

# Can AI and Advanced IT Systems Truly Enhance Drone Autonomy in Precision Agriculture and Smart Logistics Despite Cybersecurity and Regulatory Barriers?

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## **Abstract:**

The only revolution experienced in this era within different sectors is the integration of drone systems and information technology (IT). The drones were once remotely operable, but this is no longer the case, as sophisticated IT-backed devices have taken over their operation. The systems, however, leverage the latest technology, including artificial intelligence (AI), data processing, and autonomous control systems, enabling them to perform previously unimaginable operations. The dissertation examines the contribution of IT to enhancing drone operations, ensuring they become more independent, precise, and efficient. The most important aspects to consider are the implementation of AI in decision-making, the process of data processing within the real-time analysis framework, and the development of viable control systems that are stable and operable in any context. The application of IT-enabled drones in precision agriculture, smart logistics, and environmental monitoring can be seen through the lens of the details provided in the case studies, which utilise technical techniques that will be the subject of the current study. The conclusion emphasises that IT-assisted drones are transforming industries and paving the way for new ecosystems that will address environmental and social challenges. This dissertation outlines what IT can be expected to contribute to this development, as the youngster in the family is likely to play a significant role in the future development of drone technologies.

**Keywords:** Drone Autonomy; Artificial Intelligence (AI); Precision Agriculture; Smart Logistics; Cybersecurity

## 1. Introduction

### 1.1 Background of the Study

The evolution of drone technology has taken what was once a simple military use as an army spy drone and transformed it into a highly advanced autonomous “tool” with near-endless uses across industries. Although drones were initially used in military reconnaissance operations, information technology (IT) has enabled them to carry out their tasks more effectively and automatically (Emimi et al., 2023). The change is being ushered in by IT and other technologies, including artificial intelligence (AI), machine learning, and data analytics, which have made drones capable of real-time decision-making and adaptability to new situations, as well as autonomous flight patterns.

### 1.2 Research Objectives

The dissertation will examine the relationship between the drone system and the IT with the development of data processing system, AI system, and control system, and its ability to aid in the optimisation of drone to equip it with an autonomous system. It gives an even coverage of the use of IT in the development of drones including case studies and a technical review (Chen et al., 2021). The issue of data privacy, cybersecurity, and legislation in the study are examined, and the issue pertaining to the ethical aspects of the concepts of surveillance and data gathering has been discussed (Akmaykin et al., 2017). It also shows how drone technology has changed in terms of some of the emerging trends such as the use of drones in smart cities, environmental sustainability, and automation of industries.

### 1.3 Rationale

This dissertation investigates the role of IT, AI, IoT and 5G, with the intention to enhance the autonomy of drones in precision agriculture and smart logistics and the transformative role they play to enhance efficiency, sustainability, and cost-effectiveness. It briefly covers the use case for using such technologies to interface with commercial applications to capture the full extent of this drone risk while minimizing the resulting cybersecurity and regulatory risks. The military and hobbyist drones are not based on the studies because the field of investigation is limited and the research gives an impression of how the industry can be extended into the other applications and how it is related to the smart city, environmental and disaster management.

## 2. Literature Review

### 2.1 Theoretical Frameworks

#### 2.1.1 Framework: Technological Determinism

The framework brings the introductions of real-time analysis and collision avoidance, among other innovations can increase the possibilities of a drone which is in concurrence with the understanding that technological advancements determine the behavior of society. Drone technology has grown tremendously over the past decades. It went from a simple remote-controlled (RC) plane to highly advanced AI-driven products capable of complex autonomous operations. Original drones were small, and early models were initially used in the military as reconnaissance tools (Nonami, 2018). It was driven manually and had pre-programmed flight plans. The world of computers began in the late 20th century. From the DJI Mini 3 in Figure 1, as an example, it is the latest innovation in terms of consumer drone design and functioning (Chen et al., 2021). The use of sensors, directions of GPS, and flight controllers along with their greater precision and extended use outside of the military field is what allowed it.



Figure 1: DJI Mini3 Drone

#### Enhancements in Precision Agriculture

The autonomy of drones is being increased to a considerable extent due to the use of AI and highly developed IT systems in precision agriculture to analyze data in real time, make decisions automatically, and implement interventions. One case in point is drones with AI-based vision systems, which can automatically identify crops, forecast yields, and detect pests or nutrient deficiencies, based on advanced image processing of multispectral cameras (Alexander et al., 2009). This permits precise applications, including variable-rate spraying and minimizing the use of chemicals by as much as 30-50 percent in specific applications. Other companies such as Precision AI designed autonomous flying systems that reduce the choices farm-

ers need to make, including the use of machine learning to simplify operations in the field and save money (Emimi et al., 2023). The next generation is AI-based swarms of drones, which work together to perform activities, such as managing irrigation, monitoring soil health, and using IoT to integrate data easily with ground sensors. Education and research: Drones-AI projects have been implemented in order to give better crop surveying, practical applications have been demonstrated for better yield prediction and early detection of diseases via library such as biopython to process biological information (Watson, 2005). All of this has contributed to more efficient use of resources, and experimentation has shown that certain AI-integrated drones have increased farm productivity by 15-20 percent, thanks to autopilot navigation and knowledge-driven information.

