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MODERN USAGE AREAS OF UAV TECHNOLOGY

In the past century, aviation has been one of the biggest technological advances that changed people's lives. Especially in recent years in addition to being used in passenger transportation and war technologies, unmanned aerial vehicles have been carrying out important activities in many parts of life. These devices, which can be used as an integrated camera and weapon systems that can be controlled wirelessly and have superior mobility, have become one of the most important actors in defence. In addition to security services, unmanned aerial vehicles are used in many activities such as agriculture, search and rescue, cartography and fire. Unmanned aerial vehicles are also frequently used by law enforcement agencies due to their size and mobility, especially in areas such as monitoring and tracking. Unmanned aerial vehicles are used in many security needs such as traffic inspections, monitoring, social events and tracking around the world. Besides all these, unmanned aerial vehicles are frequently used for natural disasters, crime scene investigation studies and cargo transportation. However, in addition to all the advantages, these tools are also used by some malicious individuals and groups due to their low cost and easy accessibility. Many crimes such as smuggling, terrorist attacks, or illegal

image recording have been committed using this technology. For this reason, while developing unmanned aircraft technologies, studies are carried out on anti-drone technologies in order to combat these crimes. The use of unmanned aerial vehicles worldwide is controlled by laws and penal sanctions are imposed in case of improper use.

1. Historical Development of Aircrafts

Aviation activities have been one of the most important factors in ensuring international security and ending wars. In 17 December 1903 Wright Brothers has realised the first flight of a motorized aircraft and made one of the most important turning points in human history. The invention of airplanes and their use in wars changed the course of wars and caused the emergence of new power balances between countries. After planes were of such vital importance in terms of security, in 1940 a Russian-born American engineer Igor Sikorsky invented the first helicopter in 1940 and another effective player took the stage. After the invention of the first modern helicopter, helicopters have begun to provide significant benefits in the field of military and security due to their mobility advantage and vertical landing and take-off capabilities.

The security benefits of aircraft are provided not only by piloted aircraft and helicopters, but also by unmanned aerial vehicles and drones in the last period. Unmanned aerial vehicles are defined as devices that have the ability to move and operate without a pilot. In military terminology, drones are seen as a subset of unmanned vehicle systems. These vehicles, which stand out with their observation and monitoring capabilities, are controlled by radio frequencies and wireless technology. The idea that devices can be controlled with radio waves was first put forward by Serbian scientist Nicola Tesla and was patented by Tesla in 1895. At that time, as the navigation technology was not developed yet, gyroscope technology was used in the control of aircraft. The first flight of an aircraft using gyroscope technology took place in 1909 (Roche et al., 2014).

Although the idea of using unmanned aerial vehicles is very old, the first effective attack of these vehicles on the battlefield in 1849 is accepted by the Austrians using balloons with time-adjusted fuse bombs on Italy. However, some of these balloons burst within their borders due to the inability to calculate the wind (Kahveci ve Can, 2017).

According to the definition in the Chicago Convention, unmanned aircraft are defined as vehicles that do not have a pilot and have ability to move with GPS control. Unmanned aircraft can be controlled by a pilot on the ground or automatically

fly within a preloaded schedule and route. Drones provide significant benefits to support teams, security forces and firemen during interventions. Protection of valuables and important areas is provided by security cameras and security guards controlled by people by many institutions. Drones that we use can be specially programmed in these areas and have night vision features will help to reduce the margin of error (Kahveci ve Can, 2017).

Unmanned aerial vehicles are used for searching and finding missing people, detecting and tracking animal populations, determining the source of destruction in nature, crime scene investigations, and imaging and determining major accidents on highways. In addition to these, drones are also used to enter and exit forest fires, agriculture and inaccessible areas (Roche et al., 2014). Thanks to ability of high-resolution integrated camera systems, they play a critical role in situations that require surveillance and monitoring. With their cameras, drones provide great convenience in tracking any object or monitoring the area (Kardasz et al., 2016).

Day by day development and progress of technology shows that definition of crime will be different than today's crime definition. Although it is known that crimes committed today will continue to be committed in the future, it is not known exactly how developing technology will change the way these crimes are committed. İt seems likely that the developing of technology will provide some advantages for criminals. For this reason, technologic advantages should also be used to solve crime cases (Schmalleger, 2015).

