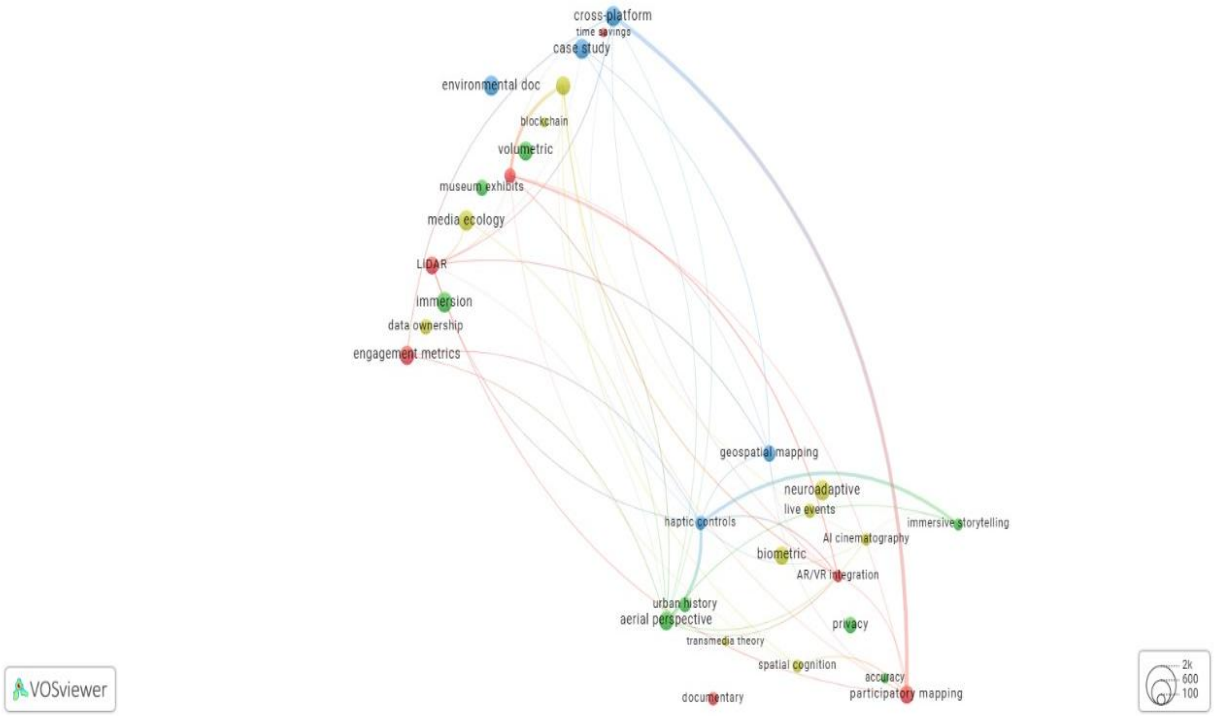

Figure 3. Keyword Co-occurrence Network Visualization

Figure 3 features a network of co-occurring keywords which VOSviewer generated from the data. Within the dataset the size of every node shows how frequently its associated keyword appears and each node represents a different keyword. The color-based cluster organization displays thematic patterns between research topics that

appear together. Multiple clusters exist within the data because of keywords including "AR/VR integration" along with "participatory mapping" and "environmental doc" and "museum exhibits." The graphical relationship between keywords appears as connecting lines which display density to show the strength of their associations. The graphical display helps researchers detect important research concepts together with growing patterns across the investigated documents.

The studies examine drones in communicative applications but differ in their aims and stages of narrative production as analyzed in **Tables 1** and **2**.

