

Drone-Based Delivery of Services and Aerial Transportation

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Abstract

This paper offers an integrated digital drone-based services solution for cities & towns, controlled through an integrated smart control room and/or where users may call in for support of required service, on a time-sharing basis; charged according to No of drones, payload, distances and time calculations. Drone demand is digital, seamless to the user, appropriately located and configured, through a mobile-based app; while the drone systems ownership is distributed, making it a financially viable option. Drone(s) is/are passed orders to take off with suitable payload(s), through cellular/satellite backbone using AI, and/or through manual intervention. This idea is then enlarged to include Aerial Drone Taxis transporting humans from one place to another within a city/town, being a natural outflow and an extension of the same concept, making expansion in the vertical dimension, as road networks are severely constrained today for space. Drone-based solutions address urban problems directly while serving the larger purpose of environmental pollution and climate change in the *Amrit Kaal*.

Keywords: Drone, Drone-based integrated solution, Aerial taxis, aerial transportation, delivery of services

1. Drone-based Delivery of Services

Delivery of services, both public and private, is restricted by heavy traffic, speed, and road congestion. Road spaces are nearly finite, especially within cities and towns; further growth is constrained. This severely affects medical services, policing, visual monitoring (even though static cameras do the job partly), physical deliveries of all kinds including pharmaceuticals and medicines/ drugs, emergency supplies, food - raw and cooked, household, industrial, and commercial miscellaneous packages, even

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communication relays, etc. Drones have come into being now for a few years and the payloads, technology, and capabilities are improving continuously. Drone-based delivery of services offers viable options to resolve ibid to provide faster and more efficient services of all kinds. Drones can carry numerous types of payloads which could include physical packages directly or odd loads in a crate configuration. They are also equipped with multiple cameras, moveable/ controllable remotely, providing day and night vision, laser range finders, communication equipment, etc. Its uses could include surveillance, operations, entertainment, signal emissions, transportation, delivery, etc., and can be used by numerous industries including agriculture, real estate, construction, survey/ mapping, telecommunication, mining, oil & gas, power, public safety/ police, defense, etc.

Commercial drones with payloads weigh typically up to 80-100 kgs, classified under the 'medium' category. They have the advantage of speed, height, and remote control but are restricted by battery life and therefore reach 60 km, typically 45 minutes of flying time, speed @ 65-110 kmph (average 80 kmph), with a payload of 40 kgs (though actual will depend on payload, drone specifications, and battery capability). The government of India issued novel drone rules for flying drones in August 2021 amended in 2022. Drones cannot fly close to airports and have a ceiling of 1000 feet. The cost of a commercial drone could be in the range of Rs 2-3 lacs today but will decrease in time to come and with economy of scale. These can be owned by the government or privately.

There is, therefore, scope for implementation of virtually and digitally seamlessly centrally connected, managed, and controlled, multi-purpose multi-functionality drones, covering a defined geographical area such as a city/ town, providing an array of support and services – A drone-based visibility & delivery solution for multi-function users, including government agencies. The proposed system can be thought of as a transportation-cum -'eyes-in-the-sky' system, offering various solutions and delivering goods and services. It will be a Drone-based visibility & delivery solution for multi-function users, including government agencies, the schema for which includes:-

(a) Drone array – Set(s) of drones based out of private & public spaces - police stations, hospitals, government offices, etc., with launch pads, charging facilities (incl sustainable options), payloads, reserves, etc.

(b) Could be manned (on a part-time/ rotational basis) or unmanned – primarily for basic maintenance, change of payloads, battery management, etc. – outsourced model.

(c) Central Server(s), with backup, software controlled and monitored 24x7.

(d) Integrated CCTV coverage across the city tapped into.

(e) Data streaming is through various communication layers that the city offers, including cellular towers, satellites, etc.

