



On Ethical and Legal Issues of Using Drones

Ivana Budinska^(✉)

Institute of Informatics Slovak Academy of Science,
Dubravská cesta 9,
845 07 Bratislava, Slovakia
budinska@savba.sk

Abstract. Extensive use of drones raises many new questions regarding ethics and morality. Questions concern the civilian and military use of drones. Drones can serve as a mobile network that can reach places, where other devices or people can't get to or can only get to with difficulties. They can efficiently collect data from large and hard-to-reach areas. They are often used for scanning and exploring forest and agricultural areas. Together with advanced image and scene recognition methods, they can greatly reduce hard work and help reduce stress in crop growth and protect forests from infestation. Other application areas are e.g. for archaeologists, when exploring remote areas. The speed and efficiency of the capture of a scenery is a great benefit of this new technology. Many people also use drones for recreational purposes. Therefore, the ethical and legal problems associated with their widespread use should be emphasized.

Keywords: UAVs · Ethics · Legislature

1 Introduction

Unmanned aerial vehicle, often called a drone, can be a remote-controlled or an autonomous airplane or a model aircraft. The body of the drone can have different shapes and different forms of drives. Most often we encounter drones that move with the help of propellers most often. According to the number of propellers, we recognize helicopters, tricopters, quad-copters, multicopters. However, the drones may also have a different construction, for example the form of a slope wing. The UAV also has an independent management system, which is located directly on the device and allows for autonomous execution of some tasks. Drones are equipped with powerful sensors, especially camera systems and various types of sensors to recognize environments and objects in the environment. In addition, the droning device may also be provided with a carrier for conveying other objects if necessary for a particular method of use. The device itself is part of a wider system that consists of other components. The most important ones are terrestrial, remote management system, communication, data transmission,

storage and processing, and other support systems. UAVs categories include a large number of aircrafts, from aircrafts that are comparable in size and equipment to piloted aircrafts to very small flying equipment used as a toy or in research. In terms of size, we classify the drones into four categories:

- nano and micro-drones, which are mainly used in research but are expected to be used, for example, in medicine,
- small drones, the size of which is tens of centimeters, and are currently used mainly for recreational and sporting purposes,
- medium drones which are mainly intended for commercial use,
- large and very large drones that approach their size of a large piloted airplanes, and their use for civilian purposes is not yet foreseen.

In particular, small drones are currently very widespread. This is due to their affordability and ease of use.

Another way of categorizing drones is based on their performance, i.e., based on the size of the space in which they can operate. This is due both to sensory equipment and battery performance.

The use of drones is very extensive and new opportunities are still appearing. In general, we can categorize the drones into: recreational, commercial, and military. Ethical issues for each type are described in the article [1] Recreational users of drones also include airplane model enthusiasts as well as photography and filmmaking hobbyists. Commercial use includes the use of UAVs for the purpose of monitoring and guarding objects, monitoring the traffic situation, controlling remote infrastructures (electricity lines, gas pipelines, oil pipelines) to obtain weather forecasting information. There is a great potential for the use of drones in agriculture and forestry, but also in services, such as delivery of parcels. Drones will be increasingly important in rescue work such as searching for affected areas and finding victims. Experiments are being carried out in which the drones can provide the first aid needed for the affected people and transport them to safety.

Drones work alone or in a group. The current trend in research is the coordination of the robot group, even heterogeneous, where airborne and terrestrial robots, or robots moving in the aquatic environment, are also present.

The application capabilities of unmanned aerial vehicles are very large. Their widespread use places demands on the legislative and ethical issues we have to address. The following chapter provides an overview of the current status of the UAV legislation in Slovakia in the context of European Union law. Section 3 raises specific ethical concerns about the widespread use of UAVs. Section 4 deals with the use of UAVs for military and defense purposes. At the end of the article, the development of robotics, its importance and its applications in the field of unmanned aerial vehicles is outlined.

2 Current State of Legislation for UAV Operation

The operation of unmanned aerial vehicles interferes with several areas of security and protection of the population. The European Union has established a

European Aviation Safety Agency (EASA) to coordinate the European Union civil aviation procedure.