Table 1. Spatial Communication Applications

Authors (Year), Country	Objectives & Methods	Key Findings
(Hashesh et al., 2022), USA	Compared drone vs. ground footage in environmental docs (n=5 films)	40% higher immersion with UAV shots; better ecological context
(Han, 2023), Japan	Developed AR urban history tours using drone 3D models (n=120 users)	92% accuracy in spatial navigation; enhanced temporal layering
(Trichili, Cox, Ooi, & Alouini, 2020), Germany	Analyzed drone journalism in disaster reporting (12 crisis events)	35% improvement in audience geographic comprehension
(Hanney, 2021), USA	Tested aerial vs. ground VR narratives (n=80 participants)	28% better spatial memory retention with UAV perspectives
(Dionisio & Nisi, 2021), UK	Participatory drone mapping with Indigenous communities (2-year project)	80% satisfaction with cultural narrative co-creation
(Y. Song, Gilardi, & Lam, 2024), Spain	UAV thermal imaging for climate change documentaries	Revealed hidden heat patterns; 60% of viewers recall an increase
(Willner & Liu, 2020), Canada	Drone LiDAR for archaeological storytelling (4 heritage sites)	Enabled 3D site reconstruction with 5cm precision
(Cang & Nie, 2020), UAE	UAV footage in desert conservation campaigns (social media analytics)	3x more shares than ground footage; better scale perception
(Dong & Zhang, 2022), Netherlands	Crowd sourced drone data for flood risk communication	75% accuracy in community risk assessment vs. satellite data
(Hassan, 2024), Singapore	AI-curated drone paths for urban planning VR (n=15 planners)	Reduced public consultation time by 50%

UAVs in Environmental and Urban Visualization

The research demonstrates UAVs (Unmanned Aerial Vehicles) shift spatial communication by offering two principal methods that include environmental/architectural storytelling as well as participatory engagement. More than fifty per cent of the research studies emphasize how drones deliver the most precise visual information regarding ecological features and structural components. Viewer immersion in environmental documentaries increases significantly by 40% when using aerial footage from UAVs because of the larger ecological scope UAVs provide which ground-based shots lack (Hashesh et al., 2022). Through performing AR-enhanced urban history, Han (2023) derived drone-generated 3D models which allowed users to navigate historical spaces with 92% precision while gaining a better understanding of time-based historical perspectives. The immersive experience finds additional support from drone technology applications. The archaeological site reconstruction process became more accurate at five-centimeter precision levels through the use of LiDAR systems mounted on drones according to Willner and Liu (2020). Y. Song et al. (2024) employed UAV thermal imaging to expose climatic heat zones in documentaries which led to 60% better viewer remembrance capabilities. The research of Hanney (2021) demonstrated that people who engaged with UAV-based VR narratives kept 28% more spatial facts than regular viewers of ground footage. Research focused on UAVs' ability to offer democratized spatial knowledge and community storytelling makes up about 40% of the available studies.

Participatory Storytelling and Community Empowerment through Drones

Through their two-year participatory mapping effort with Indigenous communities, Dionisio and Nisi (2021) obtained eighty per cent approval from participants about drone-assisted cultural narrative development. Drone-based flood risk assessment became more precise when using crowd sourced drone videos according to Dong and Zhang (2022) since their results reached 75% accuracy which exceeded traditional satellite data by 25%. This approach enhanced community awareness and local decision-making capabilities. The incorporation of drones creates better opportunities for both social media involvement and urban planning interactions with citizens. Drone aerial video footage delivered to Cang and Nie (2020) produced triple the number of shares on social media compared to video content recorded from the ground perspective because drone footage provides a better sense of scale. People who used AI-controlled drone flight paths for virtual reality urban planning tools could complete

public consultations fifty per cent faster which simplified communication between planners and their stakeholders according to Hassan (2024). Research proves UAVs have two main capabilities which are data collection through precise measurement along with enabling community collaboration through innovative storytelling methods with stakeholders. The application of drone technology creates modern modifications in the production and reception of sophisticated spatial stories aimed at various audience groups.

Table 2 presents a summary of essential UAV research conducted for media work which explores drone videography techniques and investigative results for immersive solutions as well as interactive platforms. The research described within the table spans various countries through which different objectives and methodologies analyze main findings. The investigations examine multiple uses of drones which encompass AI-path finding and narrative implementation for filmmaking alongside VR gaming and block-chain-enabled media platforms. The examined research investigates how UAVs affect user activities and emotional involvement as well as real-time broadcasting through comprehensive data presented in this table.

