

Modern Day Drone Frequencies and The Downfall They Bring

Analyzation of Autonomous Aerial Vehicles and Computational Method Analysis

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis Related Assignments

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Drones Then and Now

In an era defined by technological transformation and artificial intelligence boasting, autonomous vehicles such as multirotor drones have revolutionized society. Drones were initially integrated for military usage with UAVs, missile launchers and rescue missions but have steadily gained attraction to the general public with the rise of the 21st century (Packer, J). In the modern world, drones can be used from delivering emergency medications and creating recovery hubs to taking on agriculture tasks (Ayamga, M). The idea is to essentially lower costs of human labor and achieve convenience, which has proven to be successful in most cases. In a recently developed journal article, HCI was used to create perception glasses and VR sensors to support drone pilots with disabilities. Controllers were coded with Python and QT5 which were specialized based on the customer needs. Drones in this specific case were used as a therapy and a recovery tool for muscle training which is just one of the many applications that require attention (Garcia, J 2022). As a society, it is important that as unmanned aerial vehicles gain more traction, responsibility should be upheld from every direction. Despite all the benefits, how are drones being considered in an ethical security and privacy lens?

By analyzing the latest research and government regulations, the goal is to equip all stakeholders and general public with knowledge that may change the perspectives on how drones are truly impacting the world around us. If we are integrating drones into the same society that “WE” the people have formed ourselves, it is only right to know how these drones can breach the social contracts that have been created since the beginning of time. There are details behind each application in the drone world that have not been exposed fully. Experiments with drone

potentiality are conducted every day in top university laboratories and private research facilities, but it is my job to help break down all details and cover the fullest extent.

My technical paper will focus on the development of quadcopter drones and how their coded components ranging from sensors to power management boards all provide a unique purpose to their abilities. Exploring the options within each drone's system is salient when it comes to figuring out how these drones are revolutionizing technology. My STS research paper will explore the role that drones have in society and how they are negatively impacting us. The drones that partake in rescue missions and expand our healthcare options can be the same ones that are flying over a private civilian property without consent. With that analogy being provided, the STS paper will have much more of an ethical perspective and will analyze how these drones have caused chaos up until today.

Quadcopter DJI (Technical)

The development of quadcopter drones and Opti-Track systems for unique environment simulations allows for mass gathering of aerial data. Each drone is required to meet a specific set of customer needs and target specifications, which will benefit the user. Underneath every drone cover is a series of wires and electric boards that provide signals and data to make the whole system come to life. This portion of the product is usually ignored since most users have an immediate urge to fly. Even though it may not be the first thing on their mind, the entire portion is the most important part of a drone. This is where the ability to maintain surveillance, capture images and communicate through signals is derived. If any signal is hacked, there can be a breach of data and the functionality of the drone can be overridden by a different piloting connection. In a recent journal article by the Computer Society, "The rising popularity of drones

has increased the frequency of cyber attacks against IoD systems. For example, adversaries can target the radio connection of drones in an effort to impede the system's communication with users' devices. This intercepted communication information enables the adversary to steal data (e.g., the command/control signals) requested and transmitted by drones" (Wencheng Yang, 2022). The more frequently that drones are being used in society, the higher chances for anonymous users to steal confidential information.

In order to further studies about drone concepts and their potential impacts, I, along with my team, will be developing an advanced version of a pre-developed DJI M210 RTK V2 model. The main focus will be to write ROS (Linux Variation) code for complete autonomous flight and minimally delayed teleoperations. The previously assembled version will be updated through new modules such as ArduPilot and Matlab for safer manual control options and features for crash avoidance. As a group, the collective goal is to create a model that will meet all primary and secondary customer needs so that the product is successful. My team will have different sub-groups that focus on designing a steady reactor room with sufficient sensors and another that will focus on assembling new parts into the pre-existing drone and trying to create a variation. Creating a proper reactor room and having plenty of motion sensors available will allow it to code the drone's directionality so that it will be aware which directions to go when there is no manual control. If the environment is not stable enough and there is a miscalculation on height evaluations as well, there can be large flight control issues.

The team will have a large focus on data gathering and surveillance installation which will need to be connected to other materials such as Raspberry hardware and maximum field of

view cameras. According to the IEEE Xplore Journal, digital image processing has more benefits than just being able to take pictures and provide aerial views. There can be automatic drone landings without any manual assistance from a human required. Being able to build such a drone will not only allow us as a team to test the flight control limits, but possibly use code to allow the drone to return to its origin and land (M. Demihran, 2020)

How Much Do Drones Really Threaten Society?

In order to understand how drones are counter-intuitive when it comes to ethical responsibility and safety, literature reviews and policy analysis studies are very salient. Evaluating existing regulations in multiple world regions will allow us to understand how drones are being facilitated in terms of international and private airspace. Case studies that tackle threats a drone would ensue while also considering a counterclaim to help the reader both perspectives of an argument are also very beneficial when considering the ethical security and privacy lens of implementing drones.