EASA in a document [2] defines three categories of safety requirements for drones:

- open category - low risk: No authorization to operate outside prohibited areas. These are defined by national authorities. Safety is guaranteed by the product safety rules and the minimum set of operating rules, as well as limitations to the operating weight, speed and method of communication.
- specific category - medium risk: permission is required for national authorities to be issued on the basis of a risk assessment for a specific facility. EASA provides a list of some standards and parameters as a tool for assessing the degree of risk.
- authorized category - high risk: Requirements are comparable to requirements for airborne vehicles.

Restrictions on UAV operation are not limited to safety. If UAVs are equipped with recording capability (video, audio, etc.), their privacy should also be regulated. UAVs are increasingly used to monitor mass events, sports and cultural events, and various kinds of air shows. In some countries insurance is required for these purposes.

2.1 Valid Legislation for UAV in Slovakia

In Slovakia, the operation of unmanned aerial vehicles is currently regulated by the decision of the Transport Office no. 1/2015 of 19 August 2015 [3], which determines the conditions for the flight to be operated by an airplane capable of flying without a pilot in the airspace of the Slovak Republic. This Decree defines unmanned aerial vehicles covered by its provisions, defines persons who may be holders of a permit to fly a UAV and responsibility for the airworthiness of such a facility. The Decree does not apply to kites and unmanned balloons. This Decree regulates the conditions for the conduct of flight by an autonomous and remote controlled aircraft, the technical parameters of such means and the requirements for conducting a flight in controlled airspace. Performing a flight by an autonomous airplane is prohibited in the airspace. The decisive criterion for the execution of flights is the maximum take-off weight according to the Decree. Devices with a maximum take-off weight of 20 kg and above are subject to registration at the Transportation Office. However, weight-based categorization is not sufficient, as it is clear that kinetic performance can also be critical to the potential threat to persons and things. The Decree also introduces additional obligations for those who control unmanned aircraft. Among other things, it is necessary to keep a logbook with a record of the flights. Other limitations are related to aerial photography. If unmanned devices are used for imaging, they are subject to a specific law of the Aircraft Act and may not operate without permission. However, the actual existence of a recording device on the UAV does not imply an obligation to apply for an authorization. The situation will change

when the device is used. Performing aerial photography without permission is sanctioned. It is important to note that authorization to operate sensing devices is generally issued for one year and is legally levied. In a further conflict with the law, the drones operator can also get in a conflict with the law when operating the said drone in a fauna sensitive area. In this case, it must also have the consent of the nature conservation authority.

2.2 Examples of UAV Legislation in Other Countries

In the neighboring Czech Republic, the situation is similar to ours. An overview of the obligations of an unmanned aerial vehicle operator can be found on the Internet¹. The unmanned system operation is modified by *Supplement X - Unmanned Systems, Regulation L 2 - Rules of Flying*. Operation of a UAV up to 20 kg for recreational and sports purposes is possible without permission and registration. Public authorities require insurance. For commercial purposes, authorization and registration is required for all UAVs regardless of the maximum takeoff weight.

In Germany, the operation of the UAV is legally embedded in an amendment to the existing Air Traffic Act, which defines UAVs as aircraft operated for non-recreational and sporting purposes. The German law also deals in detail with data protection, privacy and copyright protection. It also defines sanctions in case of violation of the law.²

Even in the UK, the legislative restrictions do not apply to equipment used for recreational and sporting purposes, provided their weight does not exceed 20 kg. However, in all cases, privacy and data protection laws must be respected.³

The situation in the US is slightly different, where UAVs have been used for a long time. Advanced technologies of autonomous unmanned systems are used primarily for military and Spying purposes. However, civilian use is more widespread than in Europe. Unmanned systems are used for various commercial purposes, but also include police and rescue equipment. There have been cases of a drone helping in an arrest of a dangerous criminal.

