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Drones in Media and Entertainment

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ABSTRACT

Drones are bringing about radical change in the worlds of agriculture, inspection, real estate, and beyond. They have revolutionized the media and entertainment industry, offering new perspectives, increased efficiency, and innovative storytelling possibilities. They have brought new creative ways, given cheaper choices, improved safety and ease of access, and made the overall quality of movies and media projects better. The advent of drone cinematography has revolutionized filmmaking and video production, opening up new creative possibilities. Drones are taking unmanned aerial photography services to new heights, making it an accessible hobby that anyone can get started in. In this paper, we will explore the role of drones in the media and entertainment industry.

KEYWORDS: *drones, unmanned aircrafts, unmanned aerial vehicles (UAVs), unmanned aircraft systems (UAS), media and entertainment, M&E, M&E industry*

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INTRODUCTION

The media and entertainment (M&E) industry encompasses a diverse range of businesses involved in the creation, production, distribution, and monetization of content across various platforms. This includes film, television, music, gaming, sports, publishing, and digital media. With rapid technological advancements and shifting consumer preferences, the industry continually evolves, presenting both challenges and opportunities for professionals engaged in content creation, distribution, and digital transformation strategies [1]. One innovative tool that has revolutionized the industry is drone technology. High demand for drones has recently developed in a slightly unexpected market, the entertainment industry, where the purpose of drones is to enhance performance.

Drones offer a unique perspective and versatility that traditional filming methods cannot match. They have become a game-changer in various industries. These flying marvels have made a significant impact on the entertainment industry, particularly in ways that might surprise you. Major live events such as concerts and sports broadcasting have embraced the use of drones to enhance the visual effects for the audience. Drones provide a unique perspective that captures the energy and excitement of these events in a way that was not possible before. They bring a new dimension to the viewing experience by offering dynamic shots that traditional cameras cannot achieve. We have since witnessed drones playing increasingly vital roles in the production of many of Hollywood's biggest film blockbusters [2]. Figure 1 shows a typical use of drones [3].

WHAT IS A DRONE?

At least three terms are used to describe drones, depending on how they are operated. The terms include Unmanned Aerial Vehicles (UAVs), Unpiloted Aircraft System (UAS), and Remote Piloted Aircraft System (RPAS). The FAA defines drones, also known as unmanned aerial vehicles (UAVs), as any aircraft system without a flight crew onboard. Drones include flying, floating, and other devices, including unmanned aerial vehicles (UAVs), that can fly independently along set routes using an onboard computer or follow commands transmitted remotely by a pilot on the ground. A typical drone is

shown in Figure 2 [4]. A drone is usually controlled remotely by a human pilot on the ground, as typically shown in Figure 3 [4]. Drones can range in size from large military drones to smaller drones. Drones, previously used for military purposes, have started to be used for civilian purposes since the 2000s. Since then, drones have continued to be used in intelligence, aerial surveillance, search and rescue, reconnaissance, and offensive missions as part of the military Internet of things (IoT). Today, drones are used for different purposes such as aerial photography, surveillance, agriculture, entertainment, healthcare, transportation, law enforcement, etc.

Drones work much like other modes of air transportation, such as helicopters and airplanes. When the engine is turned on, it starts up, and the propellers rotate to enable flight. The motors spin the propellers and the propellers push against the air molecules downward, which pulls the drone upwards. Once the drone is flying, it is able to move forward, back, left, and right by spinning each of the propellers at a different speed. Then, the pilot uses the remote control to direct its flight from the ground [5],

Drone laws exist to ensure a high level of safety in the skies, especially near sensitive areas like airports. They also aim to address privacy concerns that arise when camera drones fly in residential areas. These include the requirement to keep your drone within sight at all times when airborne. In the United States, drones weighing less than 250g are exempt from registration with civil aviation authorities. If your drone exceeds 250g in weight, you will also require a Flyer ID, which requires passing a test [6]. It is necessary to register as an operator, be trained as a pilot, and have civil liability insurance, in addition to complying with various flight regulations, and those of the places where their use is permitted.

