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Drone usage and privacy infringement: Review

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ABSTRACT

Recent inventions and business methods call attention to the next step which must be taken for the protection of the person, and for securing to the individual (the right to be let alone). Drones, also referred to as UAV's (Unmanned Aerial Vehicle), are an aircraft without a human pilot. Drones deployed without proper regulation, drones equipped with facial recognition software, infrared technology, and speakers capable of monitoring personal conversations would cause unprecedented invasions of our privacy rights. Interconnected drones could enable mass tracking of vehicles and people in wide areas. Tiny drones could go completely unnoticed while peering into the window of a home or place of worship. The review paper is aimed at drone capabilities and how they could and are currently effecting privacy laws globally, and it will also focus on the laws preventing such invention.
Keywords: Drones, Privacy, and Laws.

INTRODUCTION

Drone which is also known as "an unmanned aerial vehicle (UAV) or uncrewed aerial vehicle, is an aircraft without a human pilot on board and a type of unmanned vehicle [1]. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator, autonomously by onboard computers or piloted by an autonomous robot. Compared to crewed aircraft, UAVs were originally used for missions too "dull, dirty or dangerous" for humans. While they originated mostly in military applications, their use is rapidly expanding to commercial, scientific, recreational, agricultural, and other applications, such as policing and surveillance, product deliveries, aerial photography, infrastructure inspections, smuggling, and drone racing. Civilian UAVs now vastly outnumber military UAVs, with estimates of over a million sold by 2015. How would it make you feel if a drone flew over your house while you were sunbathing by the pool, hanging out with your children, or just watering the plants? Your answer would probably depend on who was flying the drone and for what purpose. But in general, if you are like everyone else, you probably have some privacy concerns [2]. Unmanned aircraft systems are quickly becoming ubiquitous. The public wants to know how this will affect privacy and what the legal limitations are for drones. Gender plays a role in privacy concerns as well. On average, females have more privacy concerns about drones, compared to males. Fear of being videotaped was the most common reason for their concerns.

The looming prospect of expanded use of unmanned aerial vehicles, colloquially known as drones, has raised understandable concerns for lawmakers [3]. Those concerns have led some to call for legislation mandating that nearly all uses of drones be prohibited unless the government has first obtained a warrant. Privacy advocates have mounted a lobbying campaign that has succeeded in convincing thirteen states to enact laws regulating the use of drones by law enforcement, with eleven of those thirteen states requiring a warrant before the government may use a drone. The

campaigns mounted by privacy advocates oftentimes make a compelling case about the threat of pervasive surveillance, but the legislation is rarely tailored in such a way to prevent the harm that advocates fear. In fact, in every state where legislation was passed, the new laws are focused on the technology (drones) not the harm (pervasive surveillance) [4]. In many cases, this technology centric approach creates perverse results, allowing the use of extremely sophisticated pervasive surveillance technologies from manned aircraft, while disallowing benign uses of drones for mundane tasks like accident and crime scene documentation, or monitoring of industrial pollution and other environmental harms.

Types of Drones and Their Technical Characteristics

To get a better understanding of drones, it is important to discuss their different technical characteristics [5]. In this section, these characteristics are discussed and, in order to further visualize these technological characteristics, examples of existing drones with these characteristics are described. The most notable characteristic is what we will call the type of drone. In this chapter, this term is used to define the difference between fixed-wing systems, multirotor systems, and other systems. Examples of other systems are so-called hybrid systems, which are multi-rotor and fixed-wing systems, ornithopters, and drones that use turbo fans [6]. The technology used to keep the drone flying defines the type of drone. This characteristic is also the determining factor in the shape and appearance of the drone. A second characteristic is the level of autonomy of the drone. The autonomy can vary from full autonomous operation to fully controlled by a remote pilot. Another noteworthy characteristic is the difference in size between drones. The size can vary from drones the size of an insect to drones the size of a commercial airplane. Weight is also an important characteristic. The weight of drones can vary from several grams to hundreds of kilograms. The final defining characteristic discussed in this section is the difference in energy source. Examples of energy sources are battery cells, solar cells, and traditional airplane fuel. The importance of characteristics lies in the fact that the different drone pay-loads and related applications depend on (gradations within) these characteristics. Also, drones are usually categorized using the mentioned characteristics.

Main Existing Drone Types

As stated above, an important technical characteristic of drones is the type of drone. The main drone types are fixed-wing systems and multirotor systems. The majority of existing drones can be defined within these two types [7]. Other systems like hybrid systems and ornithopters are also briefly discussed.

Fixed-Wing Systems

Fixed-wing is a term mainly used in the aviation industry to define aircraft that use fixed, static wings in combination with forward airspeed to generate lift. Examples of this type of aircraft are traditional airplanes, kites that are attached to the surface and different sorts of gliders like hang gliders or paragliders [8]. Even a simple paper airplane can be defined as a fixed-wing system. An example of a fixed-wing drone is the widely used Raven, which will be discussed in more detail later in this section.