2. Advantages and Disadvantages of Drone Technology

Drones are not only accoutred with camera equipment, but when equipped with gas detectors and radio frequency identification (RFID) devices, they can provide much more benefits with low cost. Unmanned aerial vehicles used in crowded and public areas can be used to control the crowd and traffic. After the necessary programming is done, drones can provide simultaneous information flow in detecting traffic jams and risky activities in crowded areas. In case of fire and similar situations, drones carrying thermodynamic cameras not only provide information about the incident, but also allow the people who need help and need to be rescued to be identified quickly (Culus, Schellekens ve Smeets, 2018).

Using drones for tracking suspects is hundreds of times cheaper than renting a helicopter or using it for tracking. In addition to being inexpensive, drones are effective in both short- and long-range tracking and monitoring events thanks to their agility. Considering their physical superiority in patrol duties, most experts think that drones are more effective than humans. In the event of an intrusion

detected by sensors, unmanned aerial vehicles can reach the region much faster than humans. A drone with thermal vision can get much more efficient results than a security guard working with a flashlight in the area. Although drones do not need water and food and are not affected by distractions, they make drones excellent security guards, but these devices have much more fuel and energy needs than a person's need for water and food. If the energy and fuel needs are not met, they become useless (Connecting the Security and Fire Communities, 2017: 9).

The rapid rise in technology, especially in recent years, makes it necessary for the criminals to benefit from technology, and the security forces closely follow this rise and stay one step ahead of the criminals. The use of technology to record images and provide security in cities has contributed greatly to the security of law enforcement officers in recent years. In this context, the widespread use of electronic control systems has led to a decrease in crime rates and the beginning of a new era in effective fight against criminals. Not only the visual systems, but also the vehicles, weapons and all systems used by law enforcement in the field of aviation have become an integral part of the criminal struggle today.

The fact that unmanned aerial vehicles are easily accessible and inexpensive makes these technologies attractive to malicious individuals and groups. With the advancing technology of unmanned aerial vehicles, both the increase in the image quality they can record and the increase in their flight range have brought the problem of using UAVs that pose a threat to the privacy of private life. In addition to the threats about privacy of private life any illegal activities such as terrorist attacks, smuggling and unauthorized surveillance are carried out using UAVs. For this reason, in terms of security, developing anti-drone technologies as well as developing drone technologies and updating security measures is one of the most important issues today.

3. Anti-Drone Technologies

There have been many cases around the world where reports were reported that images captured by drones violate the right to privacy. For this reason, even in hobby use, it is possible to evaluate the sounds and images recorded by UAVs as an attack on the privacy of private life and therefore penal sanctions can be imposed. Considering such reasons, it is necessary to take security measures and develop defence mechanisms against UAVs, as well as having great advantages in ensuring security with UAVs.

In addition to activities such as illegal audio and video recording, smuggling, and the delivery of illegal substances to prisons, the uncontrolled use of

unmanned aerial vehicles also negatively affects airline safety. The possibility of drones flying uncontrolled near airports to crash into the cockpit window of the planes or to enter the aircraft engine endangers the lives of many people on the plane and at the airport. In addition to all these, the risk of UAVs hitting people also endangers human life. However, more important than these is that UAVs can be used in terrorist activities. These vehicles, which have load carrying capacity and can be accessed quite easily, bring the risk of bomb attacks. The fact that explosives can be loaded into these devices instead of cargo and they can be controlled remotely have caused them to become a major terrorist threat. In recent years, many people have been caught in the world with a plan to organize a bomb attack using UAVs. It seems clear by malicious people that this useful technology can turn into extremely dangerous and life-threatening weapons (Karaağaç, 2014).

Due to the fact that UAVs create a security gap, many technologies that can be called anti-UAVs are now being produced. UAV repellents generally include all kinds of technologies used to drop unmanned aerial vehicles, lose control and render them dysfunctional. In addition to the use of some signal jamming factors in neutralizing the UAVs, there are also systems where the UAVs are neutralized by physical effects. The physical advantages of drone technology and the ease of access to this technology have brought the need to develop many defence systems both in the military sense and in the field of protecting the privacy of private life.

Technologies developed against drones are widely used today. These technologies, which are called anti drones, are frequently used in cases such as protecting the airspace at airports, ensuring security in large sports activities and congresses, protecting land units and convoys. In addition, anti-drone technologies are also used in the protection of sensitive facilities, port security and maritime security (Michel, 2018).

When we look at the current anti drone technologies, it is possible to evaluate these systems under four headings (Ding et al., 2017):

– Warning Technique: Detection of a drone in the area by cameras, sensors and radars and warning the relevant systems.
– Spoofing Technique: Electronic, optical and infrared false signals are sent, causing the drone to lose control and crash to the ground.
– Jamming Technique: It is the inactivation of the automatic driving mechanism and communication system of the drones by creating a strong interference with an electromagnetic gun.
– Mitigation Technique: It is the inactivation of the drone by methods such as micro-missiles, laser or capture net that can be used to destroy or capture drones in emergency situations.