Most drones have a limited payload, usually under 11 pounds. Drones are classified according to their size. Here are the different drone types:

- Nano Drone: 80-100 mm
- Micro Drone: 100-150 mm
- Small Drone: 150-250 mm
- Medium Drone: 250-400 mm
- Large Drone: 400+ mm

One of the emerging trends in drone use for factories is the utilization of LiDAR technology. LiDAR stands for Light Detection and Ranging. This technology provides accurate depth information essential for understanding the three-dimensional structure of the environment. LiDAR sensors emit laser beams to measure distances to objects, creating high-resolution 3D maps of the surrounding terrain and objects. The ability to capture detailed data through LiDAR technology has opened up opportunities for better predictive maintenance, reduction in inspection times, and overall cost savings [7].

DRONES IN MEDIA AND ENTERTAINMENT

Drones are no longer confined to construction sites or technical projects. They have evolved into essential tools for filmmakers, event organizers, and even theme parks. These unmanned aerial vehicles (UAVs) are opening new creative possibilities in entertainment. They have revolutionized the entertainment industry, changing the rules of the game as we knew it. Their ability to fly with precision, and capture images from impossible perspectives has transformed the way certain events and audiovisual productions can be enjoyed.

The origins of drones can be traced back to World War I. For many decades since then, drones have been extensively used for military purposes. Drones were initially developed as military tools for surveillance and targeted air strikes. That history makes many people around the world uncomfortable with their use in civilian settings. The US military first began developing and flying unmanned drones in Afghanistan in 2000. In recent years, however, drones have also become increasingly popular in the entertainment industry. Drone technology is changing the way movie makers operate, and it is literally changing how Hollywood, the Mecca of movie-making, produces films for public consumption. Drones have become a hot commodity now, after finally hitting the market and becoming accessible for the average consumer to purchase [8].

APPLICATIONS OF DRONES IN MEDIA AND ENTERTAINMENT

Drones are used in filmmaking, advertising, news coverage, and live events, enhancing visual experiences and capturing content that would be difficult or impossible with traditional methods. Common areas of application of drones in the M&E industry include the following [9-11]:

- *Aerial Photography and Cinematography*: Photography and cinematography have reached great new heights thanks to drone technology. Perhaps more than any other technological development of the past decade or two, the aerial photography provided by drone technology is having a massive impact on the way movies are made. Drones can go places that no other devices can, and in ways that even the most sophisticated photography equipment simply cannot match. The only thing even close to that would have been a helicopter shot, and helicopters are so big and bulky that they simply cannot get into all the places that drones can, nor can they fly as low.

Aerial cinematography involves the skill of capturing video or film footage from an elevated position using specialized equipment like helicopters, balloons, or other aerial platforms, which may include drones. Equipped with advanced cameras and stabilized gimbal systems, these drones enable filmmakers to achieve cinematic shots from unique perspectives that were previously inaccessible or prohibitively expensive. This technology has revolutionized cinematography by offering versatile tools for creating visually stunning sequences and enhancing storytelling with dynamic aerial perspectives. A typical drone used for aerial photography is shown in Figure 4 [12].

