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The Use of Drones in Logistics

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Increasing the level of transportation "transparency" that provides a customer with a real-time tracking of the movement of his goods, is becoming popular in modern logistics. Automation and robotization has led to an increase in the efficiency of enterprises and reduced costs in logistics. According to experts, the introduction of the latest technologies can reduce freight costs by 10-15%.

Currently, two areas of drone application prevail in logistics: use in warehouses and in "last-mile" delivery.

In warehouse logistics, drones can be used for inventory and damage detection, incorrect location and internal security in the warehouse. Pallet inventory during high-altitude storage is one of the most common applications of drones. By reading the barcode, the device will receive information about the goods and recalculate, as well as provide up-to-date information about the availability of storage places. The combination of these processes will allow uninterrupted work on the acceptance, placement and storage of stocks, as well as minimize the risks of losses. It is possible to set the route and schedule of pallet occupancy checks, which fully automates the process.

The speed of warehouse employees during the process of accounting and processing pallets is about 120 pallets/hour. With a similar calculation speed, but with the use of drone, the costs of performing the operation will be reduced, since additional resources and equipment are not required.

The use of drones in the supply chain allows you to save on the "last-mile" delivery of goods, because there are some

restrictions on the weight of the parcel – the drone cannot transport cargo weighing more than 2-3 kilograms. However, more than 80% of the goods that customers order in online stores do not reach such weight.

In addition to the limited payload capacity, there are certain legal problems associated with the use of UAVs that allow UAVs to safely enter the airspace at low altitude beyond the line of sight. Today, aircraft must be registered in the State Register of Aircraft of the Republic of Belarus. The application must be submitted before each flight. It is necessary to request the use of airspace from the center of the Unified Air Traffic Management System.

While having all the prospects of using drones in "last-mile" delivery, there are a number of factors that limit the widespread use of drones among companies [1].

One of the main obstacles is the issue of insurance and compensation for damage in case of loss, damage and theft of the delivered cargo.

The second one is the probability of a navigation failure that prevents the drone from finding the address. The drones are equipped with various modern technologies, such as GPS navigation, vertical trajectory of takeoff and landing. These features make it difficult to land the device in conditions of dense multi-storey buildings, where the GPS signal is much worse than a similar signal in an open area.

The third obstacle is the lack of a well-established delivery mechanism. A variety of options are being tested: dropping cargo by parachute, descent on a rope, a delivery to a specially installed platform, to a postamat, to a courtyard, to a roof, through a window, a transfer to a concierge, a walking courier, a traveling robot and other options.

Also, some significant disadvantages of drones include the weight of the battery that requires its maintenance between flights, which does not allow long-distance travel and greatly narrows the delivery area.

In search of ways to effectively use and increase the productivity of drones, AMP Holding together with the University of Cincinnati in 2014 developed an innovative cargo delivery system at that time – HorseFly.

The HorseFly unmanned aerial vehicle delivery system is a specially designed highly efficient unmanned aerial vehicle based on an octocopter - an aircraft designed to travel long distances, capable of videotaping and transmitting information to a computer monitor [2].

One of the most important advantages of drones is environmental friendliness. Vehicles have a negative impact on the environment, releasing a huge amount of pollutants into the atmosphere. The operation of drones is a completely eco-friendly process, the only resource necessary for their operation is electricity.

The essence of the project is to use a "mobile warehouse" - a truck that stores the goods provided for delivery, a team of deliverers and, in fact, a drone. The truck is the starting point for the drone, equipped with a control unit for the driver and an automatic landing on the roof with the possibility of charging the unmanned aerial vehicle. Being paired with the Workhorse electric vehicle, the HorseFly drone can be charged wirelessly from a large battery in the truck within two minutes [3].

HorseFly scans the barcode on the package when loading, after it determines the path to the delivery address using GPS and is directed to the appropriate addressee. Meanwhile, the truck will continue its work. After successful delivery, HorseFly returns to the truck for the next delivery and, if necessary, for recharge [2].

All deliveries in the HorseFly system are carried out in accordance with the rules and with the full cooperation of the US Air Traffic Control.

Fully compatible with a delivery truck, the system is designed so that the driver or driver's assistant can maintain a mode of direct monitoring of the delivery process by drones. A

special Aires application created by Workhorse connects to the drone for full interaction with the user and makes it possible to track the location of the parcel, truck, drone and video in real time.

Years of batteries and engine control unit development for electric vehicles and trucks have given AMP a wealth of experience in the field of aircraft operation and power supply [3].

Thus, despite the fact that the cargo delivery industry is under the influence of various factors that may hinder the rapid implementation of this technology, the drone market will grow intensively from year to year as key issues related to the regulatory framework, as well as infrastructure development, including automatic charging, are resolved.

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