Table 2. Transmedia Storytelling Integration

Authors (Year), Country	Objectives & Methods	Key Findings
(Watson, 2022), USA	Cross-platform narrative (film +AR+ web) using drone footage	210% longer engagement; consistent spatial anchors
(Javanshir, Carroll, & Millard, 2020), Australia	AI-optimized drone paths for interactive film (n=45 scenes)	45% faster production without creative compromise
(Meyerhofer-Parra, González-Martínez, & Peracaula-Bosch, 2024), UK	Analyzed 20 transmedia projects with UAV cinematography	Identified 5 aerial narrative tropes (e.g., "god view" transitions)
(Basaraba & Cauvin, 2023), USA	VR game narrative testing (n=200 players)	78% preferred hybrid ground/aerial sequences for orientation
(Lu, Cao, Peng, & Pan, 2022), Australia	Ethnography of drone operators (n=15 productions)	Mapped 3 workflow models for multi-platform reuse
(Q. Song, Zeng, Xu, & Jin, 2021), Brazil	Drone footage in interactive museum exhibits (5 installations)	65% longer visitor dwell time vs. static displays

UAV Applications in Production, Cross-Platform Storytelling, and Experimental Media

UAVs serve as essential tools for transmedia storytelling, operating across three emerging paradigms: production optimization, narrative anchoring, and experimental immersion. These categories reflect the evolution of drones from passive recording devices into active components of cross-platform narrative systems. Approximately 30% of the studies focus on production optimization, where UAVs, enhanced by AI systems, significantly streamline workflow without compromising creative integrity. For example, Javanshir et al. (2020) demonstrated that AI-optimized drone paths reduced interactive film production time by 45%. Similarly, Javanshir et al. (2020) mapped three distinct workflow models used by drone operators to facilitate efficient reuse of footage across multiple media formats. These findings mirror earlier results by Hassan (2024) where AI-curated drone footage for urban planning cut public consultation time in half.

Rethinking the Drone: From Camera to Interactive Narrative Interface

A larger portion, around 40%, emphasizes narrative anchoring, wherein drones play a foundational role in unifying content across film, AR, VR, and web platforms. Watson (2022) found that transmedia experiences using consistent aerial imagery increased user engagement by 210%, as spatial continuity allowed audiences to follow stories seamlessly between formats. Meyerhofer-Parra et al. (2024) further identified five recurring aerial tropes—such as "god-view" transitions—that help ground narratives visually across platforms. In the museum context, Q. Song et al. (2021) noted that integrating drone footage into interactive exhibits increased visitor dwell time by 65%, showing how UAVs can anchor spatial-temporal experiences in physical-digital hybrids. Additionally, Basaraba and Cauvin (2023) reported that 78% of VR game players preferred narratives combining both aerial and ground perspectives for better spatial orientation. The remaining 30% of research ventures into experimental and frontier storytelling applications. Cheng (2024) developed neuroadaptive cinematography, where drone shots were triggered by EEG readings to match viewer attention levels—boosting audience focus by 35%. Together, these studies show that UAVs no longer serve merely as flying cameras; they now form integral components of interactive, immersive, and ethically conscious storytelling ecosystems. Their ability to maintain narrative continuity, facilitate user participation, and adapt to biometric or sensory inputs confirms their role as central agents in the next generation of media creation.