- *Film and Television:* The film and TV industry has changed much because of drone technology. Using drones has become very important in making films and TV today because of the new creative chances they bring. Since the establishment of the film industry, storytellers, screenwriters, and producers have always looked for ways to make movies all the more enjoyable. Filmmakers are increasingly relying on drones to capture shots that would be difficult or dangerous with traditional cameras. Before drones, achieving dramatic aerial views often required expensive helicopter rentals and extensive safety measures. Drones have changed the game by making it easier, safer, and more affordable to capture breathtaking aerial footage. Drones allow filmmakers to capture stunning aerial shots, dynamic angles, and fluid camera movements, creating more immersive and visually impactful scenes. They enable filmmakers to access tight spaces or tricky environments where traditional cameras cannot go. An example of film production using drones is shown in Figure 5 [2].
- *Live Shows:* When you think of live entertainment, you might imagine traditional elements like lights, pyrotechnics, or dancers. However, drones are now being used as actual performers, choreographed to move in sync and create mesmerising visual spectacles. Drone light shows, in particular, are taking the entertainment world by storm. They are often used during major events, such as sports games, music festivals, New Year's Eve celebrations or corporate celebrations, adding a new level of excitement. Drones equipped with LED lights create mesmerizing aerial displays and light shows, enhancing live performances and creating unforgettable experiences. One of the most impressive developments in the world of entertainment is the use of drones to create light shows. An example is the spectacle during the Tokyo 2020 Olympic Games, where more than 1,800 drones formed a dazzling floating globe VIDEO. Figure 6 shows an example of light show using drones [13].
- *Live Broadcasts:* Live broadcasts have reached new heights thanks to drones. Whether it is covering sports events, concerts, or even award shows, drones are revolutionizing how audiences experience live entertainment. For example, in sports like surfing, skiing, or motorsports, drones can follow athletes in real-time, offering an up-close and personal view of the action without being intrusive. Broadcasters are now able to bring the audience right into the heart of the action, capturing the intensity of a game or race from never-before-seen angles.
- *Sports Broadcasting:* Sports broadcasting has been revolutionized by the integration of drones, offering a dynamic perspective that enhances the viewing experience. In outdoor recreation events such as marathons and cycling races, drones provide stunning aerial shots that capture the essence of the competition. Drones are now a staple in advertising campaigns for sports events, enabling brands to reach a vast audience through captivating aerial footage. The ability to deliver real-time action from unique vantage points adds a new dimension to sports coverage, engaging audiences in ways previously unattainable.
- *Theme Parks:* Beyond live performances, drones are being used in virtual reality (VR) experiences within theme parks. Drones are increasingly becoming a staple in the magical world of theme parks. Behind the scenes, skilled drone pilots work tirelessly to capture breathtaking aerial shots that seamlessly blend into the park's multimedia content. Theme parks have always been about creating immersive experiences, and drones are now playing a vital role in enhancing that magic. Some theme parks are incorporating drones into their live-action stunt shows, using them to simulate flying objects, spaceships, or magical creatures. These drones are carefully synchronized with other effects, like sound and lighting, to create realistic and thrilling moments for park visitors. From creating mesmerizing music videos to capturing behind-the-scenes footage for virtual reality experiences, the versatility of drones in theme parks is truly remarkable.
- *Music Videos:* Music videos have evolved significantly over the years, incorporating cutting-edge technology to enhance their visual appeal.

With the advent of drones in photography, artists are now able to capture stunning aerial shots that were once only possible with expensive helicopters or cranes. Incorporating drones into music videos also allows for the creation of cinematic shots that rival those seen in blockbuster films. The ability to soar above cityscapes or natural landscapes adds a sense of grandeur and scale to the videos, immersing viewers in a virtual reality experience that feels both intimate and expansive. The dynamic movements and sweeping panoramas captured by drones add a sense of drama and excitement to the visuals, elevating the overall production value of the video.

- *Advertising:* Drones have emerged as powerful instruments for advertisers and marketers. Film and advertising have not been left behind in the adoption of drones. Their ability to capture images from previously impossible heights and angles has allowed filmmakers to create stunning, dynamic shots without the need for expensive helicopters or cranes. In advertising, drones are used for creative on-location shoots, capturing footage in an innovative and aesthetically appealing way. These advances have not only reduced production costs but have opened up new storytelling possibilities for content creators.
- *Journalism:* In the United States, the unfiltered information that journalists provide to the public serves as an important check on the country's three branches of government: executive, legislative, and judicial. Journalism has rapidly evolved over the years thanks to advancements in technology that have produced new tools and techniques for news gathering and dissemination. To date, data journalism and artificial intelligence have taken center stage in discussions on the impact of technology on journalism. Drones have proven to be powerful investigative journalism tools. Drone journalism, which is the use of drones or unmanned aerial vehicles for news gathering, is on the rise across the African continent. Drone journalism provides a safer and more cost-effective way for journalists to capture footage in dangerous or remote locations. Drones can be used to monitor natural disasters, capture footage of conflict zones, and report on other events that require aerial coverage. Drone technology allows journalists to take footage of news events such as volcanic eruptions, war-torn villages, and natural disasters. Drones can be useful tools for obtaining aerial images and news footage of areas that would otherwise be difficult to cover, such as those struck by natural disasters and conflict zones. Figure 7 show a quadcopter drone with a camera for new coverage [14].
- *Tourism and Hospitality*: Drones have become a staple in travel and hospitality marketing, playing a crucial role in enticing travelers with visually appealing content. They capture stunning aerial shots of destinations, resorts, and attractions, offering potential tourists a sneak peek into the experiences that await them. These captivating visuals inspire travelers to plan their trips and explore the world.