**2.1.2 Framework: Socio-Technical Systems Theory**

The Socio-Technical Systems Theory, which focuses on social factors, technology interaction, and how they impact on each other, has brought out the impediments to the autonomy of drones. Even though there has been a revolution of military surveillance to an artificial intelligence-based surveillance such as DJI Mini 3, limitations remain (Emimi et al., 2023). Sensors and GPS add accuracy that exposes it further to exploitation; collision avoidance and on-the-spot data processing also cannot be relied upon when there is no steady network connection in remote or war-torn areas, which degrade reliability. The combination of sensors, GPS, and flight controllers increased precision; however, the use of these technologies also makes exploitation easier (Emimi et al., 2023). Collision avoidance and real-time analysis of information rely

on a stable network connection, which is often unavailable in remote areas or conflict zones, making them unreliable.

**2.1.3 Framework: Systems Theory**

The Systems Theory looks at the complex systems as the different elements that are connected and all work towards a common goal, so it fits perfectly in the systems that will be integrated in the topic of drones autonomy and its autonomy of IT, AI, IoT, and 5G. IT has significantly contributed to the development of autonomous drone systems, which have become highly efficient. Software development enables drones to perform complex tasks and process data in real-time, with their flight control even being automated (not during human interaction) (Watson, 2005). Artificial intelligence (AI) is crucial because it enables drones to identify objects, avoid crashing into them, and adapt to their environment using machine learning. This is the ability to learn using the information, making them more effective and self-sustaining in the long term (Wright, 2014). Moreover, AI enables the integration of drones into larger autonomous systems and fosters the development of new ecosystems. 5G and the Internet of Things (IoT) have also changed drone connectivity. With this, drones can communicate with cloud-based systems and other devices in real-time and through transparent data exchange (Alexander et al., 2009). The use of drones has also been integrated into the system, as they can contribute to increased efficiency and provide real-time operations, such as surveillance, disaster management, and environmental monitoring. Figure 2 illustrates the individual impact of technologies such as AI, IoT, and 5G on enhancing drone autonomy.

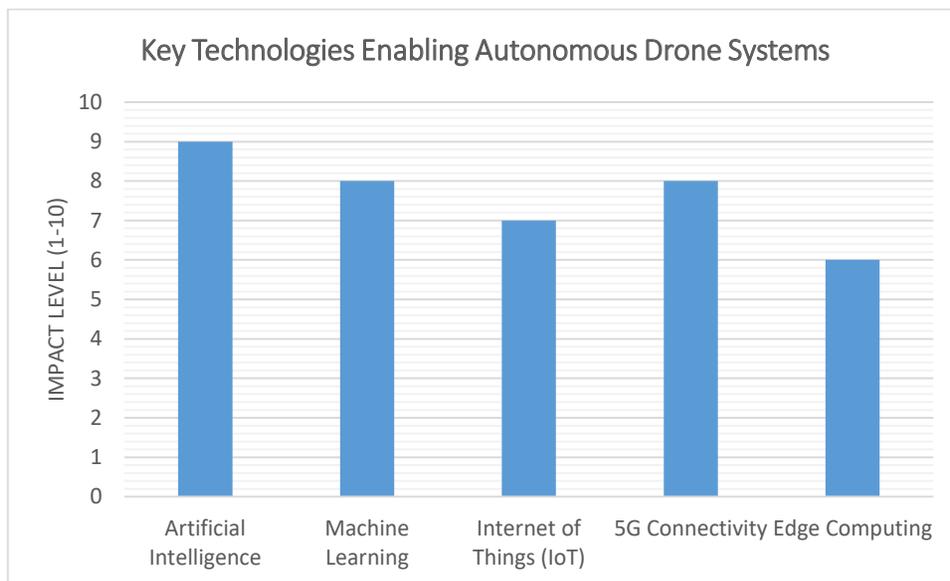


Figure 2: Bar graph showing the impact of each technology on drone autonomy

Enhancement in Smart Logistics.

The data in smart logistics AIs and IT innovations are driving the next generation of drone autonomy to deliver more quickly and reliably, especially in the last-mile. Chan et al. (2018) mention that more modern autonomous drones can optimize path, avoid obstacles in real-time with AI algorithms, and reroute dynamically based on traffic or weather information, meaning that they can efficiently perform transport tasks in cities and towns without human supervision at all times (Omolara et al., 2023). Using AI-based systems, sensor data can be analyzed to identify delivery windows and inform the supply chain software to control inventory by automating the warehouse-to-door process. Developed IT such as edge computing enables drones to compute data onboard, which improves decision-making in complex contexts such as autonomous vehicle coordination in hybrid logistics networks (Josino et al., 2023). The ones that can be observed regarding speed and accuracy are competitions and experiments in real life: AI drones can be applied to e-commerce when reinforcement learning can assist to optimize the path to follow and take a safer and more direct route (Yazdanpanah et al., 2022). By 2030, these technologies are expected to operate drone armies at scale to make logistics with AI-driven predictive analytics and autonomous fleet management a reality.

