Title: Applications of unmanned aerial vehicle (UAV) in road safety,traffic and highway infrastructure management: Recent advances and challenges

### **Applications of Drone Logistics**

This paper presents a review of recent de velopments in relation to the application of UAVs in three major domains of transportation, namely; road safety, traffic monitoring and highway infrastructure management.

### **Advantages of Drone Logistics**

UAVs can perform air operations that manned aviation struggle with, and their use results in evident economic savings and environmental benefits whilst reducing the risk to human life.

### **Disadvantages/Challenges**

Use and control of drones in the urban environment have become a hot discussion topic and this issue is considered as a major barrier for their wide-scale deployment.

UAVs operations are limited by their battery life

### **Future Directions**

Further research in UAVs technology will open doors for their wide-scale applications in considered domains in this article. These are e.g. Introducing collision avoidance system in autonomous UAVs, avoidance of cyber-attacks, integration of more sensors to record other relevant data along with the integration of video data with other geospatial information such as Point of interest information etc. In addition to the above, acceptance of society is also a big challenge.

Title: Digital Supply Chain: Literature review and a proposed framework

for future research

​****​Applications of Drone Logistics:​****​

1. ​****​Last-Mile Delivery:​****​ Drones (UAVs) are tested for rapid delivery systems, exemplified by Amazon Prime Air and Google Project Wing, aiming to deliver packages "to customers in 30-min or less" (PDF, Section 3.3, DSC Technologies).

​****​Advantages:​****​

* ​****​Speed:​****​ "Break the illusive delivery barrier" with 30-minute delivery capabilities (PDF, Section 3.2, Features of DSC).

​****​Disadvantages:​****​

The regulatory environment, privacy concerns, and integration into existing networks are substantial challenges for UAV. In addition to the tangible (and technically controllable) challenges of congested airspace and inherent risks, there is another, less defined area of concern in the public domain.

****Future Directions:​****​

N/A

Title: UAV-Enabled Intelligent Transportation Systems for the Smart City: Applications and Challenges

****Applications of Drone Logistics​**​:**

other components of the road and the end-to-end transportation system, such as the field support team, traffic police, road surveys, and rescue teams, also need to be auto mated. Automation of those components can be achieved by using smart and reliable UAVs

ITS UAVs can provide an efficient means not only to enforce traffic rules and support traffic police on the ground, but also to provide road users with efficient information on traffic

* + Some of the applications that can be enabled by ITS UAVs include, but are not limited to, fly ing accident report agents, flying roadside units (RSUs), flying speed cameras, flying police eyes, and flying dynamic traffic signals.

#### **​**​Advantages​**​:**

​****​Mobility and Flexibility​****​:

* + "UAVs are free to move in a 3D space without restriction to road topology [...] can fly to a specific location to strengthen a weak link or fix a broken one" (*DYNAMIC COORDINATION AND DATA ROUTING*).

​****​Rapid Response​****​:

* + "UAVs might be a good complementary solution to help the rescue team reach the accident scene within the shortest time" (*FLYING ACCIDENT REPORT AGENT*).

​****​Cost-Effective Infrastructure​****​:

* + "UAVs can alleviate deployment costs of RSUs [...] dynamically and optimally place them using UAVs" (*UAV LOCATION DEPLOYMENT AND PATH PLANNING*).

#### **​**​Disadvantages​**​:**

Regu lations related to operation of UAVs may restrict how UAVs can be used for ITS scenarios.

Energy limitation is another challenge.

Another challenge is linked to the maximum speed a typical UAV can reach when compared to the speed of a vehicle driving on a highway.

Similar to any other connected network of nodes, when enabling a network of UAVs we need to be careful about security and privacy.

#### **​**​Future Directions​**​:**

we envision future ITS deployments that not only consist of ground RSUs, but also fl ying RSUs that are carried at UAVs.

As future ITS and road safety systems will con sist of interconnected systems of heterogeneous systems including UAVs, vehicles, and roadside infrastructure, the UAVs will carry, generate, and hand over valuable sensitive information about the users of these systems among themselves.

