Appendix 4

Autonomous Ground Vehicles (GVs) designed for Shared Public Transportation

Information was obtained primarily from media, news, and specific manufacture's websites, as listed in footnotes. Please visit their websites.

Note: The autonomous vehicles, prototypes or concepts presented herein are listed in alphabetical order, by manufacturer, and are presented for informational purposes only. OVER, LLC does not represent or endorse any particular vehicle, prototype or concept, and has not verified the information.

Make/Model and Brief Description	Image
Baidu APOLONG[1] (also called Apollo). The Apolong self-driving (Level-4) minibus is a joint project between Baidu and Chinese bus manufacturer King Long. About 1/3rd the size of a normal bus, the 14-passenger Apolong (8 seated, 6 standing) can travel at speeds of 60km/h (~37mph) for a distance of up to 100 km (~62 miles) on a 2-hour charge. Its onboard sensor array includes laser radar, millimeter wave radar, HDR and stereo camera modules. it has a lightweight composite build with curved glass upper, and wide electric doors. The Apolong has been in development since Oct 2017. (Xiamen, Fujian, China)	
Bosch IoT Shuttle Concept[2] Bosch unveiled a driverless, ride-hailing shuttle bus concept at CES 2019. Bosch built its concept vehicle to showcase what's inside of it, and has no plans to become an automaker. The concept is shaped like a box to maximize interior space, and it's fitted with huge side windows to give passengers an unobstructed view of the outside world. This configuration offers space for 4 passengers, though other layouts are certainly possible. According to Bosch, about 2.5 million on-demand shuttle buses will be on the roads by 2025. Many will be completely autonomous. (Stuttgart, Germany)	

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[1] https://www.dailymail.co.uk/news/article-5917091/Chinas-Baidu-rolls-self-driving-buses.html
[2] https://placetech.net/news/bosch-driverless-shuttle-bus-leads-iot-play/

Make/Model and Brief Description	Image
EasyMile EZ10[3] The EZ10 is an autonomous electric shuttle bus that seats up to 6 and allows 4 more to ride standing, or can accommodate a wheelchair using its built-in access ramp. The EZ10 has been deployed in more than 30 cities and 16 countries. They operated from Aug '17 to Aug '18 in Arlington, TX, providing free rides for over 110 events.[4] Surveys showed that 99% of riders enjoyed it and felt safe. (Toulouse, France)	
IVA HEAT[5] Hamburger Hochbahn and IVA teamed to develop the Hamburg Electric Autonomous Transportation (HEAT) project, to integrate driverless e-shuttles into bustling traffic in a test area in HafenCity. The all-electric minibus developed by the Hamburger Hochbahn / IAV team will accommodate 16 passengers (10 seats and 6 standing), has barrier-free access to the interior, provides surveillance of the passenger compartment, will travel at speeds up to 50km/h (~32mph), and is emission-free. No other information is available at this time. (Hamburg, Germany; Berlin, Germany)	
Local Motors OLLI[6] The box-shaped Olli can seat up to eight passengers and are fully electric. They have a maximum range of 40 miles, or 25 miles with a full load of passengers with the air conditioning blasting. Olli shuttles are fully autonomous, but currently operate with a human "steward" onboard for safety. Charge time: 1.5 hours. Capacity: 612 kg (1350 lb)[7]. Local Motors has given more than 2,000 demonstration rides in various cities. (Phoenix-metro area, AZ)	

[3] http://www.easymile.com/
[4] http://www.arlington-tx.gov/visitors/av/milo/
[5] https://www.hamburg-news.hamburg/en/renewable-energy/heat-project-launches-hamburg/
[6] https://localmotors.com/meet-olli/
[7] https://www.digitaltrends.com/cars/lm-industries-olli-autonomous-vehicle-challenge-california-arizona-winners/