## 2.2 Common Barriers to Scaling IT-Driven Drone Systems

Precision Agriculture and smart logistics offer considerable challenges on scaling of the IT-driven drone systems. Limits to battery life do not allow long-duration flights and higher payload levels, especially when it comes to heavy-lift operations, and present technology is not able to meet the requirements of long-distance flights (Omolara et al., 2023). Lack of connection, particularly in rural regions, negatively impacts real time data processing and integrating 5G/IoT functionality and with fewer connections, it is less reliable (Esposito et al., 2021). The cybersecurity risks (hacking and data breaches) endanger the safety and privacy of the operations, and cloud-based systems in particular are compromised (Josino et al., 2023). There are regulatory complications that are practice-prohibiting, such as different standards around the world, and airspace limitations, particularly to start-ups (Wright, 2014). The prohibitive equipment costs and most especially maintenance costs further hinder accessibility, especially to small scale farmers or logistics operators (Gupta et al., 2024). All these obstacles contribute to the issue of scalability, and hence, need the improvement of battery technology, secure networks, and uniform laws to

potentially unleash the potential of drones.

### 2.2.1 Cybersecurity Challenges

Regardless of these innovations, drone autonomy is facing massive challenges posed by cybersecurity. One of the most common vulnerabilities is GPS spoofing (an attacker has access to the drones' location information and can hijack them) and signal jamming (an attacker can disrupt the line of communication between the two drones, which can lead to collisions or information loss during an agricultural or logistical mission) (Chan et al., 2018). Malware injections and unauthenticated access to confidential data, such as crop yields or delivery routes, are also enabled by software and firmware vulnerabilities, which are exacerbated by AI systems vulnerable to adversarial attacks that introduce changes casually to the image recognition (Ramos & Mosleh, 2021). Cyber risks, such as interception of data or ransomware, may compromise the whole supply chain in large-scale deployments, including drone networks used to carry out logistics operations; research indicates that many drone models do not utilize enough encryption or authentication (Omolara et al., 2023). Critical infrastructure monitoring compounds the layers of concern due to the wireless nature of unmanned systems, which makes them the easiest targets to exploit remotely, however solutions such as improved threat reporting and access controls are currently being developed.

### 2.2.2 Regulatory Barriers

Lack of regulatory frameworks also becomes a hindrance to adoption since in most cases, technology has left it behind. Similar to precision agriculture, the challenges it faces are airspace prohibitions, certification of beyond-visual-line-of-sight (BVLOS) flight, and hodgepodge state-level regulations that make it difficult to operate a drone across state boundaries in large farms (Tano, 2024). The same applies to logistics where aviation regulations restrict urban flights of drones due to safety concerns, privacy regulations curb the use of drones to collect data, and no uniform policies have been established to regulate the use of drones in densely populated regions (Esposito et al., 2021). International supply chains face some challenges due to global inconsistencies, including the difference in FAA standards in the US compared to EU standards, as well as environmental and noise-related regulations (Ramos & Mosleh, 2021). The social-economic factors such as expensive training and limited rural connectivity can serve as an indirect obstacle to programs such as the White House initiative to streamline drone regulations. Finally, advanced IT systems and AI, in fact, can really boost the drone autonomy in the following areas, as demonstrated by the current trends in effectiveness and

decision-making (Akmaykin et al., 2017). As proactive developments take place, the advantages are likely to prevail over the difficulties in the short term.

### 2.3 Case Studies

Drones are revolutionising every industry, particularly agriculture, transportation, and disaster management. Multispectral drones equipped with sensors and cameras can be utilised in agriculture to facilitate precision farming by quantifying crop health, tracking soil status, and gathering information on irrigation, pest management, and crop

growth (Ramos & Mosleh, 2021). All this real-time information will enable farmers to make informed decisions that enhance productivity, reduce waste, and minimise environmental damage. Drones have revolutionised logistics delivery systems, particularly in urban and rural areas. Organisations such as Zipline and Amazon have pioneered the concept of drone deliveries, and Zipline has particularly utilised drones to deliver medical supplies to remote, inaccessible regions in Rwanda (Chan et al., 2018). As shown in Figure 3, drones have versatile applications across agriculture, logistics, and emergency services.