As their expansion on a global scale continues to rise, the dangers behind artificial intelligence and autonomous aerial vehicles must be widely exposed. Even though drones are capable of shifting the economy and have a convenience benefit, their ethical standpoint is one that causes concern. The primary concern is security and privacy within private property perimeter. According to Michelle B, who wrote *University of Illinois Journal of Law, Technology & Policy 2*, drones are able to record footage of people from above their own private property and breach different segments of data. Michelle examines the weak links in the FAA regulations for air space control and connects any potential harm that can be caused within society. Drones have the capability to breach international air space and even conduct illegal activities without any oversight, consequently threatening the security of many civilians. Security with drones and

any autonomous product is one that can not be taken lightly. In a recent event involving the United States and China, a Chinese “spy” balloon was spotted floating over the US atmosphere and was immediately shot down. Officials claimed that the balloon could have interfered with US communications, which only accentuates the weak regulations that AV’s have (Ng, L. H. X., & Carley, K. M. 2023). If autonomous products are able to infiltrate foreign countries, then the damage that can be done in local neighborhoods is unimaginable.

The unparalleled potential of drones has been largely considered through the lens of innovation and creativity for the past century. In 2010 after Haiti was struck with a level 7.1 magnitude earthquake, drones were utilized by Matternet to travel inaccessible areas to deliver medical supplies and emergency equipment for civilians to survive (Scott, J). Since the infrastructure of the cities were all destroyed and road access was limited, artificial intelligence took a powerful stand which changed the lives of hundreds. Furthermore, medical organizations and prominent healthcare models are also looking to integrate drones in their delivery services for rapid blood, vaccine and medication transportation (Scott, J., & Scott, C. 2017). Medical care has a potential to be delivered straight to people’s doors instead of having to wait on pharmacy prescriptions. The preceding drone missions were aimed to benefit those in need by leveraging efficiency, but that is not always the case. The same drones that are able to change life for the good are then ones that can cause chaos when least expected. If a drone’s tele-operational management system has latency or the turbulence system experiences unexpected winds and building crashes, the possibility for causing physical damage is very high for any human that is around the vicinity. Pilotless drones are prone to computational error which sometimes cannot be

manually shifted, causing communication breach and navigation issues. These issues therefore lead to crashes which is an undesired outcome (Sandbrook, C. 2015).

In an article written by Springer International Publishing, an unmanned Uber in 2022 had crashed into a cyclist, consequently applying manslaughter charges to the man who had been using AI in order to operate his vehicle. In another case, the same article discussed damages that a UAV had caused after a crash but the charges were not applied to a human, but rather claimed AI at fault. The regulations on AV control do not allow for specifications on how fault is distributed (Shirokova, E. S., & Fedulin, A. M. 2022). This shows that drones not only have the potential to cause physical damages and computing errors, but rather physiological harm.

Furthermore, drones have an ethical dilemma through the lens of business models. With companies such as Amazon, Uber, and FedEx who want to invest in efficient delivery services to lower manual labor costs, drones are the future. There are also conglomerates and firms who would invest in drones in order to increase profits and stock, which will eventually raise drone frequency. This might seem like a great margin for the economy to grow, but what about the blue collar workers who still need jobs? If drones continue to be mass produced and artificial intelligence is relied on, then thousands of jobs are on the line. The potential of drones in this case has a two sided debate since one leans towards economic progression and the other has the social implications of job loss. With the introduction of drones in such niche fields, there would also need to be consideration for the level they will be performing at in the case that navigation errors occur and consumers are unhappy (Anne Hopkins, 2017). Any drones entering in private

airspace have disruptive potentials and combative lawsuits as seen in *United States vs Causby* and *Dobbs vs Wiggins* are eligible (Michelle , B. 2015).

In order to understand how drones can ethically be implemented into society while also carrying out a social and economic lift, I am required to shuffle through multiple literature reviews and case studies. Each case study tackles a different threat drones would ensue while also considering a counterclaim to help the reader both perspectives of an argument. A main method to assist my argument is analysis of policies where organizations such as the Federal Aviation Administration are under observation. Knowing which sections of the law are lenient and which ones need to be revised allows for understanding how society has been shaped today.

Conclusion

My technical paper focuses on the design and development of a DJI Quadcopter along with its newly implemented sensor system with OptiTrack. It has an overall goal to carry out new flight experiments after becoming fully functional with a new power management system. The idea behind creating a drone is salient to understanding how propulsion and coding platforms work together in order to produce lift. My STS portion focuses on how the development and rapid frequency of drone presence has a security and privacy threat to society. There are projects in this world such as the Facebook initiative to provide internet through drones that boast popularity, but that is not where the extent of drone impact ends. After conducting a risk analysis assessment, it is clear that the only way drones are able to safely operate within society are through secure regulations designed by the FAA and federal government. Drones cannot be allowed to fly in unrestricted international airspace or trespass another's property. The future research that will be conducted will test surveillance data and teleoperation capabilities within

the DJI, which will reveal successful flight and data collection. This successful flight will be the first step to revealing how ethical drones really are when tested in public environments.

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