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APPLICATION OF DRONES IN SECURITY AND RESCUE OPERATIONS

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Abstract
It is known that the fields of application of drones are wide. One of these application areas, security and search and rescue, is one of the main areas where the surveillance capabilities of drones are applied. Thermal and acoustic sensors are important tools as the main parts of drones applied in these areas. With their help, it is possible to find people who remain in extremely difficult areas - disaster zones. Which is one of the main purposes of drones.In the article, the areas of application of drones and the application of drones in security and search and rescue operations were considered. Thermal and acoustic sensors, which are their main parts, and some models are mentioned.
Keywords*:* Drones, Security, Search and Rescue, Thermo Sensors, Acoustic Sensors

Introduction
In terms of areas of application, the sphere of use of drones is quite wide. Although they are mainly used for similar purposes, the use of drones in each field has its own characteristics.
The fields of application of drones have expanded even more recently.

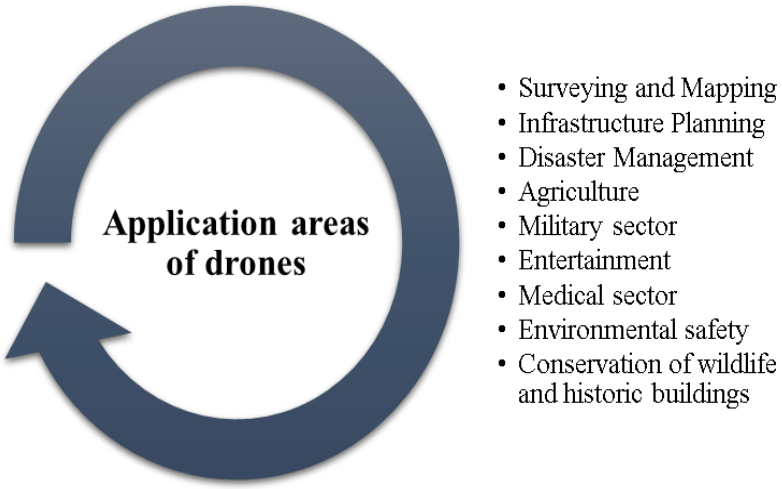

Figure 1. Application areas of drones

Let's take a look at some of the main application areas:

- Agriculture – Drones are used in agriculture for soil and field analysis, crop monitoring, plantation, livestock management, crop health check, plant growth monitoring, weather forecasting, moisture, dryness, etc., etc. [1]

- Military sector - one of the main and even primary application areas of drones is the military sector. Drones are used for a variety of purposes, including reconnaissance drones, kamikaze drones, transportation, surveillance, mapping, and more.
- Search and rescue operations - drones are used in search and rescue operations with similar purposes of studying disaster zones, mapping the zone, locating disaster victims, transporting various objects (food, medicines for first aid, etc.).
- Entertainment sector – drones are used during video or photo shooting, various sky shows, games, competitions.
- Service – mainly transportation and delivery services are related to the application of drones in customer-based work.
- Environmental security – Due to the growing urban population, drones are successfully used in environmental monitoring and emergency response processes. To prevent environmental pollution, drones not only implement projects aimed at cleaning the seas, but also make an important contribution to the fight against poaching and the tracking of endangered animals. Animal behavior and diseases can be monitored thanks to thermal cameras. In addition, oil companies use drones to inspect oil and gas leaks. Drones with thermal cameras perform important tasks in the quick detection of leaks and prevention of possible risks. [2]
- Drones are an economical and effective alternative to monitor wildlife species and protect natural life. Rapid aerial observations are an important tool for gaining a better understanding of species and ecosystem health, monitoring and investigating migration routes by tracking animal groups, and preventing poaching. Drones also scan forest floors destroyed by fires, dropping seed pods containing seeds, fertilizers and nutrients to help trees regenerate. Considering that it will take many years to restore such areas by human labor, the importance of using drone technology becomes even more obvious. On the other hand, drones also play an important role in historic preservation efforts. Drones provide great convenience in creating 3D maps of historical sites or buildings. 3D images used to restore lost areas provide clues to experts about culture and architecture. [2, 3]

One of the above-mentioned security and rescue processes is also one of the main application areas of drones.

Drones in security

In security, drones are mainly used for surveillance purposes. This application has a number of advantages, which include the following:

Improved visual capabilities

During surveillance, drones have the ability to remotely monitor areas. This possibility is possible due to cameras. In some situations, drones are essential for obtaining video and images from areas that cannot be accessed by humans.

Improved interaction

This characterizes the ability of drones to quickly respond to the center. So, it is possible to get live videos due to this advantage. At the same time, it is possible to make an immediate decision with a one-to-one interaction.

Cost savings

Implementation of security and control at the expense of drones allows to save costs and increase efficiency. Thus, the implementation of this process by drones instead of a person (or group of people) is efficient both from the point of view of risk and from the point of view of training people (training people on the job).

Risk management

Risk management characterizes the deployment of drones instead of human labor in hazardous areas.

There are a number of surveillance drones that are particularly recommended by experts: [4]

CW-15 A multi-purpose and battery-powered smart VTOL drone	
	CW-25E Long Endurance Electric and Fixed-wing VTOL Drone
CW-30E Hybrid Gasoline and Battery, Long Flight Drone	

Figure 2. Some surveillance drones' models

Drones in rescue operations

There are several advantages to using drones for search and rescue operations, which is why drones are becoming increasingly indispensable in these missions. One major advantage is the extended aerial coverage that drones can provide compared to a single rescue team or even a rescue team with access to a helicopter. [5]

Search and rescue operations are carried out in different areas: on land, at sea, in the mountains, in the air, etc. These operations have been carried out directly by humans for a long time. However, now with the development of technology, this processes is carried out with the help of different technologies. One of these technologies is drones. Drones act as a control mechanism to rescue people (as well as other creatures) from dangerous areas, especially during disasters such as debris, floods, etc. As in the above-mentioned security operations, drones are mainly involved in surveillance and locating people in the disaster zone. So, this process and security processes are part of drone surveillance operations in general. Drones intended for rescue mainly consist of a number of parts. The most important of them are sensors. Sensors mainly consist of two types.

