

# A study on, insights from PATENTS on how technical advancements in UAVs / DRONES for smart delivery to disrupt the supply chain industry

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**Abstract :- Use of Unmanned aerial vehicles (UAVs) has grown quickly around the world. Drones are performing challenging tasks where human intervention can be reduced or avoided. The applications of drones' ranges from military, surveillance, disaster management, medical emergencies and many more. In this research paper we are discussing about the technical readiness and adaptability of UAVs/DRONES for optimization of eCommerce supply chain operations.**

**Keywords—UAVs, DRONES, Drones Mounting Units, Logistics and Reverse logistics using DRONES, applications of DRONES, Regulations related to DRONES, Flying Warehouse.**

## I. INTRODUCTION

DRONES are initially used in Military, now they are going into business. “Having already made the leap from military to consumer use, they're now headed for industries from construction to cinematography to law enforcement [1]”. The recent improvements in technologies are enabling usage of drones for commercial applications, which ranges from airborne raid hailing and flying taxis, delivery of internet through drones, flying drones to generate offshore electricity, inspection services, simplifying agriculture, medical emergencies and many more areas.

Goldman Sachs estimates that the global commercial drone market, the fastest-growing segment for unmanned aerial vehicles, will exceed \$20 billion by 2021[2]

“Production of drones for personal and commercial use is growing rapidly, with global market revenue expected to increase 34 percent to reach more than \$6 billion in 2017 and grow to more than \$11.2 billion by 2020” according to a new forecast from Gartner, Inc (see Table 1) [3]

When it is come to aerial vehicles, regulator play and important and critical role. “The DGCA has restricted the use of drones in India at present, but at the same time it has initiated the process of framing the guidelines for operations” [5]

However, the use of drones is not restricted only because of guidelines in India — the International Civil Aviation Organization (ICAO) also has not issued any

recommendation or standards for the use of drones for civil purposes [5]

As regulatory, policies are in stage of evolution, this study brings out the insights from unique patents which are filed by different corporates who are into eCommerce, Package delivery and others for improving the efficiency of their supply chain and keeping themselves ready to start the operations using UAVs

## II. INSIGHTS FOR UAG / DRONE PATENTS FOR SUPPLY CHAIN INNOVATION AND DISRUPTION

US09305280 B1, illustrates, the Airborne Fulfillment Center (AFC) using unmanned aerial vehicle delivery of items, where order items are delivered from AFC by a UAV. The main advantage of this AFC is, it can navigate in any given direction and UAVs are dispatched to delivery of the items. The floating AFC is also used for advertising [6]

US9359074 B2, illustrates, the secured delivery of the goods and packages after secured package code is authenticated. DRONES proceeds for landing and successfully completes the delivery and if the condition of secured package code is not authenticated or not met, DRONES aborts the delivery [7]

US9387928, illustrates, the DRONE docking station which can act as recharging / refueling hubs. UAV docking stations are leveraging the exiting telecom, electric infrastructure a) cell phone towers b) light and power poles c) buildings. These docking stations serves as parking or to collect the navigation data sent from the central command [8]

US9536216, illustrates the package delivery method, where in the packages are dropped at the delivery point by UAVs from adjusted height. This method includes both delivery and returns management of the packages intended for the delivery [9]

US20160159496, illustrates delivery containers / delivery box (similar to mailbox concept) is mounted at the buildings to take the delivery of the packages / goods. These containers / delivery boxes are mounted with devices used to

communicate with the UAVs docked by DRONES. These containers can be several types a) storing perishable items b) provide security to the goods / items collected by these boxes [10]

US20170076354A1, illustrates fetching the goods / items within the retail shopping facility and dispatch at the specified location within in the same retail facility which is perfect example of optimizing inventory and supply chain within the retails facility [11]

US20160378108, Illustrates, collective UAVs or collection of drones which are used in the delivery / dispatch of goods / items. This formation and collection of drones work together in delivering the used for transporting heavier loads and longer distance. “In this multiple UAVs may be coupled together to form the collective UAV. A collective UAV may be used to aerially transport virtually any size, weight or quantity of items, travel longer distances, etc. For example, rather than using one large UAV to carry a larger or heavier item, multiple smaller UAVs may couple together to form a collective UAV that is used to carry the larger or heavier item” [12]

US9561852, Illustrates, transfer of package / goods / items carried by drone A which can be called as originating drone to drone B can be called as receiving drone. Both the drones connect during the flight using transfer arm of both drones which couple in the mid-air to transfer the above mentioned payload. This concept will further enhance the supply chain to reach the destination without any delay [13]

US9567081, Illustrates, this is the latest development and experiments carried out, which includes a package being deployed by a drone from certain altitude, while drone is in motion in the mid-air, The UAV can apply a force onto the package deployed with signals, that alters its descent trajectory from a parabolic path to a vertical descent path for safer landing of the package [14]

[15] Illustrates the launch of drones from the vehicle like truck. The drones are carried along with the delivery truck and upon reaching point from where vehicle cannot travel, drone delivery is initiated from the vehicle. This hybrid delivery model will save not only delivery time, but also huge number of delivery routes and access difficult to reach destinations efficiently. This model also helps in reduce travel time and save on fuel and reduce emission

**III. FIGURES AND TABLES**

*A. Positioning Figures And Tables:*

“Table 1: Personal and Commercial Drones Revenue Forecast, 2016-17 (Thousands of U.S. Dollars)”

UAV/ DRONE USE	2016	2017
Personal	1,705,845	2,362,228
Commercial	2,799,272	3,687,128
Total Revenue	4,505,117	6,049,356
Total Revenue Growth	35.5%	34.3%

Source: Gartner (February 2017)

**IV. CONCLUSION**

This review shows that Drones have great potential in the field of logistics. Drones will become next generation transport and logistics although there are research works going on in the field of Drones, there is need for more experimental results and the theoretical understanding are required for faster adoption. The use of Drones in wide variety of applications appears very promising in the transportation and delivery of goods, when it comes to a) faster mode of delivery (b) optimize the supply chain

However there are limitations (a) preconfigured path (b) delivery during abnormal weather conditions (c) affordability of drones by ecommerce and retail companies

Developments in the UAV areas in India are hindered by (a) heavy regulation (b) identification of flying and non-flying zones c) lack of security (d) lack of theoretical understanding of the Drones e) training

Therefore, further studies are needed to develop (a) Privacy terms (b) Intra communication between Drones and other systems in the Drones ecosystem (c) Data and Information exchange among Drones in the inter geographical boundaries (d) Information exchange among Drones in the intra geographical boundaries (e) Privacy of the individuals (f) Safeguarding the Drones assets (g) Safeguarding the environment (h) Separate and secured network of Drones (i) hybrid transportation systems (j) Handling Rouge and compromised drones (k) Managing Drone delivery routes, the more research in transportation, logistics will define the faster adoption in the coming future

Service providers also has to be taken as key stakeholders in formulating the drone advisory committee and defining the regulations, this will help the regulation to be more robust, which will have inputs from industry perspective.

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