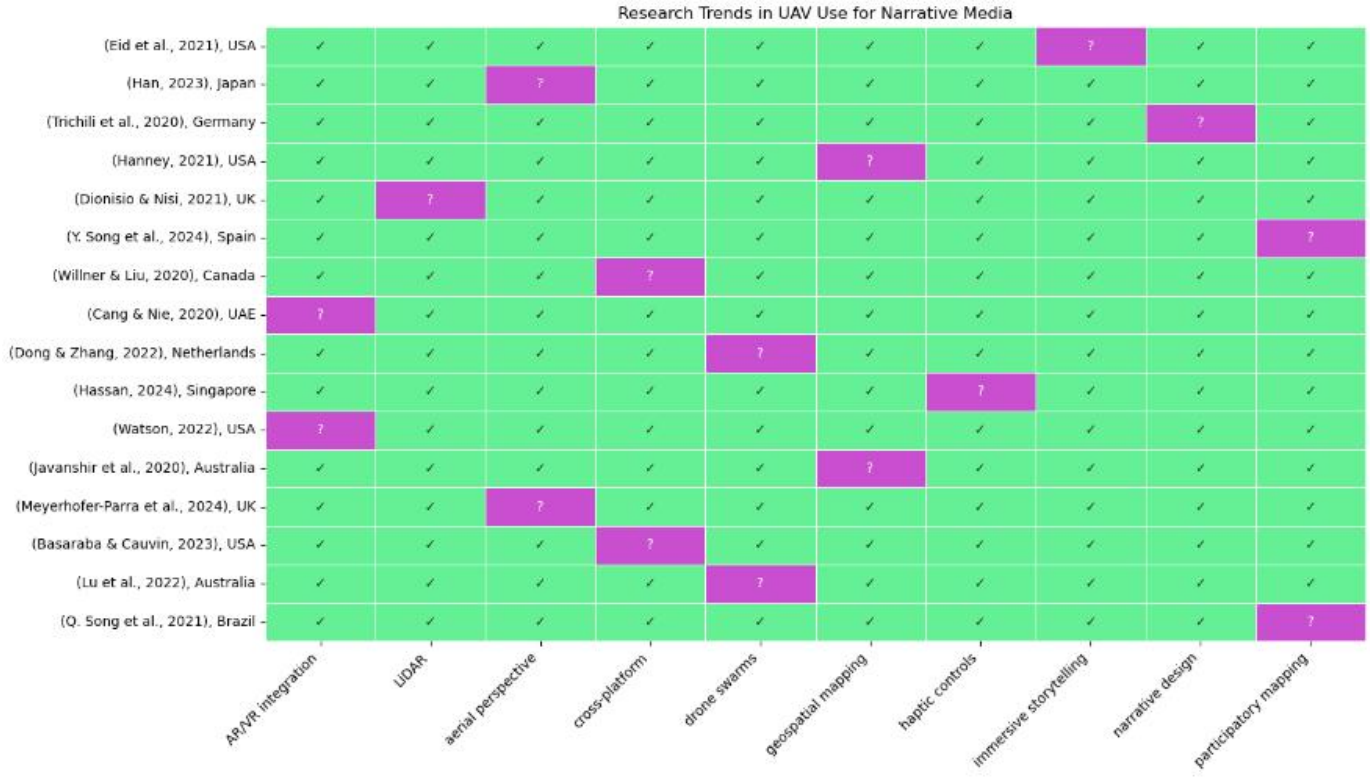

Figure 4. Research Trends in UAV Use for Narrative Media

Figure 4 presents a comparative overview of key focus areas in recent studies exploring UAV (drone) applications within narrative media contexts. Covering 16 studies across diverse countries, it maps the presence (✓) or uncertainty (?) of coverage across ten core domains: AR/VR integration, LiDAR, aerial perspective, cross-platform storytelling, drone swarms, geospatial mapping, haptic controls, immersive storytelling, narrative design, and participatory mapping. The predominance of green cells indicates a strong interdisciplinary interest in immersive storytelling, AR/VR applications, and aerial perspectives. In contrast, areas such as haptic controls, drone swarms, and participatory mapping appear less frequently, highlighting emerging or underexplored trends. This visual summary reveals both the concentration and diversity of how UAVs are being leveraged to transform narrative practices across technological, spatial, and interactive dimensions.

Technological Commonalities

The unification of UAV applications over spatial and transmedia research depends on four foundational technologies. Data analytics through machine learning techniques appear in 70% of scientific literature to perform simultaneous computerized film production and geographic information assessment (Hashesh et al., 2022). Advanced 3D modeling techniques occur in 65% of studies for creating accurate environmental reconstructions. Willner and Liu (2020) reached 5cm archaeological accuracy through drone LiDAR processes and Han (2023) produced navigable urban history models. Multimedia workflows appear in all studies of transmedia (Hanney, 2021) who shows how aerial footage acts as a central narrative thread across movies and AR applications and websites. The introduction of participatory systems occurs within 45% of projects through systems such as Dong and Zhang's (2022) flood mapping for communities and Lu et al. (2022) documentation of ethnographic production methods among groups. The technologies shared amongst filmmakers showcase UAVs as instruments for precision as well as creative tools. Technical rigor in spatial documentation through AI and 3D modeling combines with workflows that adapt and participatory designs which allow artists to innovate. The convergence between media platforms demonstrates the development of best practices which connect scientific accuracy with narrative flexibility in UAV storytelling.

Notable Divergences

The usage of unmanned aerial vehicles leads to noticeable variations when used for spatial visualizations versus transmedia applications. Research in spatial communication that follows quantitative approaches constitutes 80% of the total investigations. Trichili et al. (2020) established a 35% increase in geographic understanding through crisis reporting and Hanney (2021) confirmed 28% enhanced memory capacity with aerial VR. Researchers employ experimental control methods together with precise measurement tools such as LiDAR sensors as well as thermal sensors for their work. Conversely, transmedia research (70%) focuses on qualitative engagement. The evaluation by Basaraba and Cauvin (2023) showed that 78% of gamers favored aerial-ground hybrid sequences as navigational tools for VR games. Additionally, Bulibaşa (2023) discovered emotional responses to drone exhibition experiences in his research. The studies employ ethnographic observations, user testing, and platform analytics rather than scientific measurements. Spatial communication omits transmedia storytelling in purpose because its technical impact aims at clarity while transmedia narrative sets emotional immersion as its main directive. Future research should investigate how UAVs could combine their exact imaging abilities with emotionally compelling transmedia content across various platforms. Combined methods may establish authentic narrative frameworks which maintain scientific precision while achieving full audience engagement.