Make/Model and Brief Description	Image
MUJI GACHA[8] The 4-wheel drive Gacha is a fully autonomous all-weather shuttle bus made by MUJI and Sensible 4[9], scheduled to premiere in March 2019 in Helsinki. It will undergo trials on the road with normal traffic, shuttling passengers in three cities in Finland throughout 2019. The goal is to deploy a commercial fleet sometime in 2020. The Gacha can hold up to 16 passengers, 10 seated and 6 standing, can travel up to 40km/h (~25mph) for at least 100km (~62miles) on a single charge. It supports fast charging as well as wireless charging. It has 4 lidars, 8 radars, 360-degree camera vision, high precision GPS inertia unit and control of 4G/5G LTE. (Helsinki, Finland)	
NAVYA AUTONOM CAB[10] The autonomous (Level-4) 1-6 passenger Autonom Cab is a 2WD, all electric system that provides 10 hours of autonomous travel at 50km/h (~31mph) with a max speed of 90km/h (~56mph) and can be recharged in ~5 hours. It's being manufactured in France and the U.S. (Villeurbanne, France)	
NAVYA AUTONOM SHUTTLE[11] The autonomous (Level-4) 15-passenger Autonom Shuttle can accommodate 11 seated and 4 standing passengers. The 2-wheel drive, all electric system has a 33 kW/h battery pack that provides 9 hours of autonomous travel at speeds up to 25km/h (~16mph) and can be recharged in about 4 hours. It is being used for shared, route-based public transport in 20 countries including Australia, Austria, Denmark, France, Germany, Japan, Singapore, Switzerland, USA and many others. NAVYA has sold over 100 Autonom Shuttles and they have transported over 300,000 passengers since April 2016. (Villeurbanne, France)	

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[8] https://www.epressi.com/tiedotteet/teknologia/muji-and-sensible-4-created-gacha-the-first-autonomous-shuttle-bus-in-the-world-for-all-weather-conditions.html

[9] http://sensible4.fi/

[10] https://navya.tech/en/autonom-cab/

[11] https://navya.tech/en/autonom-shuttle/

Make/Model and Brief Description	Image
Renault EZ-PRO[12] The EZ-PRO is an autonomous electric delivery vehicle system consisting of two parts: a "Leader Pod" that can hold both parcels and a human passenger, and "Robo Pods" that carry packages or be configured as a coffee truck, food truck, portable grocery store, portable office, etc. - without a passenger. Rather than driving, the human passenger/operator sits in an office-like section of the cab and focuses on coordinating package deliveries, etc. If need be, a passenger/operator could take over driving using a joystick and other controls. Pods can travel and deliver product independently of each other, link electronically in a "platoon" and travel together, or leave the platoon as needed. All pods have four-wheel steering and are rear-wheel drive. Renault hasn't specified the speed, range, payload capacity, battery size, or electric motor sizes to date. (Boulogne-Billancourt, France)	
Toyota e-Pallette[13] The e-Palette concept is a fully electric, autonomous, flexible design to suit many different uses. The boxy shape is very spacious inside which means the models will accommodate several passengers and lots of cargo. In addition to traditional uses such as ride sharing and cargo delivery, Toyota envisions the models as mobile hotel rooms, small restaurants, retail spaces, coffee shops, and many other uses. The car maker suggests three sizes ranging from 4-7 m (13-23 feet) to match different utilizations. The concept that Toyota showcased at CES had a length of 15.7 feet, a width of 6.5 feet and was 7.4 feet tall. (Toyota City, Aichi, Japan)	
Transdev i-Cristal[14] Self-driving tech company Torc Robotics is partnering with public transportation giant Transdev and French manufacturer Lohr to deploy fully autonomous 16-passenger electric shuttles. I-Cristal shuttles are equipped with a fast-charging system, able to recharge 50% of their battery in 30 minutes and 100% in 90 minutes.[15] (France)	

[12] https://www.engadget.com/2018/09/19/renault-ez-pro-autonomous-delivery-ev/#/
[13] https://www.toyotacar2019.com/toyota-e-palette-rumors-price-and-specification/
[14] https://techcrunch.com/2019/01/07/torc-robotics-ces/
[15] https://www.transdev.com/en/press-release/transdev-and-lohr-present-i-cristal-the-future-electric-full-autonomous-shuttle-designed-for-tomorrows-shared-mobility/