The added value of the drones and their potential for different areas is indisputable. As the number of cases when drones used for recreational and sports purposes pose a safety risk to the population rises, the issue of stricter legislation is very current. It is important for law-makers to be involved in legislating, as well as users and developers of drones. Such an approach will certainly bring positive results and create space for user-friendly and safe use of drones by the public.

¹ <http://www.caa.cz/letadla-bez-pilota-na-palube?lang=1>.

² <https://www.wbs-law.de/internetrecht/civilian-drones-legal-issues-surrounding-use-50459/>.

³ <http://www.telegraph.co.uk/technology/2016/04/18/drone-laws-in-the-uk-what-are-the-rules/>.

3 Ethical Issues of UAVs Use

Although the ethical issues related to UAVs are mostly related to their military use, there are still issues that we need to address even in the civilian use of drones.

3.1 Remote and Autonomous Motion Control

Imagine a scenario in which we run a drone, which operates remotely from the operator. Its task is to collect information about the unknown environment, to monitor the agricultural or forest areas, to control remote borderlines. In the current state of the art, such activities can also be carried out autonomously by drones. Their advantage is that they are not subjected to fatigue at work, they are not distracted by the circumstances and the task they were designed for and programmed for they will do without error. They can get into environment which is dangerous for people or they can perform their tasks in an environment in which the work is very demanding for people. Everything seems to be all right. So what are the ethical issues? The first circuit concerns the work of the operator who is responsible for managing the UAV in a remote environment. For example, if remote controlled or an autonomous drone searches for victims in places of natural disaster, and a record of the victims is transferred to an operator's center. How will the images of the suffering people affect the operator's psyche when he she is unable to help? What ethical principles will he apply if he / she has to choose whom he/she will give help to earlier and whom not to help at all? The recordings of the situation will be able to be played again and the correctness will be verified afterwards. Misstatement of operator decisions, which will also have an impact on his psyche.

The second area of ethical problems in this context is general availability. The availability of technologies for the inhabitants of differently developed regions. Their use will bring about the deepening of inequality and, ultimately, the tensions among the population.

Another factor is the trust of people in the work of autonomous facilities. If unmanned systems operate in remote areas, their presence will be inconsistent with local residents, irrespective of the objectives of these facilities. Here, it is necessary to apply generally accepted ethical principles and not to carry out activities that would or could lead to harm other people, fauna, flora or property.

3.2 Data Collection and Acquisition

This area is relatively well legislatively developed in the framework of data protection and privacy protection. The ethical issues involved relate to the decision as to whether and under what circumstances it is possible to use the data obtained to ensure the safety of persons and things. Systems with artificial intelligence also play an irreplaceable role in the fight against terrorism. With advanced technologies, they can recognize faces, suspicious activity, suspicious objects in a crowd of people. UAVs will get into dangerous places and provide us with

information about them. In fulfilling the tasks, however, they obtain information about the number of other inhabitants. Even in these cases, we need to assess to what extent we are willing to renounce privacy in the interest of safety.

3.3 Autonomous Decision Making

The field of autonomous decision making of artificial intelligence systems is one of the most serious and most discussed issues in the field of robotics. Assume that the drone, an autonomous robot in general, is equipped with an advanced sensory system and has developed cognitive abilities. It is already clear today that robots, thanks to advanced technologies, can assess the situation better than a person. They are equipped with senses that enable them to recognize objects hidden behind an obstacle, better orientate in the dark, have computational power to help them quickly and efficiently recognize objects. Missions are not burdened with emotions when we do not program them. And here is the cornerstone of the problem. How to program the robot's decision making mechanism to deal with complex tasks in terms of utilitarian or deontological ethics. Which principle should be preferred. Can a robot refuse to execute an operator's order if, based on its capabilities, it evaluates the situation differently from the operator? A robot equipped with the ability to make a decision based on his or her own assessment of the situation is considered a moral robot. [4] However, how to develop a moral robot? There are different moral principles depending on culture, social status, religiosity and geographical location. Scientists experiment with different approaches to the development of moral robots. According to [5], the robot needs to know what is right and what is wrong. However, each decision applies to a particular situation, and the evaluation of good and bad can vary from one situation to another. Therefore, Malle and Scheutz attempt to compile a vocabulary of the moral notions of Kristen Clark. The group of volunteers assesses possible activities in the context of a situation as correct and incorrect. The results will be stored in a semantic network that will show the relationships between the different activities and the context. In this way, a network will be created to decide how very right or wrong is the performance of certain activity in the context. If such a network has a moral robot available, we can assume that its behavior will respond to ethical principles in that context. However, creating such a general vocabulary of moral terms is unrealistic. Therefore, we must confine ourselves to creating ethical rules for designing intelligent decision-making algorithms. When creating decision-making mechanisms correctly, it is possible to assume that the artificial intelligence system will decide not to take the lead and to prioritize a solution that will lead to more individuals or solutions, the consequences of which will be more favorable.

