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Sahil Dagli is an Architect and an Urban Designer based in New York. Sahil completed his undergraduate studies in Architecture from Mumbai University in 2013 and finished his post-graduation in Architecture and Urban Design from Pratt Institute, New York in 2017. Having keen interests in site documentation, history, contemporary planning strategies and technical detailing, he holds a professional experience of three years. Sahil currently works as an Architectural Designer with J Goldman Design, New York. He has worked on strategy implementation, planning and design at various architectural and urban scale projects with Paradigm LLC, Philadelphia and Design Variable, India.

Along with industry experience, Sahil has keen interests in architectural academics, urban research and education. Sahil has been a visiting lecturer at Rizvi College of Architecture, Mumbai, Graphiques, Mumbai and The Institute of Career Advancement, New York. He has taken lectures, workshops and design studio projects in subjects of culture and built form, Architectural Design and Basic Design. Sahil also engagingly participates in various activities under The American Cancer Society in his available time.

THE FUTURE OF LAST MILE DELIVERY TECHNOLOGY IN URBAN ENVIRONMENTS

Sahil Dagli

A. Abstract:

The goal of this paper is to decipher trends in last mile delivery that is defining the urban landscape of big urban cities and retail establishments. We are at a precipice where the need for fast deliveries to our homes has surpassed our need to shop in retail stores and big box retailers are now switching to a more streamlined process in making sure that goods are well bought, sought after and distributed. Multiple sources show a growing need for faster and cheaper online deliveries and shifting consumer behaviors: those who used to shop in-person at a physical location are now wanting to browse products using online platforms to have their purchases delivered at their front door, or easily picked up from a nearby area. This has only intensified in the last three years especially after the world event of Covid-19. We have witnessed in the past two years growing numbers in online retail orders in the U.S. with a near spike in ecommerce in 2020, compared to 2019 (Fig. 1) (Digital Commerce 360, Jan. 29, 2021).

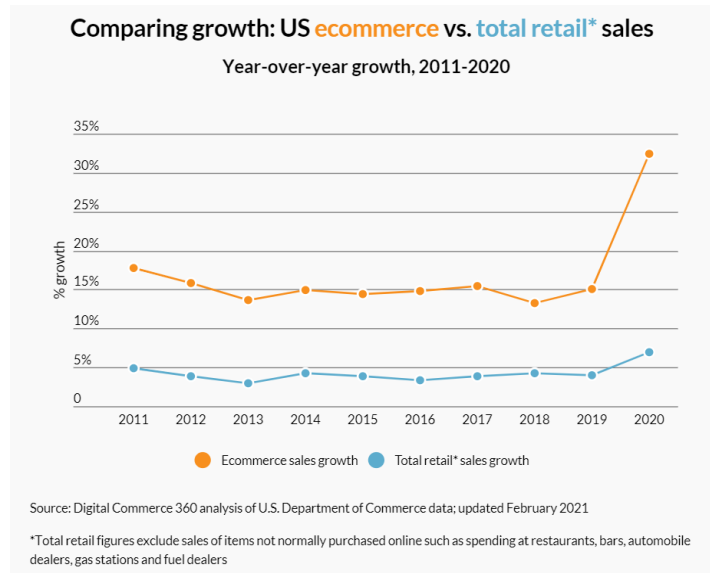


Fig. 1 – Growing e-commerce trend in the U.S. (Source: <https://www.digitalcommerce360.com/article/us-ecommerce-sales/>)

Advances in software engineering for online delivery platforms, as well as in urban infrastructure and logistics, increased the efficiency and speed of deliveries. Technologies of various types and scales, ranging from small circulating droids to flying drones and largely automated distribution centers, have allowed for retailers to produce, organize, and ship products with less time and fewer costs.

This paper briefly touches upon different types of retailer groups and speculate on how retailers may need to adapt their physical store designs and delivery processes to remain competitive in the e-commerce market. This report also lays importance on brick-and-mortar retailers, as these are likely to be most highly impacted by the shifting trend from in-person to online shopping. The paper also holistically looks at technologies that are likely to dominate in the next five to ten years based on statistics, and how these are utilized within distribution centers, called “micro-fulfillment centers” or MFCs.

Overall, this is a topic that is at the confluence of three realms: the urban environment, retail design and logistics of e-commerce (Fig. 2).