Title: The strategic role of logistics in the industry 4.0 era

### **Applications of Drone Logistics (Quoted from Original Text):**

​****​Faster Delivery Services​****​:

"Amazon is exploring the use of drones for delivering small packages. In China, Alibaba’s food delivery unit Ele.me started delivering foods by drones in 2018 [...] covering an area of 58 square kilometers" (Section 2).

"Researchers started to focus on the required operational models to route the drones to different customers (e.g., Carlsson and Song (2018), Agatz et al. (2018))" (Section 2).

​****​Disaster Response and Search/Rescue​****​:

"After Hurricane Harvey, FAA authorized 43 small drones [...] to assess damage to homes, roads, bridges, power lines, etc." (Section 3).

"Drones equipped with heat-sensitive infrared cameras can scan for human outlines, enabling rescue forces to locate victims efficiently" (Section 3).

### **​**​Advantages**:**

​****​Speed and Efficiency​****​:

"Faster Speed: delivery services conducted by drones [...] reduce last-mile delivery time" (Section 2).

"Anticipatory shipping could enable Amazon to ship products before customers order them" (Section 2).

​****​****Faster and safer response and recovery operations

​****​Sustainability​****​:

"Precision farming via drones reduces water waste and improves yield" (Section 4).

"Drones reduce emissions by replacing traditional delivery vans" (Section 4).

### **​**​Disadvantages​**​:**

​****​Safety and Regulatory Challenges​****​:

"Safety regulations must be developed to ensure drones operate safely in restricted airspace" (Conclusion).

"Unauthorized drones disrupted London airports, highlighting risks of unregulated operations" (Conclusion).

### **​**​Future Directions​**​:**

​****​N/A****

****Title: Urban Air Mobility: History, Ecosystem, Market Potential, and Challenges****

****这篇不管了，几乎没有提及drone****

Title: Merging the norm activation model and the theory of planned behavior in the context of drone food delivery services: Does the level of product knowledge really matter?

### **Applications of Drone Logistics (from the original text):**

****​Food Delivery Services​****​:

* + "Drones used for food delivery have also been tested as a greener delivery mode... Domino's franchise in the United Kingdom posted a video of the unmanned DomiCopter delivering two pizzas" (CNN Money, 2013; Forbes, 2018).​

### **Advantages of Drone Logistics (from the original text):**

it is commonly anticipated through numerous empirical evidence that drone delivery plays a significant role for en vironmental improvements compared to the current ground delivery means, such as motorcycles or cars, because the drone delivery has the potential to greatly reduce energy consumption and carbon dioxide (CO2) emissions

The foodservice delivery drones are not operated by individual controls, but by a computer program that allows the user to enter the air route before delivery (Kesteloo. 2018). Thus, the risk of problems, such as air traffic/accident are not high.

Drone-based delivery services have gained a great amount of at tention in the foodservice industry because of the various benefits, such as quick food delivery, the reduced labor costs, and the decrease of traffic accidents during delivery.

### **Disadvantages and Challenges (from the original text):**

​****​Technical and Safety Concerns​****​:

* + "Drones are not operated by individual controls but by computer programs... risk of problems like air traffic/accidents is not high but requires stringent management" (Kesteloo, 2018).

### **Future Directions (from the original text):**

A cross-cultural test is essential to improve the validity of the model regarding environmental behavioral intentions (Milfont, Duckitt, & Wagner, 2010), and therefore additional research is necessary to determine whether the study results can be generalized to different areas. Second, this study focused on drone food delivery services, so it is somewhat difficult to apply the results of this study to other industries. Third, despite the wide use of online survey methodology based on the convenience sampling, several disadvantages, which included issues related to sampling frames and participant deception, were raised (Wright, 2005). For this reason, fu ture research needs to use different types of data collection methods, such as a field survey in order to reduce biases. Lastly, the use of drones as a food delivery tool has not been totally commercialized in Korea, so it is recommended to collect data from consumers who have actually experienced drone food delivery services for future research.