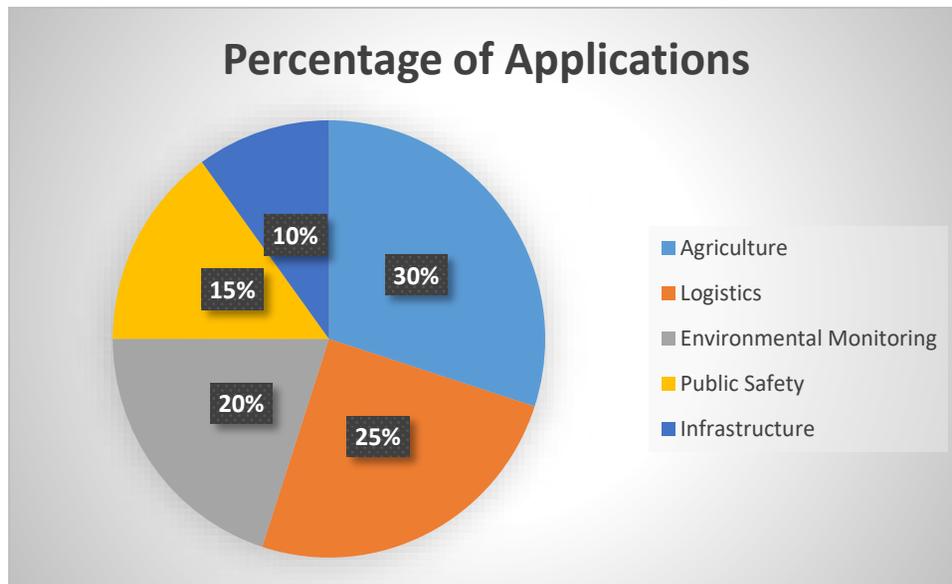


Figure 3 Applications of IT-Driven Drones Across Industries

Last-mile delivery is highly beneficial when utilising this capability, especially since conventional solutions can be complicated. Drones have been invaluable in search and rescue, firefighting and disaster management when responding to emergencies. Drones with thermal imaging systems and real-time information communication systems can evaluate the disaster site and the location of survivors, and deliver important information to the responders (Yazdanpanah et al., 2022). For example, as it was the case with Hurricane Maria in Puerto Rico (2017), the drones would be invaluable, for the damage assessment and for the aerial mapping that would allow the emergency services to prioritize the work that they have to do and the allocation of resources (Esposito et al. 2021). These two cases show that drones increase the response rates, safety levels, and save lives in life-threatening scenarios.

## 3. Methodology

### 3.1 Design of Research

This dissertation applies a mixed-methods research design to the opinion piece to explore how drone autonomy, IoT, 5G, and cybersecurity regulatory issues in precision agriculture and smart logistics can be developed by integrating information technology (IT) and artificial intelligence (AI). The mixed-methods design is a blend of the qualitative and quantitative approaches to provide a comprehensive analysis of the research, balancing the qualitative research depths with the quantitative (empirical) data presented to address the research purpose. The design of this is appropriate in relation to Systems Theory, which perceives the drone systems as a bundle, which facilitates a total analysis of the interactions between technology and constraints.

The qualitative aspect is a systematic literature review and analysis of a case study. The review of the literature provides the synthesis of existing studies on the IT-driv-

en progress of drones with regard to AI, data processing, control systems, cybersecurity and regulation systems. Real-world example applications are already found in precision agriculture ( e.g., multispectral drones to monitor crops) and smart logistics ( e.g. the drone delivery system and associated modelling and optimization developed by Zipline and Amazon). These cases provide useful and practical insights into the role that IT plays in enabling drones to increasingly operate autonomously, and they also describe the challenges that are encountered in applications such as connectivity issues or operational restrictions imposed by regulation.

The quantitative section is represented by secondary data analysis of industry reports, technical characteristics and performance indicators of drone systems. As an example, the battery life, the payload capacity, and connectivity stability (e.g. 5G latency) data are used to measure the effect IT has on the efficiency of a drone. Such metrics can be represented with bar graphs and flow charts like the graphs shown in Figure 4, 5 and 7 that provides a data-backed analysis of the contribution of and limitations to technology. Such an interdisciplinary mode of thinking and practice guarantees both a strong grasp of the technical features and the applied issues in the field of drone autonomy.

### 3.2 Sources of data

The data used in this research was mainly through secondary sources, which consist of scholarly articles in journals, industry forecasts, and technical reports between 2005 and 2025, making them relevant to current research practices. The most significant databases are IEEE Explore, Science Direct, and Google Scholar, with such search terms as drone autonomy, AI in drones, IoT and 5G in drones, precision agriculture drone, smart logistics drone, drone cybersecurity, and drone regulations. Particular sources are the Emimi et al. (2023) research on the potential of drone technologies of the opportunities, Gupta et al. (2024) review of the use of drone technology in logistics, and the Wright (2014) account of the regulatory issues. Technical and regulatory information is also available through industry reports released by government agencies such as the Federal Aviation Administration (FAA) and privately owned companies such as DJI and Amazon. Case studies were based on reported uses, e.g., medical

delivery by Zipline to Rwanda and a disaster response using drones in Hurricane Maria (2017). To these cases are added quantitative data, e.g., drone performance indicator (e.g., flight time, data processing rate) and cybersecurity incident statistics (e.g., Josino et al., 2023). To make it more reliable, sources are duplicatively checked in terms of credibility with the emphasis on peer-reviewed sources and industry sources of quality. There was no use of primary research, i.e., expert interviews considered, the exclusion is based on the focus on synthesis of the existing knowledge but is mentioned as the limitation.

### 3.3 Limitation

The methodology has various limitations that affect the area and applicability of the study. To begin with, the use of the secondary data constrains the possibilities of acquiring first-hand perceptions of real-life issues, including the experiences of the operators or the novel cybersecurity risks that were not reported yet. It can cause an overweight of the theoretical outlooks, Li et al. (2020) says, and it is possible to miss out on practical considerations. This gap can be filled by incorporating original data, like interviews with industry and player professionals of the drones industry or operators, but was unfortunately not possible either time- or resourcewise. Although this is valid and complies with the aims of the study, it can be lacking in covering more of the ground of people in other spheres of life experiencing IT integration. Third, drone regulation inconsistencies across jurisdiction (e.g., FAA standards, which contrast with other regions) make it hard to generalize the results since regulatory issues vary greatly depending on the jurisdiction (Wright, 2014). Finally, the mixed-methods approach is a comprehensive approach, but it has problems in merging qualitative and quantitative evidence effectively. In particular, qualitative case studies can not be as precise as quantitative measures, and secondary data can not include the latest innovations as there could be some lag before they are published.