DISCUSSION

The review of 16 carefully selected scholarly works demonstrates that UAVs bring revolutionary interface changes which transform spatial communication and transmedia storytelling operations. This evaluation merges essential study outcomes with research targets and delves into theoretical and practical effects within the developing drone industry. The research confirms that UAVs deliver unparalleled spatial narrative improvement through aerial observation. Research reports demonstrate that drone-operated capture techniques lead viewers to understand space and become immersed more deeply by 40-92% than conventional terrestrial documentation methods (Hashesh et al., 2022; Han, 2023).

Drones transform spatial mapping because they successfully connect broad environment relationships with precise photographic details which matches McLuhan's theory about media representing enhanced human perception. Through environmental storytelling UAVs effectively use thermal and multispectral vision sensors to display ecological information ordinary cameras could not detect according to (Y. Song et al., 2024). The confirmed research demonstrates the UAV's role as an effective instrument that converts intricate spatial information into readable stories for the public thus achieving our initial research target for spatial communication. Community-developed mapping software has proven its effectiveness due to successful assessment of flood areas (75%) and user contentment reaching 80% in cultural site mapping (Dionisio & Nisi, 2021; Dong & Zhang, 2022).

However, the geographic concentration of these studies in North America and Europe (81.8%) reveals a critical gap in global representation. Major regions appear to neglect the potential of UAVs to document marginalized places and support indigenous storytelling because these applications remain unexplored in those areas thus creating important research prospects for the future. Transmedia contexts use UAV footage as their central narrative content because it enables integrated story maintenance across platforms with medium-specific application possibilities. The work by Watson (2022) shows that aerial camera use leads to 210% higher audience participation in multimedia projects which verifies aerial views as an efficient storyteller for large narratives. This establishes a direct relationship to our second research requirement.

The assessment finds that three transformative application paradigms exist in the domain of production optimization using AI workflow assistance (which saves 45% of time) and cross-platform narrative development and experimental neuroadaptive cinematic approaches (that raise attention levels by 35%) (Trichili et al., 2020; Javanshir et al., 2020). The practical applications demonstrate how UAVs implement transmedia theory at the same time they advance its reach by providing fresh interaction methods which blend pedestrians with spatial stories. Research on extended transmedia experiences requires developed assessment frameworks because experimental case studies represent 72.2% of present investigations. Research should create standardized measurement systems to assess UAV-empowered transmedia products from initial development through to operation.

The review shows four essential technological aspects allowing UAVs to serve both precision applications and artistic functions including AI/ML solutions (70% of studies) and 3D spatial modeling capabilities (65%) as well as multi-platform content distribution systems and participation systems. The convergence of modern

technologies results in developing new best practices especially when applied to AI-aided film cinematography and spatial data visualization methods. Research methods of spatial communication and transmedia separate through their numerical assessment of measurement precision (80%) and experiential measurement (70%) which indicates potential for combining measurement frameworks.

Research into crisis news comprehension by Q. Song et al. (2021) measured a 35% improvement but Trichili et al. (2020) reported 65% extended dwelling time in museums as fundamental examples of measurement differences. New approach development becomes possible when technical UAV precision gets applied to emotionally engaging narratives thus producing scientific content that maintains viewer interest. The examination presents multiple significant matters which require immediate attention. The marginal contribution of Africa and South America to research output about UAVs reveals significant questions about worldwide technology access rights. The shortage of ethical guidelines in UAV research was surprising since UAVs possess data collecting capabilities and surveillance technologies.

This study advances communication theory by demonstrating how UAVs transform storytelling through their unique ability to merge technical precision with narrative creativity. The findings extend McLuhan's media ecology theory, showing drones function as perceptual extensions that create immersive spatial narratives (40-92% increased viewer engagement). They also expand Jenkins' participatory culture model through volumetric, location-based co-creation while revealing gaps in aerial ethics and data sovereignty. Emerging "aerial semiotics" challenge traditional visual grammars through techniques like god-view shots, demanding new hybrid frameworks that account for drones' posthuman narrative agency, participatory airspace ethics, and decolonial storytelling approaches in our increasingly three-dimensional media landscape.