BENEFITS

Drones bring a new dimension to the viewing experience by offering dynamic shots that traditional cameras cannot achieve. They improve safety by reducing the need for human presence in hazardous filming locations. They offer flexibility and accessibility, allowing for filming in hard-to-reach places. With advancements in drone technology, live event organizers can now create stunning aerial shots that add a dynamic element to the overall experience for viewers. One of the primary benefits of incorporating drones into film production is the cost-effectiveness they offer compared to traditional aerial cinematography methods. Other benefits of drones in media and entertainment include the following [15-17]:

- *Cost Savings:* The low cost of using drones is a major benefit that makes them liked in the film and media industry. Instead of having to rent out expensive cranes or pay for high-cost helicopter rentals, a production crew can now use a relatively low-cost drone to capture a higher-quality shot on film and save a ton of money in the process. The cost for renting a very capable drone might only be 25% of the cost of renting other more expensive equipment, and the resulting film would not be as good.
- *Time Savings:* In another big savings bonanza, the time needed to set up a shot with drones is considerably less than it would be with any other type of equipment, which is a godsend to independent filmmakers with limited resources. Scenes that used to require 5 to 10 cameras and an entire filming crew, can now be captured with less than 30 minutes of setup time, and only three crew members to pull it off.
- *Enhanced Aerial Perspectives*: Incorporating drones into corporate video production offers a revolutionary way to capture stunning aerial shots. Unlike traditional filming methods that rely on cranes or helicopters, drones can effortlessly glide through the air, providing unparalleled access to various altitudes and angles. This

flexibility allows for the creation of dynamic and engaging visuals that were previously difficult or impossible to achieve.

- *Real-Time Monitoring*: Another important benefit of using drones in making films and media is that they can show video while recording. Drones have live feeds so directors and camera operators can watch what the drone sees instantly. This helps them to change the shots immediately as needed. This real-time watching makes sure the right angles and compositions are achieved, lessening the need for reshooting and saving important production time.
- *Flexibility and Accessibility:* One of the most significant advantages of using drones in corporate video production is their remarkable flexibility. Drones can effortlessly navigate various environments, from urban landscapes to rugged terrains, enabling filmmakers to capture footage from virtually any location. Unlike traditional camera setups that are often limited by ground-based constraints, drones can soar above obstacles and provide unique perspectives that enhance the visual appeal of corporate videos.
- *Engaging Storytelling:* Drones have revolutionized corporate video production by adding dynamic elements that were previously hard to achieve. Their ability to capture smooth, sweeping shots from various angles introduces a new level of cinematic quality to corporate videos. This dynamic range of motion helps in creating more engaging and visually appealing content.
- *Advertising:* Drones offer a unique perspective for showcasing products and locations, making ads more engaging and visually appealing. Drones in the cinema and advertising industry have not been left behind in the adoption of drones.
- *Drone Pilot:* The secret to succeeding as a drone pilot for film and video production stems from one thing: a passion for aviation, technology, and photography. Becoming a drone pilot is the perfect way to combine all of these interests. Pilots must acquire numerous flight hours, advanced operating and flying skills, familiarity with given equipment and obtain relevant FAA certifications.
- *Ubiquitous Utilization:* As with any new technology, it has taken a little while for drone usage to catch on, but now that it has; it is seemingly everywhere, both in television and in movie scenes. Because the potential applications for drone videography is virtually limitless, more and more studios are becoming aware of the benefits, and are incorporating them as part of the production process.