The proposal will offer an integrated solution to cities & towns, controlled through monitored CCTV cameras as part of an integrated smart city control room or users may call in for support and these can be used on a time-sharing basis. Drone demand is seamless to the user, appropriately located and configured, through a mobile-based app. Drone(s) is/are passed orders to take off with suitable payload(s), through cellular/satellite backbone using AI, and/or through manual intervention. Payloads could be cameras, including communication, thermal imaging/ night vision etc; LED lights; LASERs; Electronic (multiple options); cargo carriage (medicines, emergency supplies), etc. Loads could range from 1 to >100 kgs. In due course, even a person can be carried. Uses could be found by defense forces, including battlefield management, surveillance, policing, drones as weapons platforms, etc. On orders, the drone(s) take off to accomplish a given mission (surveillance, cargo, etc.). Owing to limited battery life, one Drone may hand over a task to the next, while the control links the mission seamlessly. As required data, including video, is streamed simultaneously to the user. Drone traffic control, changes to route (e.g. in police chase), calling in more drones, passing data to other users, etc. are part of the operation, until the mission requirement is fulfilled. With the use of Artificial Intelligence (AI), the system will mature and perform faster and better. Drones fall back to bases and are charged while awaiting the next mission. Wireless charging technology has been tried and tested. Restrictions are in terms of fly/no-fly zones, ceiling height, weight restrictions, and thus payload that can be carried.

This integrated solution is ideal for comprehensive city/town governance, results in better effectiveness & efficiency, resource savings, lesser risks, timely delivery, etc. It can be replicated by other cities/towns in India or globally. Drones can be owned by individuals/ companies and the drone pods (consisting of multiple, suitably configured with payloads, with

charging facilities) can be located at home terraces/ balconies; and integrated into the central system. The government, in conjunction with manufacturers, needs to define safety aspects, communication ranges/ channels, manufacturing guidelines, specifications, etc. for Drones, especially batteries at the earliest. Construction guidelines will also have to be amended. This will benefit manufacturers, those who wish to own drones and sub-let as part of the central project, and end-users. In Urban planning, this will play an important part.

2. Drone-based Aerial Transportation/ Taxi Services

The *ibid* idea can be comfortably enlarged to Aerial Drone Taxis transporting humans from one place to another, within a city/town, being a natural outflow and an extension of the same concept. One normally says ‘the time has come’; but if you think of it, this is a reactionary response to a problem that has besieged us and put us into a corner. What is being referred to here is the ‘transportation’ problem. The urban city governing and management bodies and authorities should not wait for the ‘time to come’, but rather find a solution, to a future foreseeable problem, today. The urban population in cities has grown to 55% in 2022 and is expected to reach 68% by 2050 and then at exponential rates. The population of our country will be 1.4 billion, the highest in the World very soon. We also know that roads are clogged, and public transportation systems have been added over time and in whatever space is feasible. Further expansion feasibility is limited i.e. growth on ‘land’ is finite, limited, and will reach its threshold very soon. Whereas aerial spaces are yet to be fully exploited in India, even in terms of helicopter services or small aircraft inter-city transportation industry. Hence, it is best that we exploit the higher atmosphere i.e. air above us. If we plan well it will serve us well and for long.

Whereas for delivery of services, the concept of distributed-yet-integrated drone pods and bases is workable, for aerial taxis it could be a combination of building terraces, heliports, airports, and drone/air taxi-dromes. Drone taxi safety will play an extremely critical part in policy formulation and strict implementation since human life is involved. Numerous companies worldwide are working on large drones to name a few Joby, Jetson, etc. These employ either a purely vertical take-off system (e-VTOL/ like a helicopter) or a combination of vertical during take-off-and-landing and horizontal (like an aircraft) while flying when en route by the movement of

rotors/motors, thus gaining the advantage of speed. Drone taxis under development will be able to carry 1-6 persons. These can be manually controlled or autonomously driven. Industry and manufacturers are certain to overcome issues related to the later category in time.

Conceptually, the idea is nascent yet forward-looking and pioneering. If well-conceived and formulated, the industry will get the right push and direction and India can become a leader in aerial taxi eco-systems, promoting *Atmanirbhar Bharat*. Indians are the best in the World be it software or hardware, especially now with the ease of doing business and push to indigenous manufacturing. 75 years of independence and into *Amrit Kaal* heading to 100 ears in 2047; this is the right time to show the path to the rest of the Globe.

