ENHANCED DRONE DETECTION ALGORITHM WITH INTERPULSE AND INTRAPULSE DATA ANALYSIS

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One of the urgent scientific and technical problems of our time is the development of methods and means of protecting various objects from the impact of unmanned aerial vehicles (UAVs) which carry a significant potential threat to various areas of human activity. Significant technical capabilities, a wide range and relatively low cost of UAVs, in combination with the difficulties of their observation and control, are the main features of this problem.

The article [1] discusses the information capabilities of each of the detection methods: radar, acoustic, optical and infrared. It is shown that the radar method has the best search capabilities. New effective methods of complex processing of multimodal signals and images were synthesized [1].

Recent research in drone detection technologies yield to new algorithms. Visiting military exhibitions and analyzing products of companies with state-of-the-art technologies of drone detection gave results in finding an interesting product with an enhanced drone detection algorithm implemented.

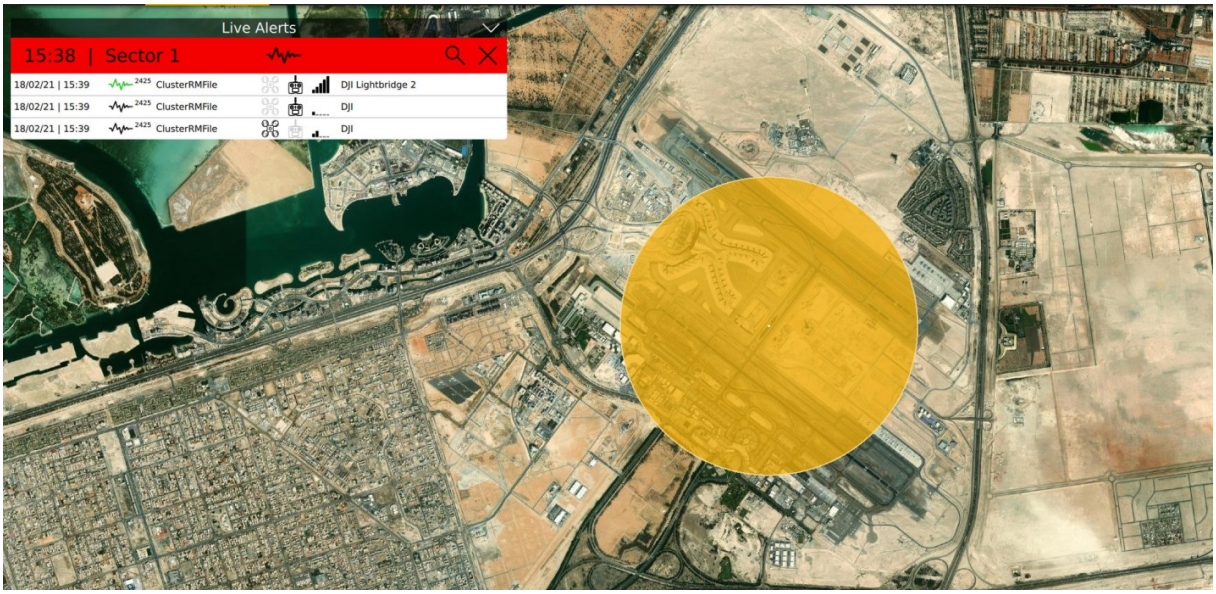
During the IDEX 2021 exhibition held in Abu Dhabi on Feb 21-25, 2021 one of the companies have introduced a product for purposes of drone detection [2]. The product is based on the analysis of the radiofrequency spectrum. That is a direction finding system with sensors that scan the electromagnetic spectrum for frequencies used by the communication protocols of commercial drones.

As soon as a signal is intercepted, the product characterizes it by comparing it to a database with signatures and gives operators an azimuth of origin symbolized on the interface of a command and control center. The device is coupled with another product – a specially designed jammer, which is actionable when the threat is clearly confirmed. This radio jamming cuts the communication link between the drone and its operator, thereby forcing the UAV to land [2].

Finally, there is a product with a combination of these two systems for special forces (police, army, etc.). Composed with 3 connected hardware items: an antenna, located in the dedicated backpack, a digital command and control tablet attached to the front of the tactical vest, and an effector, the third product allows a single operator on a mission to detect and neutralize hostile drones [2].

There is an increasing number of false alarms reported in environments saturated with electromagnetic radiations. To solve this problem, an enhanced algorithm has been developed. The core of this detection algorithm is based on a mapping of the frequency / time space. By performing a first detection, the

overall characteristics of the packets sent between the drone and the remote control are identified, then the first filter on the entire spectrum is applied in order to precisely isolate the potential packets emitted by the specified model of a drone. After this crucial step, the new enhanced algorithm analyzes the content of the packet to detect patterns of each communication protocol. If these indicators are present in the package, a confirmation with an absolute certainty of the nature of the drone can be provided [2]. The new algorithm scrutinizes both the interpulse data and the intrapulse data. The interpulse data is the relative positions between the different transmitted packets. The intrapulse data is the data relating to a packet. Example of the drone detection results is presented on a Figure below.



The biggest challenge is to get the clearest signal possible. Multiple recordings to be analyzed and thousands of tests to be carried out to calculate and synthesize this algorithm. This technology is more reliable, eliminating as much as possible false alarms, which can generate unnecessary actions for the user.

References:

1. Complex processing of signals of integrated unmanned aerial vehicles surveillance system with the use of target designation / V.M. Kartashov, V.M. Oleinikov, V.P. Ryabukha, V.I. Leonidov, V.V. Voronin, A.I. Kapusta, I.S. Selezniov, I.V. Pershyn // Radiotekhnika : All-Ukr. Sci. Interdep. Mag. 2020. №203. ISSN 0485-8972.

2. Exhibitor List | IDEX [Electronic resource]. – Mode of access : URL : https://idexuae.ae/exhibitor/exhibitor-list/#1768 – Title from the screen.