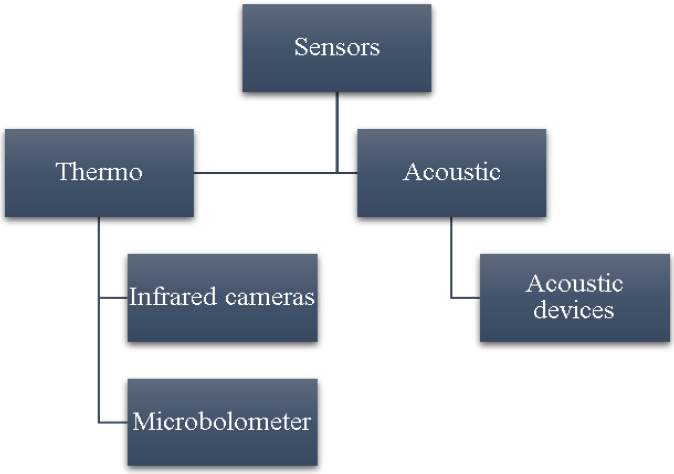

Figure 3. Two types of sensors

Infrared cameras, which are one of the thermo sensors, are one of the main tools used to find people. It is used to determine the temperature of the human body. Thus, it is possible to find a person who buried under the rubble.

A microbolometer is a special type of bolometer used as a detector in thermal cameras. It is a network of microscopic vanadium oxide (or amorphous silicon) thermal sensors on top of a corresponding silicon grid. Infrared radiation from certain wavelengths hits the VOx and changes its electrical resistance. [6] The microbolometer provides thermal images in the longwave infrared (LWIR) wavelength range (8 to 14μm) and a 44◦ horizontal field of view (FOV). [7]

Acoustic/seismic listening devices are used to detect survivors, and their application involves placing a series of receiving probes around the perimeter of the search area. If sounds are detected, the probes are evaluated individually to determine which one gives the strongest indication and is closest to the source of the sound. Some of the disadvantages of this method are the presence of interfering signals, limited range, inefficiency in concrete and inability to detect unconscious victims. [8]

The use of drones in rescue operations has several advantages. Some of these are mentioned in the description below.

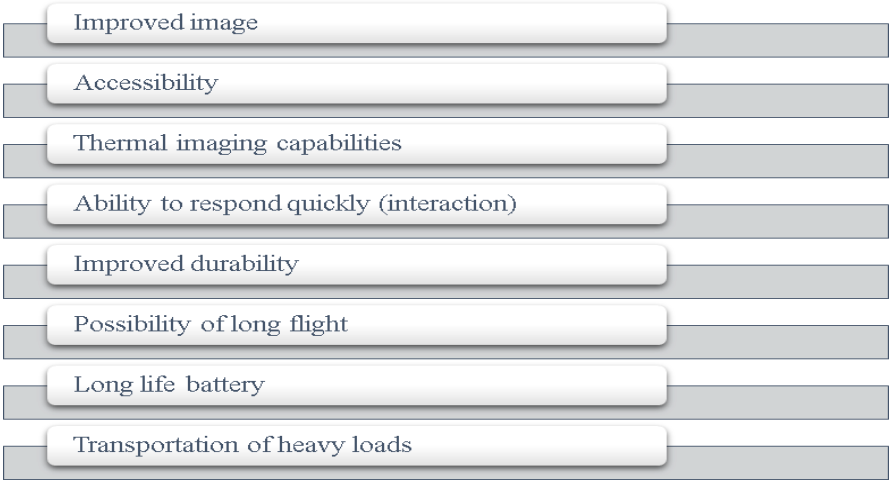

Figure 4. Some advantages of drones in search and rescue operations

Some of the most commonly used search and rescue drones in worldwide application are: [9]

- DJI M300 RTK

- DJI M30T
- DJI Mavic 3 Enterprise
- DJI Mavic 2 Enterprise Advanced
- DJI Phantom 4 RTK

Conclusion

In general, the following results can be noted:

1. In the application areas of drones, the two main areas where their surveillance capabilities are applied are security (surveillance) and search and rescue.
2. Drones are not only for observation purposes, but can carry various objects for long-term and long-distance flights for people.
3. In terms of risk management, drones are more effective than human workers
4. Drones also carry thermal and acoustic sensors, which are the main tools for search and rescue, while playing the role of the main carrier.

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МЕТОДЫ ПОЛУЧЕНИЯ ДАННЫХ В БОЛЬШИХ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЯХ

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Абстракт

В современном мире огромные объемы данных становятся все более значимыми для различных сфер деятельности, от бизнеса до исследований и общественной политики. Методы сбора данных в больших информационных технологиях играют важную роль в сборе, обработке и анализе этих данных. Настоящее исследование сосредотачивается на анализе различных методов сбора данных, актуальных за последние 10 лет. В современном контексте широко используются сенсорные технологии, позволяющие собирать данные о физических параметрах окружающей среды в режиме реального времени. Интернет вещей (IoT) предоставляет возможность собирать данные с помощью подключенных устройств и передавать их на облачные серверы для дальнейшей обработки. Веб-скрейпинг, метод автоматизированного сбора данных с веб-сайтов, остается актуальным в современных информационных технологиях.