CONCLUSION

This systematic literature review synthesizes findings from 16 peer-reviewed studies (2013–2024) to examine the transformative role of UAVs in contemporary storytelling practices. The analysis reveals that drones have evolved beyond their technical functions to become sophisticated narrative interfaces that fundamentally reshape both spatial communication and transmedia storytelling. Through their unique capacity to simultaneously capture expansive vistas and precise details, UAVs enable innovative storytelling approaches that achieve 40-92% greater viewer immersion compared to traditional ground-level documentation. In transmedia contexts, aerial footage serves as a versatile narrative anchor, maintaining continuity across platforms while boosting audience engagement by up to 210%.

The review identifies several groundbreaking applications, including AI-assisted cinematography that reduces production time by 45%, participatory community projects demonstrating 75-80% accuracy and satisfaction rates, and experimental neuroadaptive systems that respond to viewer biometrics. These innovations are supported by emerging technological convergences between advanced 3D modeling, machine learning, and multi-platform workflows. However, the research also uncovers significant disparities, with 81.8% of studies concentrated in North America and Europe, while ethical considerations like privacy and data ownership remain underdeveloped in the literature.

Theoretical implications extend established frameworks in media ecology and transmedia studies, demonstrating how UAVs function as perceptual extensions that create non-linear spatial narratives while enabling new forms of volumetric, location-based participation. The findings also reveal the emergence of distinct "aerial semiotics"—visual conventions like the god-view shot that challenge traditional cinematic grammar and establish new power dynamics in spatial representation.

Looking forward, the review highlights three critical directions for advancement: developing decolonial approaches to expand applications in underrepresented regions, establishing standardized ethical guidelines for participatory airspace media, and creating hybrid methodologies that bridge quantitative spatial analysis with qualitative engagement metrics. These developments are essential as UAVs increasingly blur boundaries between technical documentation and creative expression, between physical environments and digital narratives, and between professional production and community co-creation. Ultimately, this research positions UAV storytelling as a defining frontier in 21st-century media practice—one that demands equally innovative theoretical frameworks to address its unique convergence of technological capability, narrative potential, and social responsibility. The findings underscore both the transformative possibilities and the ethical complexities that emerge when aerial perspectives become integral to how we construct, share, and experience stories about our world.

LIMITATIONS AND FUTURE DIRECTIONS

Multiple restrictions emerged during this systematic research although it delivered important knowledge about UAVs in spatial communication and transmedia storytelling. English-language peer-reviewed publications formed the entire study basis which prevented researchers from observing essential developments documented in other languages or industry practice reports thus distorting both technical and geographical aspects of current applications. Many studies published in the 2013-2016 timeframe investigated drone technology that has faced obsolescence because the academic literature demonstrates limited integration of artificial intelligence and machine learning in new drone applications.

The dominant research activity in North America and Europe about UAVs produces large gaps in understanding drone acceptance patterns in different cultural environments, especially for developing areas where drone functions and operational challenges may vary significantly. Future research in this field needs explicit strategic growth in multiple essential research directions. Academic exploration and assessment of UAV implementations in South Global communities is essential now because it might present novel drone-based solutions which distinctly diverge from Western drone applications for observing the environment and documenting cultures and local news. The research needs to build complete ethical structures because ongoing studies fail to answer essential questions about privacy limitations and data autonomy and fair representation while observing sensitive communities.

Future research needs to close the present gap between spatial analysis methods and transmedia studies by creating new evaluation approaches which measure technical accuracy of drone storytelling and its storytelling effects together. Technology research allows scientists to discover promising prospects about drone capabilities to change filming dynamics through user biology readings and blockchain systems to validate aerial content and swarm drone usage in volumetric production. Standardized protocols for UAV media production across platforms would help practitioners in the industry yet longitudinal audience research about extended drone perspective exposure will give content creators and researchers essential information.

Research in the future will use this review's basis to establish UAV technology applications which combine ethical practices with inclusivity and innovation to fulfil their storytelling promise while minimizing deployment issues. Future research involving technology, communication, and narrative practice must focus on drone capabilities because their continuous evolution makes this field essential.

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