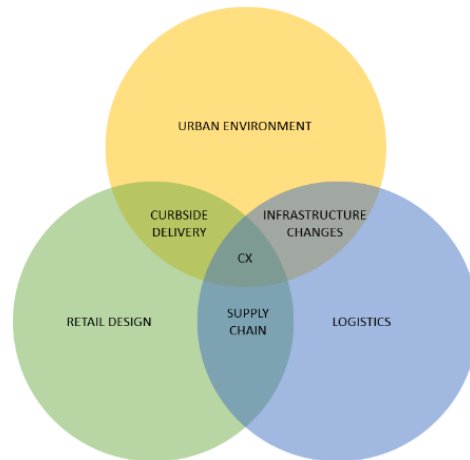


Fig. 2- Premise of the research (created by: author Sahil Dagli)

B. Context:

a) Growing Urban Population

It is estimated that about 1/3rd of the human population is going to reside in urban centers and cities. Along with the influx of people in the cities as seen over the last few decades, there has been an increase in demand and growth in e-commerce and consumer goods. Companies like Amazon and Alibaba have changed the way we humans consume goods and interact with shopping online. In the past decade, e-commerce sales have almost tripled; and the pandemic has resulted in an aggressive change in the relationship between retail and the average urban consumer (Fig. 3).



Fig. 3 - Project Futures and their use. Courtesy: World Economic Forum

The growing population along with the pandemic and the growing purchasing power of the people is projected to increase the number of delivery vehicles by a whopping 36% in the next decade alone. With this there is a growing need for faster and cheaper delivery services or systems, and thus a need to automate last mile delivery as it is the most expensive step of the supply delivery chain, amounting to almost 50% of the overall cost of delivery.

b) What is “last-mile”?


The last mile refers to “the very last step of the delivery process when a parcel is moved from a transportation hub to its final destination—which, usually, is a personal residence or retail store.”

(onfleet.com, May 18, 2021). It is usually the most complex and costly step in the delivery chain.

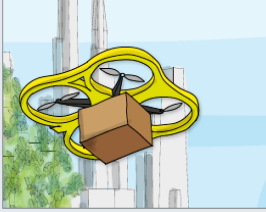
c) What are the existing last-mile delivery options?

Identified delivery models


We thoroughly investigated the start-up scene¹ and scanned for new technologies², which led us to identify seven operational models:




Today's model. A dedicated delivery person employed by the parcel delivery service provider picks up the parcels at a consolidation point, e.g., delivery base, and delivers them directly to the recipients. Large vans are typically used as delivery vehicles.




Drones. Autonomous aircrafts, e.g., copters or vertically starting planes, carry parcels (up to 15 kg) to their destination along the most direct route and at relatively high average speed. Like droids and AGVs, they too need to be supervised. We believe that one supervisor per roughly eight drones is a reasonable assumption.



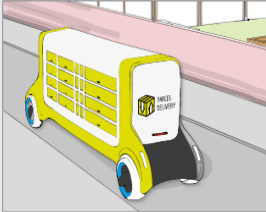
Bike couriers. Couriers employed by the parcel service provider deliver a small number of parcels by bike. Today, this is often seen in point-to-point delivery, especially for B2B documents and prepared food.




Semiautonomous ground vehicles. A delivery person is still required, but could theoretically use the driving time more efficiently to take care of sorting or smaller administrative tasks, e.g., scanning or announcing arrival while the vehicle does the driving. These advantages need to compensate for higher investment costs, as autonomous ground vehicles are likely to be more expensive than regular cars or vans, at least initially. However, the delivery person will likely not be allowed to move freely while the vehicle drives, limiting the tasks that can be performed in transit. We find it difficult to see how the savings in terms of streamlined administrative tasks can compensate for the higher investment cost.



Crowdsourcing. Any member who has signed up as a driver to the crowdsourcing network can choose to complete a specific delivery order. The advantage of this model is its flexibility in supply, especially in covering peaks and troughs, the multi-purpose use of certain assets such as cars, as well as the low investment requirements for parcel companies. Furthermore, some companies hope to create synergies beyond regular parcel delivery, e.g., with taxi services.



Autonomous ground vehicles (AGVs) with lockers. AGVs deliver parcels without any human intervention. Customers are notified of the exact arrival time. Upon arrival at their door, customers are asked to pick up the parcel from the specified locker mounted on the van or truck – picture a mobile parcel locker. Granted, such vehicles would need to be supervised. We assume that a central supervisor could manage roughly eight to ten AGVs.



Droids. Small autonomous vehicles, only slightly larger than a regular parcel, deliver parcels to the doorstep. These vehicles are relatively slow at 5 to 10 km/h and use the sidewalk rather than the street to reach their destination. Such droids also need to be supervised, but due to their size and low speed, developers currently believe that a single supervisor could manage 50 to 100 of them.

1 We reviewed ~ 300 start-ups, identified based on a semantic search in major databases such as Capital IQ, CB Insights, AngelList, and CrunchBase, to uncover new operational models.
2 We searched through patents filed, leveraging a semantic search of more than 2,000 published articles.

Source: McKinsey&Company (Joerss, Joerss, et.al.), "Parcel delivery. The future of last mile." Travel, Transport and Logistics. September 2016

d) Which last-mile technologies are likely to dominate in the future?