

Proceeding Paper

Implementing Public Service Features in Autonomous Vehicles in Seoul [†]

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Abstract: Autonomous vehicle technology has been primarily developed by the private sector, with a focus on the automobile industry and fourth industrial revolution technology. However, for self-driving cars to become reliable forms of urban transportation, the private and public sectors must collaborate. The Seoul Metropolitan Government operates three self-driving test beds, namely, Sagam, Gangnam, and Cheonggyecheon, and has implemented various measures to support the use of autonomous vehicles as a means of urban transportation, such as an open platform for traffic signals, roadside safety facilities, dedicated road signs and lanes, and deregulation. This paper explains the technical and institutional support provided for autonomous-driving services in Seoul and suggests ways to build a safer and more effective autonomous driving environment.

Keywords: autonomous vehicle; strategies of transportation in Seoul; urban transportation

1. Introduction

The self-driving car industry has traditionally been led by established vehicle manufacturers like Mercedes-Benz, BMW, and GM. However, in recent years, the focus has shifted towards software platform companies such as Microsoft, Google, and Apple, who prioritize fourth industrial revolution technology. Private companies have primarily driven the industry, but governments are now implementing various support policies to ensure the safe operation of autonomous vehicles. These policies involve reorganizing urban infrastructure, equipping safety facilities where necessary, and sharing traffic signal information with the private sector.

Since 2018, KPMG, a global management-consulting firm, has developed the Autonomous Vehicles Readiness Index (AVRI) to assess the state of the autonomous driving environment worldwide in terms of policy, legislation, consumer acceptance, and technology. As of 2020, Singapore ranked first in terms of policy, legislation, and consumer acceptance, while the Netherlands topped the infrastructure category. Korea is ranked seventh out of thirty countries globally, and its ranking is increasing each year. It has been evaluated as remarkable in terms of 4G communication coverage, mobile connection speed, and ICT, but assessments have determined that its levels of consumer acceptance, government legal regulations, and government readiness for change are low.

In Korea, self-driving car testbeds have been established in local governments across the country, with significant efforts being made to not only develop technology but also increase consumer acceptance and use as a means of urban transportation. This study introduces the public sector's efforts and promotion directions for the introduction of self-driving vehicles as urban transportation in Seoul and suggests future development directions [1].



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2. Introduction of Testbeds for Autonomous Driving in Seoul

There are three autonomous driving testbeds in Seoul: Sangam, Gangnam, and Cheonggyecheon (Table 1).

Table 1. Testbeds for Autonomous Driving in Seoul.

Name of Testbed	Area/Length of Road	Test Service
Sangam	6.2 km ²	First/Last Mile
Gangnam	20.4 km ²	Demand response
Cheonggyecheon	8.8 km	Tour bus

The testbed at Sangam, the first of the three testbeds, covers an area of approximately 6.2 km² and operates six autonomous vehicles on five routes that connect subway stations and destinations. (Figures 1 and 2) Three of the routes connect subway stations with major commercial and business districts, while two routes operate between nearby tourist attractions and subway stations, including an internal circulation route within the tourist attractions. The fare has been set at around \$1.5 per trip—higher than bus or subway fares but lower than taxi fares—to test the functionality and public acceptance of autonomous vehicles in terms of typical urban transportation. By 2025, a total of 25 autonomous vehicles are scheduled to perform test operations in Sangam, with plans to expand the applicability of autonomous vehicles to include not only passenger transportation but also personal logistics [2].

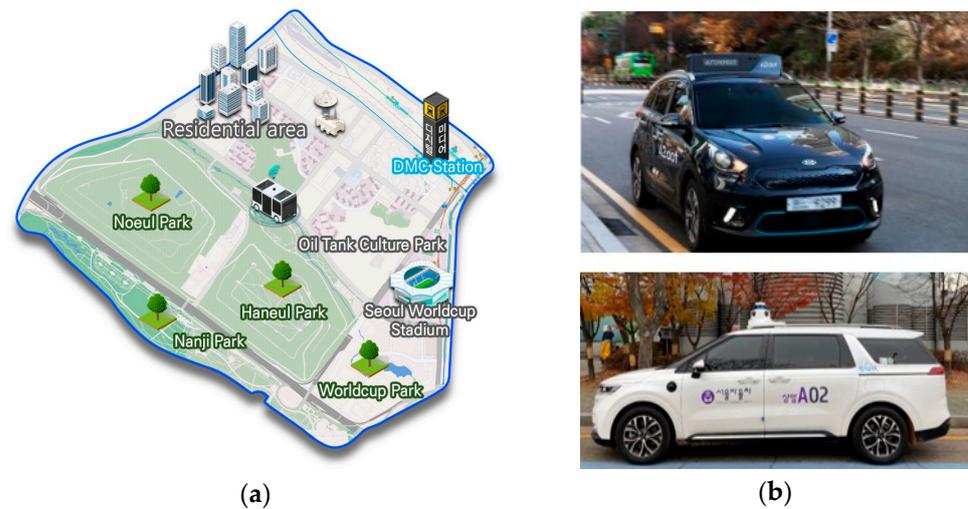


Figure 1. Sangam Testbed: (a) The location of Sangam autonomous-driving testbed and (b) self-driving car in Sangam testbed.