## 4. Findings and Analysis

Real-time monitoring enables more sustainable and effective farming practices, resulting in improved environmental outcomes and increased farm profitability. Figure 4 outlines how drones collect, process, and convert agricultural data into actionable insights.

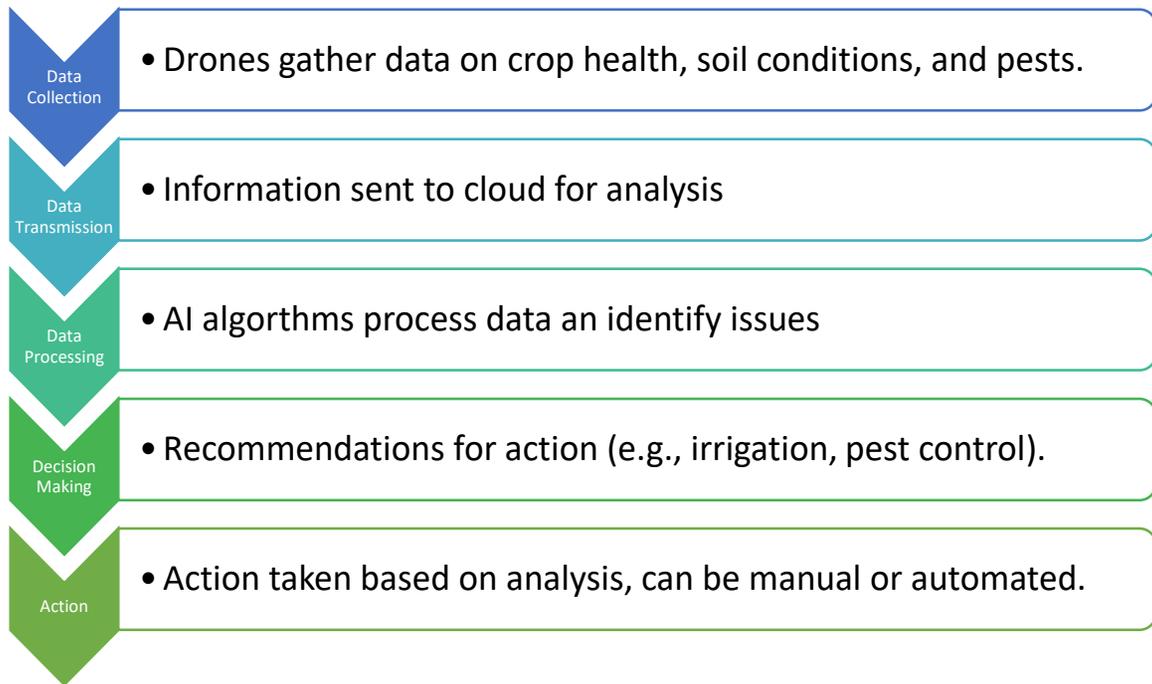


Figure 4A flowchart showing how data is collected, processed, and used for decision-making

Smart Logistics: Automated Delivery and Route Planning Drones are transforming the logistics field, particularly in last-mile delivery and route management, through the application of technology. Drones with GPS and real-time data processing are self-guided in urban areas to deliver packages as efficiently and fast as possible. Amazon and DHL are companies that utilise drones to reduce the cost

of delivery and time (Akmaykin et al., 2017). Using AI-based algorithms makes automated route planning more efficient, taking into account traffic, weather, and regulations, so that deliveries can be made efficiently and reliably (Omolaro et al., 2023). As depicted in Figure 5, each step in the drone delivery chain varies in time, with AI playing a crucial role in optimisation.

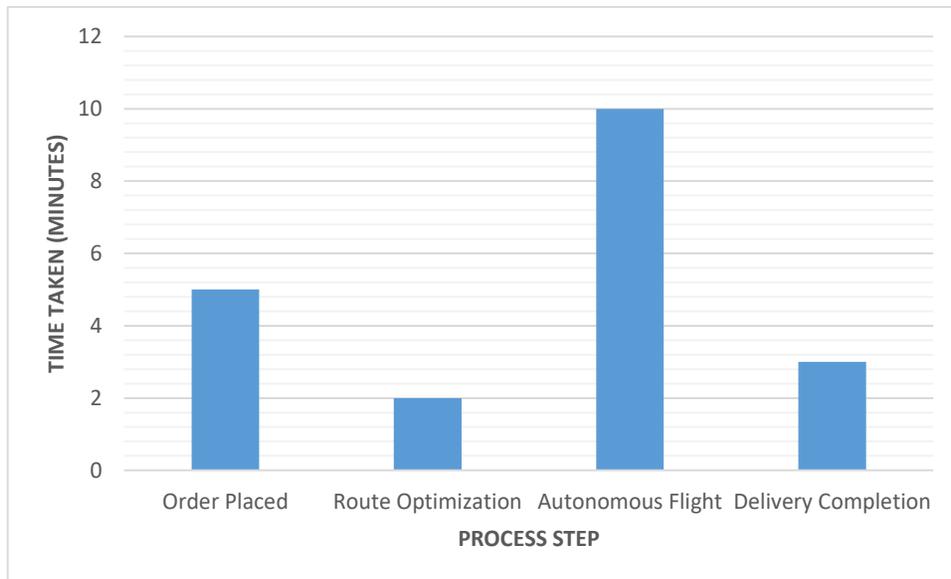


Figure 5: Bar graph showing the time taken for each process step in drone delivery