CHALLENGES

While drones have opened up new creative possibilities in filmmaking and video production, they also present a unique set of challenges and limitations that must be addressed. Although drones are a relatively cost-effective method of obtaining aerial footage, they can still be prohibitively expensive for smaller newsrooms, particularly the high cost of training journalists on how to use them safely. As drones continue to shape the entertainment industry, the demand for skilled pilots is on the rise. Other challenges of drones in media and entertainment include the following [18,19]:

- *Privacy:* Privacy is a fundamental human right and its protection is crucial to the preservation of other rights, like freedom of expression and the right to personal security. Despite the risk of these regulations being weaponized against journalists, there are key questions around the need to protect privacy when promoting the use of drones. Although there might be legitimate newsgathering interests, citizens do have a reasonable expectation of privacy. There are concerns that, in the absence of adequate legal protections, drones could be used to surveil citizens.
- *Safety:* Drones can be dangerous. There have been a rash of incidents, mostly involving drones operated by hobbyists. It is crucial for filmmakers and video production teams to prioritize legal and safety considerations. Safety concerns are paramount when operating drones on film sets or during live-streaming events. These unmanned aerial vehicles can pose risks to crew members, actors, and bystanders if not operated properly. Comprehensive safety protocols, risk assessments, and experienced pilots are crucial to mitigating potential hazards and ensuring a safe working environment. Filmmakers must ensure that their drone pilots are properly certified and trained to operate drones safely and legally, mitigating potential risks.
- *Ethics:* Journalism ethics require that a balance be struck between the right to privacy and journalists' duty to inform the public. Provision to laws regulating drone use would help strike the necessary balance between safeguarding citizens' privacy and allowing journalists to pursue their investigations freely. This potentially prevents journalists from reporting on public interest stories that take place on private property. Journalists should be trained to use drones safely and to apply ethical standards.

- *Regulations:* Legal restrictions and regulations play a vital role in the use of drones for film production and content creation. Regulation can also be used to shut down access to this technology entirely. In many countries and jurisdictions, there are strict rules governing where drones can fly. In Kenya, for example, civilian drone use was banned between March 2019 and November 2020, due to privacy concerns. Now that the ban has been lifted, drone use remains impeded by a lengthy and expensive registration process, which can cost thousands of dollars. Similarly, in Nigeria, drone licensing costs can be prohibitively expensive for smaller newsrooms.
- *Weather:* One of the most significant challenges is the impact of weather conditions. Drones are sensitive to wind, rain, and other environmental factors, which can impact their flight performance and the quality of the drone footage captured. Pilots must thoroughly inspect their equipment, assess weather conditions, and identify potential hazards or obstacles in the filming location.
- *Battery Life:* Battery life is another crucial consideration in drone cinematography. Most professional-grade drones have a limited flight time of around 20-30 minutes, which can be a constraint for certain shooting scenarios or extended takes. Careful planning, efficient battery management, and the use of backup power sources are essential to ensure smooth and uninterrupted aerial filming operations.
- *Technical Limitations:* Drones have limitations, especially when it comes to filming high-speed action scenes. Technical limitations, such as range and interference, can impact the effectiveness of drone cinematography. Certain environments or locations may have signal interference or obstructions that can disrupt the drone's performance, communication with the pilot, or the quality of the captured footage. Furthermore, drones have limitations in their payload capacity and the types of cameras and equipment they can carry.

CONCLUSION

Filmmakers now have a powerful tool at their disposal to capture stunning visuals from unique and dynamic perspectives. By incorporating drone shots into their projects, filmmakers can enhance the overall production value of their films, immersing viewers in breathtaking aerial vistas that elevate the storytelling experience. Major live events such as concerts and sports broadcasting have embraced the use of drones to enhance the visual effects for the audience. As drone technology keeps getting better, we can look forward to more creative and amazing uses of drones in film and media.

With advancements in drone technology, live event organizers can now create stunning aerial shots that add a dynamic element to the overall experience for viewers. Only time will tell how drones will continue to change media and entertainment as we know it. The future of drone cinematography holds exciting possibilities as technology continues to evolve and push boundaries. Advancements in camera technology, such as higher resolution sensors, improved dynamic range, and better low-light performance, will further enhance the quality of drone footage. More information about drones in the media and entertainment industry can be found in the books in [20-23].

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Figure 1 A typical use of drones [3].

Figure 2 A typical drone [4].

Figure 3 A drone is usually controlled by operators on the ground [4].

Figure 4 A typical drone used for aerial photography [12].

Figure 5 An example of film production using drones [2].

Figure 6 An example of light show using drones [13].

Figure 7 A quadcopter drone with a camera for new coverage [14].