Multirotor Systems

Multirotor systems are a subset of rotorcraft. The term rotorcraft is used in aviation to define aircraft that use rotary wings to generate lift. A popular example of a rotorcraft is the traditional helicopter. Rotorcraft can have one or multiple rotors [9]. Drones using rotary systems are almost always equipped with multiple small rotors, which are necessary for their stability, hence the name multirotor systems. Commonly, these drones use at least four rotors to keep them flying. A popular example of these multirotor drones is the widely used Phantom drone made by the Chinese company DJI. This four-rotor drone will be discussed in more detail later in this section. Differences between fixed-wing drones and multirotor drones are

important for the different applications consumers want to use the drone for. For example, multirotor drones do not need a landing strip, make less noise than their fixed-wing counterparts and can hover in the air. Fixed-wing drones can fly faster and are more suitable for long distances than their multirotor counterparts. These characteristics determine which of these drone types to use for a specific application.

Other Systems

Some types of drones cannot be labeled as a fixed-wing or a multirotor drone. Sometimes because the drone simply is neither fixed-wing nor multirotor, sometimes because the drone has characteristics of both types [10]. Hybrid systems are systems that have characteristics of both multirotor and fixed-wing systems. The hybrid quadcopter is an example of such a drone. This drone uses multiple rotors to take-off and land vertically but also has wings so it can fly longer distances. Drones that are neither fixed-wing nor multirotor systems are far less frequent. An example of such a drone is the ornithopter. These drones fly by mimicking wing motions of insects or birds. Most of these ornithopters are scaled to the birds or insects they represent [11]. These small drones are mostly still under development and are not widely used in practice. Examples of ornithopters include the Delfly explorer, a drone that mimics a dragonfly, and the micromechanical flying insect, a drone under development that is eventually going to represent a fly both in size and movement. Another example of drones that are neither fixed-wing nor multirotor are drones using jet engines. The T-Hawk drone is an example of such a drone. This drone uses a turbo fan, making the drone look more like an unmanned (hydro)jetpack than fixed-wing or multirotor. To give a more complete picture, unmanned balloons (filled with for example hot air, helium, or hydrogen) are mentioned here as well. These balloons can fly by heating the air inside. Unmanned balloons are a special kind of unmanned aircraft, but are not commonly seen as drones [12]. The same goes for rockets and jetpacks.

Applications of Drones

The applications of drones cover a wide range of civil and military applications. Drones can perform both outdoor and indoor missions in very challenging environments. Drones can be equipped with various sensors and cameras for doing intelligence, surveillance, and reconnaissance missions. Drones have a variety of applications in our daily life. Drones can have more than two-hundred applications in future according to their types. For example, these drones can be used for search and rescue missions, environmental protection, mailing and delivery, performing missions in oceans or other planets, and other miscellaneous applications. These drones can provide a rapid overview around the target area without any danger. Drones equipped with infrared cameras can give images even in the darkness. For instance, because of their reduced dimensions, micro drones

The applications of drones cover a wide range of civil and military applications. Drones can perform both outdoor and indoor missions in very challenging environments [3]. Drones can be equipped with various sensors and cameras for doing intelligence, surveillance, and reconnaissance missions. The applications of drones can be categorized in different ways. It can be based on the type of missions (military/ civil), type of the flight zones (outdoor/indoor), and type of the environments (underwater/on the water/ground/air/space). Drones have a variety of applications in our daily life. Drones can have more than two-hundred applications in future according to their types. For example, these drones can be used for search and rescue missions, environmental protection, mailing and delivery, performing missions in oceans or other planets, and other miscellaneous applications. These drones can provide a rapid overview around the target area without any danger. Drones equipped with infrared cameras can give images even in the darkness. For instance, because of their reduced dimensions, micro drones can be used for

reconnaissance inside buildings. As reported, small drones are currently the only way to "look" inside buildings in the battlefield [4]. They can carry specific sensors to locate biological, nuclear, chemical, or other threats.

Search and rescue missions

One of the important applications of drones is using them in search and rescue missions. In search and rescue operations, every second is vital. In order to function as efficiently as possible, it is important to be able to obtain a rapid overview of the situation. While manned airplanes and helicopters need time to be ready for doing the mission, drones can be put into action immediately without any loss of time [6]. Because of the important role of drones in search and rescue missions, they attracted the attention of many researchers. To this end, several drones were designed and fabricated for performing this type of missions.

Environmental protection

Although drones are considered as a vital part of military missions, they are also being increasingly used for performing environmental actions, such as managing national parks and agricultural lands, tracking wildlife in different areas, observing the effects of climate change, and monitoring the biodiversity of different ecosystems from rainforests to the oceans [7]. These drones can be used for recognition and investigation of natural disasters including forest fires, avalanches on mountains, etc.

Mailing and delivery

Recently, drone delivery service became an interesting topic for different companies around the world. For example, Amazon and Google in the U.S, DHL post service in Germany, and many other companies are using drones to deliver packages to customers. For delivery, the designed drones land and take off vertically and have the customer address to carry the cargos.