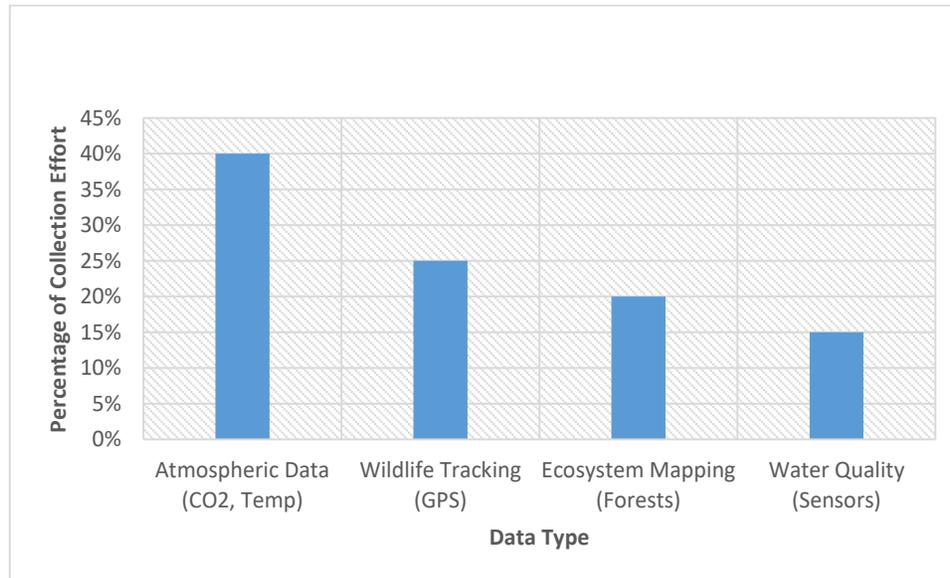


Figure 6: A bar graph depicting what percent of effort is done towards various collection of data in environmental monitoring.

Figure 6 illustrates the focus areas for drone data collection in environmental monitoring. Drones equipped with thermal imaging cameras and GPS devices are also utilised in wildlife conservation to survey endangered species and track poaching operations without disrupting natural habitats (Omolaro et al., 2023). Especially in nations such as Africa, extensive drone coverage can collect information on animal movement, activity, and population health, and offer real-time monitoring of any illegal poaching, which the government can address with swift action (Tano, 2024).

#### The Technological Proponents' View

The adoption of IT into the architecture of drones is associated with many advantages with AI and data computing taking a key role in their adoption of autonomy. It can be done, as it is shown in the case studies, where drones are used in logistics to deliver items perfectly and in agriculture, to screen the crops effectively (Li et al., 2020). AI algorithms also enable drones to make real-time decisions, allowing them to navigate even the most complex environments in an automated manner (Malowany & Guterma, 2020). With big data being processed by sophisticated algorithms, drones can stay on the optimal flight path and perform tasks most effectively.

#### Opposing Perspectives

Although these are the advantages, serious issues exist that compromise the effectiveness and widespread use of IT-drone integration. Cybersecurity threats are crucial because drones relying on network-based systems will be prone to hacking, data leakage, and unauthorised control,

which may compromise their privacy and safety (Nonami, 2018). The methodology emphasises the use of secondary data, which is less informative than firsthand information (Li et al., 2020). It may lead to an overemphasis on theory within the realm of investigation rather than reality.

#### Alternative Interpretations

Another way to substantially reinforce the analysis would be to introduce primary data, including interviews with experts in the drone industry, to fill the identified research methodology void (Qi et al., 2021). This would allow for obtaining firsthand opinions about the practical difficulties and achievements, and would enable a more down-to-earth judgment of the question of IT-drone integration (Nonami, 2018). This argument suggests that regulatory challenges act as a bottleneck; however, opportunities exist to be creative in finding solutions.

## 5. Discussion

### 5.1 Synthesis of Findings

The study finds that as illustrated in Figure 7, battery life and connectivity remain the primary constraints facing IT-based drones. Despite the advancement of drone technologies, IT-based drones still have some technical limitations that hinder their extensive large-scale usage. Battery life is among the most significant limitations (Omolaro et al., 2023). Drones, especially industrial drones, fly using batteries, and the current technology allows them to stay in the air longer (Wilson, 2014). Despite the improving

battery capacities, they do not match the energy density required to fly long-haul drones, especially in heavy-lift applications such as agriculture and logistics.

