

Autonomous Vehicles for Urban Air Mobility: Future of Mobility

Urban mobility is evolving with the arrival of autonomous vehicles which contributes for a unique fundamental change. The environmental and social concerns have brought the quest to redesign urban mobility sustainably.

Significance of Urban Air Mobility

Urban air mobility is not a new concept though it drew attention and made discussions in recent years. The current urban transportation infrastructures would not be sufficient to cater to ever-rising population in the world. Urban air mobility has the challenge to address urban integration, acceptance from the public, automated air traffic management, and evolving technological aspects. The modern and rapidly increasing urbanization sights sustainable solutions like electric air taxis, drone transportation for the mobility need. The new perspective for urban mobility is introduced with autonomous air taxi services and autonomous vehicles for freight transportation by flying over cities.



The Global Urban Air Mobility Industry report has mentioned that the urban air mobility market will reach \$12.4 Billion by 2027[1]. The compound annual growth rate in the global market for urban air mobility is expected to grow 9.9% over the 2020-2027 period [1].

Autonomous vehicles are a crucial mode of transportation when it is linked with passengers' trust, willingness to travel, social influences, readiness to use, and behavioral intentions. The passengers' trust contribution mostly describes whether they accept the autonomous commuter vehicle though it values time, cost, and comfort. The risk perceptions, lack of knowledge among passengers can act as challenges when converting passenger mode choice on autonomous vehicles in air transport.

Factors to Consider

According to the European Union Aviation Safety Agency (EASA), autonomous vehicles for air mobility require to consider several factors refer to their design. Safety and security, noise and environmental impact, integration with existing infrastructures, granting approval from governing bodies, and acceptance from the public are these factors. The autonomous vehicles for air mobility are guided and coordinated with an interconnected web of intelligent applications and infrastructures like artificial intelligence or 5G technology.

Urban air mobility contributes immensely to travel time-saving. It requires transforming urban travel while having faster connections with facilities like business, residential, medical, and others. To maintain these connections, air taxis need to integrate with already established infrastructures and fly close to the high-density population areas. In urban air mobility, the infrastructure-related issues and concerns arise with respect to autonomous vehicles. The main infrastructures for passenger air mobility are called vertiports, vertipads, vertistops and skyparks [2]. In the urban city area, some possible infrastructures can be used to facilitate for vertiports such as rooftops of supermarkets, vacant lands, floating barges, helipads, large stadiums, parking lots which are only used for weekends, etc. According to researches, the ideal vertiport loca-

tion will help to maximize population-cumulative potential travel time savings[2]. Further, different vertiport designs and different layouts like linear, satellite, pier impact the capacity concerns of vertiport.

Autonomous vehicles for air mobility can be powered mainly using a battery or electric grid. If the flying time is high missions, the vertiports require a great number of charging stations and also will require many vehicles to cater to the demand in air mobility service. Therefore, the vehicle characteristics like energy consumption level or recharge time directly impact the cost, efficiency, and viability of air mobility networks.

Future Applications in Urban Air Mobility Companies

The increasing demand for alternative transportation modes with less carbon footprint and the need for decongested roads have made the urge for many companies to make innovations on urban air mobility. Airbus has announced its plans in late September to launch a new CityAirbus, a brand new flying taxi. The CityAirbus is expected to fly with a cruise speed of 120km/h within the 80 km range matching it for major city operations. This is fully electric and has four passenger seats flying

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Research Highlights



with the aim to cover short distances speedy and quietly.

As a true pioneer in delivering solutions for urban air mobility, Volocopters experiment the first public test flight, VoloDrone in Hamburg, Germany in October 2021. The flight was limited to three minutes which reached 72 feet altitude which marked the first-time operation in a public environment. VoloDrone will be built more efficiently and robustly to address existing logistics processes. The invention of autonomous aircraft and the necessary software, infrastructure systems will keep the momentum for Volocopter to initiate commercial flights in Paris and Singapore in upcoming years.

Urban Aeronautics is well known as the developer of the first compact, wingless electric vertical takeoff, and landing (eVTOL) aircraft. In early 2021, Urban Aeronautics experimented with their first flight tests, on flying car CityHawk partnering with HyPoint Inc. which is powered by hydrogen. This innovation is empowered by fan craft-based technology and has high stability and decrease noise. The compact design is efficient enough and ensures to save time which is well capable to land on vertiports in building rooftops. CityHawk has its own ability for safe operation under any weather condition.

The electric air taxi developer Joby Aviation made the acquisition of Uber Elevate from Uber Technologies last year. It is as a part of the deal to integrate services and develop eVTOL passenger aircraft which is aimed to fly in early 2023.

German electric aircraft developer Lilium GmbH is expecting to unveil regional air mobility vertiports in Bavaria positioning in Dusseldorf airport and Cologne airport. The Lilium Jet will travel 186 miles per hour and accompany five passenger seats that help to reduce travel time between regions.

The autonomous vehicles for air mobility will make new opportunities in logistics, public services, development in agriculture, and forestry experimenting in many industries other than the purpose of commuting. The innovativeness, environmental concerns, usefulness of the autonomous vehicles positively impact the intentions of the passengers to move with air mobility.

References

- [1] "Global Urban Air Mobility Industry." https://www.reportlinker.com/p06033200/Global-Urban-Air-Mobility-Industry.html?utm_source=GNW (accessed Nov. 22, 2021).
- [2] L. A. Garrow, B. J. German, and C. E. Leonard, "Urban air mobility: A comprehensive review and comparative analysis with autonomous and electric ground transportation for informing future research," *Transportation Research Part C: Emerging Technologies*, vol. 132, p. 103377, Nov. 2021, doi: 10.1016/J.TRC.2021.103377.

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