Space drones

One of the environments in which drones can be used, is space and the exploration of other planets, such as Mars. In planetary explorations, because of the advantages of drones compared to other robots, there is a tendency to design and fabricate some drones that can fly and perform missions in space environments. For example, NASA is building drones to explore other planets [9]. Different types of drones were designed and fabricated in order to carry-out space missions and planetary explorations. It should be noted that design and fabrication of space drones should be done based on that environment. For example, because of the amount of gravity on Mars, the weights of drones differ from their weights on Earth. Indeed, the weights reduce by 61.5%.

Marine drones

Drones can be applied in the marine environments to study marine organisms, identify the location of oil spills, and for other military or civil applications [2]. Because of the lack of a runway in marine vehicles, such as submarine and boats, most of the drones are launched vertically in these environments. Launching drones from underwater was introduced at first by U.S researchers in 2005. Nowadays, there are different types of drones including Scan Eagle, Volans, Cormorant, etc, which are launched from submarines. The successful launch of these drones from submarines offered a pathway to perform critical intelligence, surveillance, and reconnaissance missions.

Drones' miscellaneous applications

Despite of the conventional applications of drones, they can be used in some non-ordinary missions. As an example, Tokyo's Metropolitan Police Department unveiled its new anti-drones which are used to take down naughty or offensive drones from the sky. In this type of application, if a suspicious drone is detected, at first the operator is warned. In case the operator is not found or the flight continues despite the warning, an interceptor drone is scrambled to catch the suspicious drone. Moreover, drones can be used as a runway for another drone, can be applied to guide (or scare) birds away from airport runways, can be used to clean windows, gutters, and solar panels, and for other applications, such as hobbies.

DRONES AND PRIVACY CONSIDERATIONS

Privacy and Security

"It is now established by case law that the personal rights of the citizen guaranteed by Article 40.3.1{o} of the Constitution include a right of privacy" [9]. The right to privacy is a civic right which is applicable to all citizens In the USA, the supreme court has made various rulings promoting the right to human privacy, an example is the recent ruling that cell phones cannot be searched without a warrant, all enforcing the right to human privacy. But as the US Supreme Court ruled to promote human privacy another bill that was filed was not even given a committee hearing, that bill was drafted by Senator Jim Tomes, a Republican from Wadesville, Indiana. The bill was aimed at making it illegal to use a drone covertly. By not even hearing the proposal for this bill the US government are maintaining their ability to survey citizens without their knowledge. Whether the government is watching citizens or not there want to have the ability to do so is a great cause for alarm, it is a great invasion of personal privacy. The advancement in commercial drones has been rapid with companies like the aforementioned DHL putting their new delivery drones into practice, companies in the US have had the door firmly shut with the banning of drone use for commercial purposes in 2007. The U.S. government are doing some back tracking now with new legislation on the use of commercial drones in the U.S. with them being possibly granted legality as early as September 2015 [4]. Amazon, like DHL, have been developing their own delivery drones, with Amazon talking about the ability to have delivered orders to customers within 30 minutes after purchase according to Amazon CEO Jeff Bezos. This would effectively change the world of retail shopping for good, but will face its own problems also. The U.S. is notorious for it's no fly zones, for example in Washington D.C. a large portions of the city are no fly zones, how could a company like Amazon operate or deliver to customers via drones who happen to live in these areas. There seems to be a lot hurdles for commercial drones before they can be made legal in the U.S. and there will have to be a lot legislation and laws for the use of these drones, there will be a lot of work to be done before they are legalized by the estimated time frame of September 2015. These drones being used for surveillance in a commercial capacity could become the next phone hacking scandal, these drones used for media purposes has limitless possibilities whether it be monitoring the situation in a war zone or stalking a celebrity, with the latter being very intrusive and potentially infringing on a person right to privacy. With drones likely to be put into commercial and more so in military use, all uses seem to infringe on all definitions of privacy whether that is with proper reasoning or justification and without.

CONCLUSION

In conclusion all evidence points to the fact that drones are only going to become more and more part of everyday life as we know it (Market Research Media, 2013), in order for these machines to be successfully integrated into our society, the transition must be gradual and well marshalled, with laws yet to be drawn up yet. Drones have many strong points and improve many fields of profession, whether that be archaeology, agriculture, retail etc. the possibilities are endless for the progression of drones in society. But the advancements of drones also has its negative effects with drones potentially doing the work that humans have been previously used to perform these tasks, then you also have the moral dilemmas of drones being used by the military for the assassination of terrorists. Also with drones possibly taking peoples jobs for cost and reliability reasons, drones may potentially be portrayed in a negative light but drones will work alongside people taking people out of harm's way whether that be in a military sense or a rescue sense. Drones doing the jobs we should not have to do, can only help society and lower job risks. As drones evolve and become an everyday part of our lives, drones will eventually greatly benefit the way we live and enhance our quality of life. Technology never stands still, if you buy a laptop today in five

years' time the odds are that the laptop's hardware and software would be out dated in comparison to the present times standards. Like technology the drone industry is and will continue to advance as it has done in the past. The drone industry has advanced in the past from military machine to commercial aid demonstrates the range of uses drones have and this expected to continue with drones now even being used to aid in the selling of homes and properties.

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