Title: Artificial Intelligence, Transport and the Smart City: Definitions and Dimensions of a New Mobility Era

****1. Key Applications:​****​

* ​****​Commercial Cargo Transport:​****​ UAVs are highlighted as tools for "cargo transport" (Section 4).
* ​****​Emergency Services:​****​ They support "emergency search and rescue, disaster control and management" (Section 4).
* ​****​Surveillance & Monitoring:​****​ UAVs aid in "intelligence, surveillance and reconnaissance, traffic control, and aerial mapping" (Section 4).

### **Advantages of Drone Logistics:**

* ​****​Efficiency:​****​ UAVs provide "robust solutions [...] for improved military, policing, and commercial services" (Section 4).

### **Disadvantages of Drone Logistics:**

* ​****​Technical Limitations:​****​ UAVs face challenges such as "navigation system susceptibility to adverse weather conditions" (Table 1).
* ​****​Privacy & Acceptance:​****​ Concerns include "trespassing and unnecessary surveillance, visual intrusion, and excessive air traffic" for PAVs (Section 4), as well as "public acceptance" barriers (Section 4).
* **Future Directions for Drone Logistics:**

Fully autonomous UAVs and PAVs in the future will be of massive importance for logistics and also for moving people; they are expected to reshape travel patterns as we have known them for decades now by expanding vertically the urban landscape and transport network of future cities.

Integrating UAVs with smart cities will create a sustainable economic environment and a peaceful place of living if challenges relating, on the one hand, with business considerations like ethics and privacy, cost, licensing, legislation and market adoption, and on the other hand, with technical issues, such as the proper use of wireless sensors, data communications, application management, resource training and allocation and power management are addressed adequately [45,46]. The key stakeholders for addressing these challenges all have a distinct role. Governing bodies work on introducing regulations, policies and operations guidelines to ensure the safe use of UAVs; researchers design models and architectures to build, integrate and deploy UAV applications; and the industry aims to develop and introduce value-added features to smart cities using UAVs

Title: Drones for disaster response and relief operations: A continuous approximation model

### **Applications of Drone Logistics:**

1. ​****​Disaster Response and Relief​****​: Drones are used to transport emergency supplies (e.g., medicines, first-aid, food) to disaster-affected regions where road access is disrupted. Examples include mapping devastated areas post-Typhoon Haiyan (2013), radiation monitoring in Fukushima (2011), and delivering aid in Haiti and the Dominican Republic (Cohen, 2014; Murphy, 2014).

### **Advantages:**

1. ​****​Accessibility​****​: Drones bypass damaged infrastructure, reaching remote or inaccessible areas where traditional vehicles fail (e.g., blocked roads post-hurricane) (Section 1).
2. ​****​Cost-Effective Reconnaissance​****​: Drones reduce risks and costs associated with human-led inspections in hazardous environments (e.g., nuclear radiation zones) (Table 1).

### **Disadvantages:**

1. ​****​Technological Limitations​****​: Limited battery life (e.g., EHANG-184’s 23-minute flight time) and payload capacity (max 99.7 kg) restrict operational range and utility (Section 5).
2. ​****​Regulatory Barriers​****​: FAA regulations cap drone altitude at 400 ft, constraining their coverage and effectiveness (Section 6.2).
3. ​****​High Operational Costs​****​: Energy-intensive operations (climbing, hovering) and maintenance lead to higher per-mile costs compared to trucks (Section 3.3, 6.4).

### **Future Directions:**

. Future researchwill devote to this research direction by finding high quality solution approaches for our proposed optimization model.This study ignores wind factors in approximating the routing cost for drones. It will be interesting to see how the inclusion of wind factors in the optimization framework impact the overall delivery performance of drones.Moreover,in real settings when a set of drones will be deployed to serve a disaster affected region then it will be interesting to see how their scheduling and routing mechanisms will be coordinated. Inthiswork, although the model has been developed with utilitarian policy, some aspects of egalitarian policy(e.g., fairness and time) can still be satisfied as long as enough trucksand drones are available and the demand points fall within dronerange.In future work, we will try to understand how limiting theavailability of trucks and drones and incorporating both densely andsparsely population centers will affect the results. We also do notconsider battery costs for the replacement right after trips. We assumeenough fully charged batteries will be available in the distributioncenters for drones. In future studies, we also want to incorporate thisfactor into a mathematical model.