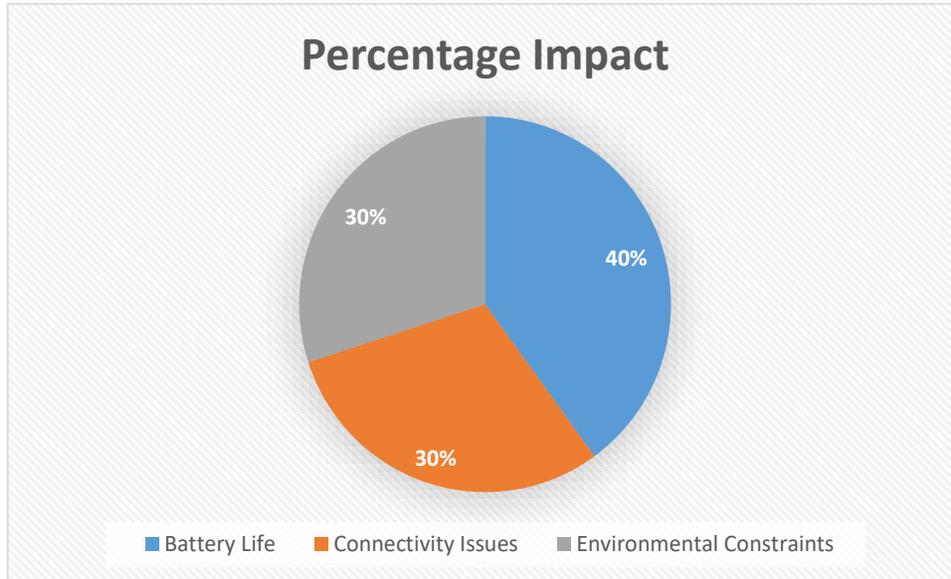


Figure 7 Pie chart showing the distribution of technical limitations for drones.

Due to the increasing centrality of drones in spying and data collection, concerns have been raised regarding the privacy implications of data and the ethical collection of aerial information. Using expensive drones equipped with high-definition, thermal, and facial recognition cameras, capable of collecting significant personal information, raises a serious privacy concern. Morally, spying on publicly or privately owned premises without the consent of the proprietor is also a threat to people’s privacy rights (Friedewald et al., 2017). There has been too much emphasis on facial recognition, particularly because drones can easily track a person over a long distance, leading to unlawful behaviour (Sifakis & Harel, 2022). This raises the issue that it should be dealt with more seriously, lest it be misused, particularly where people would wish for more privacy. Also, there is data storage and access by Drones, including capture in the air. Any data kept on the cloud has the risk of exposure (Ramos & Mosleh, 2021). The security and privacy of data gained by organisations using drones are the responsibility of these organisations. The regulatory environment constitutes one of the most significant challenges hindering the widespread adoption of IT-based drone systems. The regulations governing

drone operation vary significantly across countries and regions (Wright, 2014). In most cases, they have not kept pace with the rapid advancements in drone technology. For example, the Federal Aviation Administration (FAA) has established regulations on the commercial use of drones in the United States, including requirements for remote pilot certificates, airspace restrictions, and altitude limitations (Sifakis & Harel, 2022). These complex rules, however, could hinder startups and newcomers in the drone marketplace.

**Cybersecurity Risks: Vulnerabilities in Remote Access and Cloud Systems**

Security in cyberspace is crucial, as drones increasingly rely on IT infrastructure for communication, data storage, and operation. Drones are typically networked to remote control stations or cloud systems, which can leave them vulnerable to cyberattacks and hacking (Josino et al., 2023). The hacker can hijack a compromised drone, posing a serious threat to both drone users and the general populace on the ground (Tang et al., 2022). For example, cyber hackers can take control of drones used for delivery or logistics and hijack packages, or, at worst, use drones for malicious purposes.

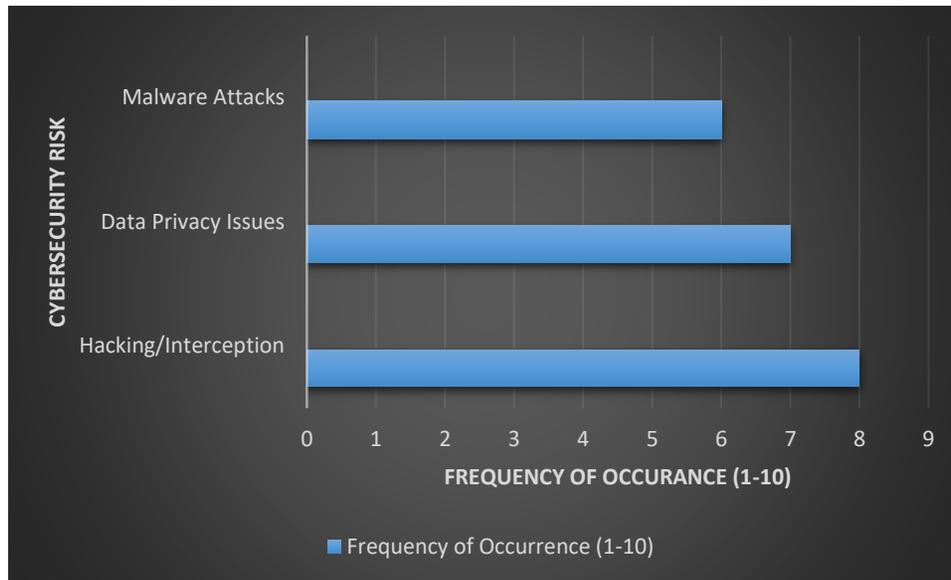


Figure 8: Bar graph comparing cybersecurity risks

Figure 8 compares the various cybersecurity risks threatening drone systems and infrastructure. The presence of remote access and cloud-based impediments raises questions about introducing drones into strategic infrastructure, such as supply chains, emergency response systems, and government operations.