It will also be economically advantageous for the manufacturers and the associated industry when asked to replicate it globally. Government and policymakers, in conjunction with industry, need to formulate policy of all associated aspects. Plans, guidelines, and policies need to be framed; technology needs to be developed, tried, tested, and validated. A comprehensive techno-social research needs to be undertaken. A vision statement needs to be issued. Then, guidelines and policies should be framed. The various focus areas that need to be addressed in the policy are:-

- (a) Manufacturing of drones, their components, and approval processes need to be made easy yet stringent with heavy penalties for poor quality. Technology development will itself take 3-4 years. Alternatively, technology transfer and joint ventures may be feasible. Standards will have to be laid down. Testing, trial, and validation processes, agencies, and authorities will have to be taken on board, including DGCA. Battery technology is also being evolved and numerous research are underway.
- (b) Design; Certification and Standardizing agencies will need to be earmarked and work on laying down rules/protocols/etc commenced. The designs have to be 'Fail Safe' as human lives are involved – thus we need to define protocols and check parameters for drones being used as aerial taxis. If required laws will need to be framed and tabled before Parliament.
- (c) Height ceiling restrictions exist for flying any aerial objects above certain height limits. For drones necessary amendments will need to

be defined. Aerial routes will have to be laid down for each city connecting housing hubs to business centers, excluding no-fly and restricted zones.

(d) Heliports / Drone-o-dromes need to be developed. Land acquisition will have to be done.

(e) Construction guidelines – Landing/Take-off platforms - If being based on terraces, construction norms will have to be laid down as also need for approval of structural integrity checks for existing buildings.

(f) Akin to road traffic control centers in smart-city projects Drone / aerial taxi control centers will have to be established.

(g) Payloads placing & integration on drones being used for delivery of services as aerial taxis will need to be looked into.

(h) Data security within Indian servers and the cloud will have to be ensured. Hybrid Communications both 5G and NavIC (Indian satellite) will have to be laid down to ensure dual-safety and assured data-streaming.

(j) Air traffic control and policing of drones will have to be undertaken de-novo.

(k) Where possible integration into the Smart City project can be done.

(l) The outsourcing model applies to both classes of drones (service delivery and transportation). Financing options can be worked out; pricing control is stipulated. The operation can be on a profit-sharing basis between Drone-owner, City municipal corporation, State government (both through taxation), and central government (through taxation/cess).

(m) The Motor Vehicle Act will need to be suitably modified or a separate act for drones and aerial taxis written afresh. Also, issues related to insurance need to be worked out.

(n) Maintenance and replacement plans for drones and associated systems need to be worked upon.

It is recommended that under the aegis of the Ministry of Civil Aviation (or any other ministry) an SPV be created for taking the proposal forward, involving all stakeholders, including institutions, industry players, Niti Aayog, the concept conceiver, etc.

References

1. 'Beating the Retreat' ceremony. (2022, January 29). Retrieved Nov 05, 2022, from In a first, a mesmerizing and spectacular novel drone show was one of the major attractions of 'Beating the Retreat' 2022 ceremony: <https://www.indiatoday.in/india/story/republic-day-2022-1000-make-in-india-drones-enthrall-audience-beating-retreat-vijay-chowk-1905768-2022-01-28>
2. Air, A. P. (n.d.). Retrieved Sep 04, 2022, from <https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011>
3. Army showcases swarm drones at Army Day Parade, p. t. (n.d.). Army termed the drone system a disruption technology, which can hit targets 50 km inside enemy territory. The system has been developed in collaboration with Bengaluru.
4. News, C. (n.d.). U.S. giving Ukraine more drones – a surprisingly lethal weapon in the war against Russia so far. Retrieved Mar 17, 2022, from <https://www.cbsnews.com/news/u-s-giving-ukraine-more-drones-a-surprisingly-lethal-weapon-in-the-war-against-russia-so-far/>
5. Records, G. W. (2021, Mar 29). Global luxury automotive brand GENESIS stirred up a sensation in Shanghai. Retrieved from Lighting up the evening sky with thousands of drones in a stunning performance to celebrate the official entry of GENESIS into the Chinese market breaking Guinness World Records for most UAVs airborne simultaneously: <https://www.guinnessworldrecords.com/news/commercial/2021/5/3281-drones-break-dazzling-record-for-most-airborne-simultaneously-655062#:~:text=3%2C281%20drones%20break%20dazzling%20record%20for%20most%20airborne%20simultaneously,-By%20Echo%20Zhan&text=Glob>
6. The Print, D. (n.d.). Army termed the drone system a disruption technology, which can hit targets 50 km inside enemy territory. The system has been developed in collaboration with a Bengaluru startup. Retrieved Apr 04, 2022, from Army showcases swarm drones at Army Day Parade, plans to scale up capability soon: <https://theprint.in/defence/army-showcases-swarm-drones-at-army-day-parade-plans-to-scale-up-capability-soon/586020/>