3.4 Environmental Protection

Important issues of environmental protection are related to environmental noise pollution and wrecks of damaged and destroyed UAVs, especially when using micro drones that will work in large groups. Such inhalation or ingestion of such

drones pose a serious health risk not only to humans but also to the animals in the environment. This also applies to the use of robots moving in the aquatic environment.

4 UAVs for Military and Defense Purposes

This issue has its own specifics and is dealt with in detail by institutions working in the military field. From the point of view of a civilian researcher, it is important to realize that each result is abusive and that not all military activities are inhumane. Guglielmo Tamburina in his article [6] draws attention to the dangers associated with the use of autonomous weapons. Some legal and ethical aspects are discussed in [7]. At present, a wide range of robots operating in different environments are used for military purposes. Their border guard services (e.g. in Israel and South Korea) and working in dangerous environments are extremely beneficial to people. From an ethical point of view, however, they are very controversial. Above all, it must be remembered that current technologies are so advanced that with some of their abilities they predominate man, on the other hand even the most advanced contemporary machines are not infallible. This is, of course, not a man, but in the case of a failure of the autonomous system, the consequences can be much more extensive. UAVs are used for military purposes to retrieve information about foreign territory, transport various equipment, information and technology to remote locations and can also be used for direct military interventions. In the case of an open war conflict, it can be assumed that their activities will be more humane in a certain sense. The robot is not subject to stress or bad emotions. Against the enemy, he does not show hatred, he does not tend to commit crimes and violence. Even in the case of military conflicts, UAVs can be used for sovereign human purposes, such as looking for injured soldiers and transporting them to safety. Nevertheless, concerns about the use of autonomous unmanned vehicles in wartime conflicts are justified. UAVs conducting a survey above enemy territory may contain data that becomes misleading when captured by wrong actors. Using UAVs creates an imbalance in the power and resistance of local residents. While robots are equipped with advanced technologies, they always risk being mistaken for civilian and military objects. Attacks to objects may cause further damage and unplanned casualties to the civilian population. What is an acceptable share of innocent victims to evaluate the attack as successful? According to the International Convention, the use of weapons with a death rate of more than 25% is prohibited. For example, chemical and biological weapons are forbidden because they are too effective. Can we consider the robot, whose efficiency is close to 100%, more humane just because it does not target civilian objects?

5 Conclusion

The need for broad application of ethical and legal principles in connection with the widespread use of drones is very urgent. The main issues to be addressed

are related to the problems of privacy, the protection of the environment and the health of the population [8,9]. The Aviation Strategy from the year 2015 also contains a legislative suggestion that would allow a proposal to establish technical rules and standards for drones and drone flights. It is expected that the European Parliament and the EU Member States will reach an agreement as soon as possible. In November 2017, a Helsinki Declaration was issued in relation with the real world drones applications. It is calling for citizens to be protected, based on safety, protection, privacy and the environment. The Helsinki Declaration calls for cooperation of scientists, developers and applicators of drones on three basic pillars: legal requirements, testing and verification of real world application of drones and the introduction of standards for efficient development of digital technologies for drones. It is of the utmost importance for the scientists and engineers working on autonomous drones and intelligent systems in general to think about the possible consequences of their work. We have a chance to build a better society, to better understand our weaknesses and to utilize the potential of artificial intelligence systems to improve human life.

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