The small size and low weight of amateur drones cause these vehicles to suddenly appear and disappear again, making it difficult to detect drones. In addition, the combination of artificial intelligence with drone technology and the increase in the technology of materials used for drone manufacturing are likely to become factors that make these drones difficult to detect in the coming years. Most of the current anti drone sciences are technologies designed to be prohibitive for certain drones in certain scenarios (Ding et al., 2017).

4. Conclusion

The importance of unmanned aerial vehicles in security and defence fields is rapidly increasing today. In addition to ensuring security, unmanned aerial vehicles are frequently used in the resolution of cases and forensic investigations. Apart from these, the numerous advantages and various usage areas of these vehicles make this technology indispensable. However, today's globalizing world and developing production factors enable technologies produced at one end of the world to be easily accessible to people in another part of the world. Advantages such as the worldwide popularity of unmanned aerial vehicles technology and the low price advantage of this technology make it very easy to reach unmanned aerial vehicles today. This accessibility creates big gaps, especially in the field of security. Unmanned aircraft used by malicious people or careless operators pose important problems in terms of public safety. In addition, terrorist activities that can be carried out using these vehicles have also made it necessary to develop technologies against unmanned aircraft. Many companies are developing anti-drone technologies and seeking measures against a possible attack using these tools. Drones, which facilitate human life day by day, especially with their use in the field of security, provide significant benefits in many areas such as investigation of crime scenes, detection of disaster areas and due diligence in cases such as pandemics. The emergence of new security threats day by day shows that drones will be one of the important security factors in the future. When examined in this context, effective use of unmanned aircraft by authorized forces in the process of ensuring security has become a necessity today. However, being able to eliminate the threats posed by these tools is also a necessity in terms of security. Security forces should both use the advantages of these tools and have the necessary equipment against the threats that may be caused by these tools.

References

- IFSED Global (2017) *Connecting the Security and Fire Communities: The security drones report*. Available at: https://www.ifsecglobal.com/security-drones/?cid=twitter_wotchit
- Culus, J., Schellekens, Y., Smeets, Y. (2018) *A Drone's eye view. Overview of the Belgian UAV ecosystem & the development of commercial drone applications in Belgium*. Brussels: PWC Belgium.
- Ding, G., Wu, Q., Zhang, L., Lin, Y., Tsiftsis, T.A., Yao, Y.D. (2017) An Amateur Drone Surveillance System Based on Cognitive Internet of Things. *IEEE Communications Magazine, 56*(1), pp. 29-35. doi: 10.1109/MCOM.2017.1700452
- Kahveci, M., & Can, N. (2017). İnsansız Hava Araçları: Tarihçesi, Tanımı, Dünyada ve Türkiye'deki Yasal Durumu. *S.Ü. Müh. Bilim ve Tekn. Derg*., c.5, s.4, ss. pp. 511-535.
- Karaağaç, C. (2014). Zararlı Drone'ların Yayılması:İHA'ların Suç ve Terör Maksatlı Kullanımı. Available at: https://www.linkedin.com/pulse/20141102165529-94517074-zararlı-drone-ların-yayılması-iha-ların-suç-ve-terör-maksatlı-kullanılması?trk=portfolio_article-card_title
- Kardasz, P., Doskocz, J., Hejduk, M., Wiejkut, P., Zarzycki, H. (2016). Drones and Possibilities of Their Using. *J Civil Environ Eng, 6*(3), pp. 1-7. doi;10.4172/2165-784X.1000233
- Michel, A.H. (2018) *Counter-Drone Systems*. New York: Center for the Study of the Drone at Bard College
- Roche, C.B., Lyon, D., Mansour, M.J., Molnar, A., Saulnier, A., Thompson, S. (2014) *Surveillance Drones: Privacy Implications of the Spread of Unmanned Aerial Vehicles (UAV) in Canada*. Kingston: Queen's University.
- Schmalleger, F. (2015) *Criminology Today: An Integrative Introduction. Seventh edition*. New York: Pearson.
- Shi, X., Yang, C., Xie, W., Liang, C., Shi, Z. & Chen, J. (2018) Anti-Drone System with Multiple Surveillance Technologies: Architecture, Implementation, and Challenges. *IEEE Communications Magazine*, *56*(4), pp. 68-74. doi: 10.1109/MCOM.2018.1700430.