### 5.2 Policy and Support Implications

Drones, combined with 5G and the Internet of Things (IoT), are game changers in drone technology, as they

provide low-latency connections and enable real-time information processing. IoT enables drones to be linked to a vast network of devices, sensors, and systems, allowing them to receive, transmit, and respond to data from various or a single system (Tarr et al., 2021). Such a connection can enable clear communication between drones and other machines, i.e. sensors, cloud servers, or control centres, and enhance the operation of the entire drone system (Tang et al., 2022). As illustrated in Figure 9, IoT, and 5G technologies play a great role in the autonomy and sustainability of drones in the long-term perspective.

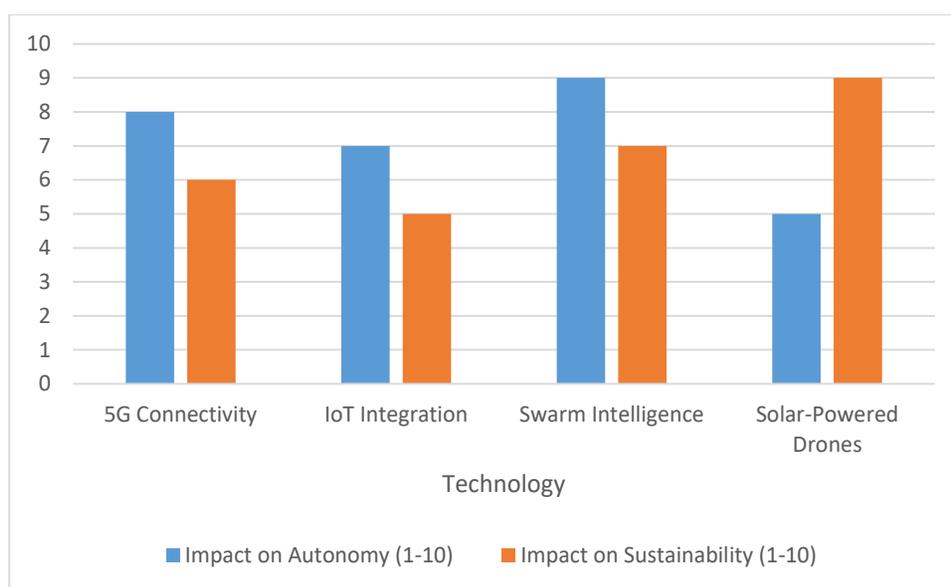


Figure 9: The comparison of the influence each technology has on autonomy and sustainability in the form of the stacked bar graph

### Drones as Intelligent Agents

The upcoming change in the world of drones is swarm intelligence, as an adaptation of the collective behavior of social organisms. Swarm intelligence can be defined to be the act of synchronizing two or more drones together into one intelligent agent in order to do what individual drones would not have managed to do easily. (Cai et al., 2023). Together with AI algorithms, drones can be programmed to cooperate, enhancing time-consuming functions such as search and rescue missions, surveillance, infrastructure inspections, or environmental monitoring (Wilson, 2014). Swarm-based drones are capable of communicating with one another, as well as coordinating their activities and performing tasks based on the individual perception of their surroundings (Tang et al., 2022). An example is a swarm of drones in search and rescue missions, which can cover a large search area more efficiently than a single drone because it divides the search area into smaller areas and reports its results to other drones.

### Toward Full Autonomy: Deep Learning, Object Recognition, and Adaptive Algorithms

One of the most significant drivers of the industry is the complete autonomy of drone technology. In the future, drones may be able to fly without the need for human monitoring. They will be characterized by high learning rates, image recognition and adaptive algorithms, which is why they will have no need to be given explicit instructions by the human being to go through different complex situations (Ramik et al., 2013). It uses the deep learning AI technology, which would allow the drone to become more advanced as it learns with huge volumes of data and is capable of making complex decisions in real-time. Machine vision/learning will help us understand better how objects can be detected and understood and trained, and drones will learn to identify and categorize objects in the nearby environment (Li et al., 2020). It will also ensure that drones are more effective in relation to infrastructure inspection, wildlife surveillance, and detection of the threats that are present.

### Sustainable Drone Technology: Solar-Powered Drones and Biodegradable Components

Because of the increasingly troublesome and crippling environmental impact of technology, there is increased popularity in green drone technology. The most striking development in this aspect is Solar powered drones. The working time of the drones fitted with solar panels will be longer, they will use less traditional battery capacity, and their environmental friendliness will be minimal (Wilson, 2014). Solar drones allow for longer range flights and can be used to access remote territories, for environmental protection, animal conservation and even as a combined approach for climate research (Esposito et al., 2021).

Unlike the drones that can only fly on a charge, the solar drones are able to fly for a long period of time. For this reason, they are suitable only in operation where data monitoring or data at a constant level is required.

## 6. Conclusion

The scope of this dissertation analysis was the study of the role of information technology (IT) at the interfaces of drone systems, especially how IT can improve the performance and capacity of drone systems for different industries. IT evolution has been influencing the drones' history from the remote-control aircraft to the super-intelligent drones with AI technology. The research conducted brings to light the fusion of IT and drones, and in particular the technologies that allow to program drones so that they can fly and navigate autonomously. From precision farming to intelligent logistics, the research on the utility of drones in these domains shows how drones can be used in the present. In addition, the paper uncovers certain of the main problems regarding regulatory aspects, data security and cybersecurity risks and also explores some of the new trends: swarm intelligence and green technologies. Overall, this paper provides a worthwhile contribution to the emerging literature on the impact of IT on the future of drone systems and applications.

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