The Gangnam testbed is the most complex of the three testbeds in Seoul, and it is conducting tests on the largest area. The area is a mix of business, commercial, tourism, and residential areas, resulting in high demand for transportation and heavy traffic. The entire area of the Gangnam testbed is about 20.4 km², and it is planned to test autonomous vehicles on approximately 85.1 km of roads (Figure 2). The area has a high demand for transportation due to the evenly distributed business, commercial, tourist, and residential areas, resulting in heavy traffic. Additionally, there are many bus and subway routes, and road construction occurs frequently. The main purpose of the Gangnam testbed is to test the safe coexistence of autonomous vehicles in a realistic traffic environment that is closer to reality than the Sangam testbed. The main test service item of the Gangnam testbed is the taxi service, and Hyundai Motor is preparing to test the commercialization of a demand-responsive Robo-Taxi.

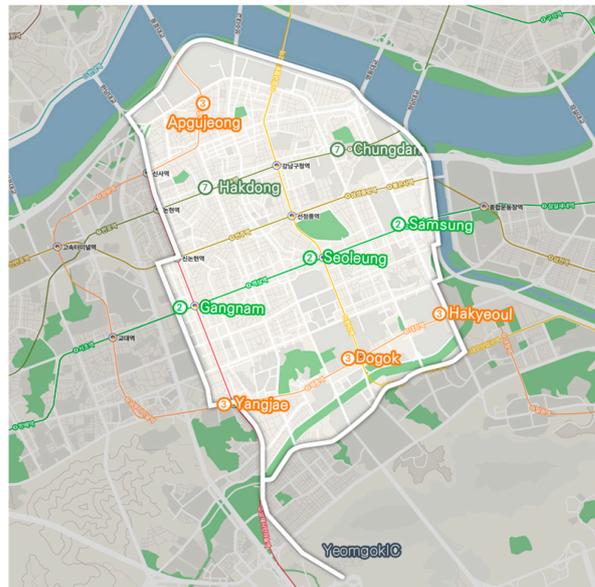


Figure 2. The location of Gangnam autonomous-driving testbed.

The third autonomous driving testbed in Seoul is a self-driving mini-bus for tourism that operates around Cheonggyecheon (Figure 3). The Cheonggyecheon testbed is designed to operate on a total of 8.8 km stretch of the area around the Cheonggyecheon stream, which connects major tourist attractions in Seoul, such as Dongdaemun Market, Deoksugung Palace, Gyeongbokgung Palace, and Jongno. It is also a historically significant location. Currently, the testbed is operating free of charge, with a focus on tourists.

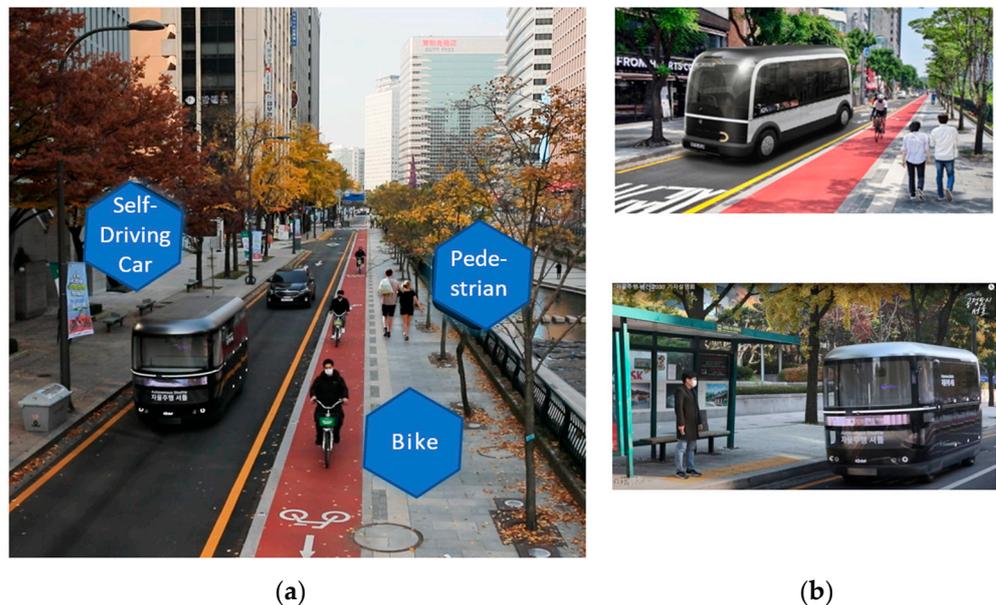


Figure 3. Cheonggyecheon Testbed: (a) The location of Cheonggyecheon autonomous-driving testbed and (b) self-driving shuttle.

In particular, the Cheonggyecheon road is a popular tourist destination where many pedestrians gather, and there are also many bikes in the area transporting cargo from the market. Therefore, the main purpose of the Cheonggyecheon testbed is to test the coexistence of autonomous vehicles with pedestrians and bikes compared to the other two testbeds.

All three areas are equipped with infrastructure for safe testing, including basic safety signs and priority lanes for autonomous vehicles. Additionally, they have installed and are operating various RSEs (to cover communication blind spots), CCTV, and a communication system based on 5G to support cooperative driving. Furthermore, the Seoul Metropolitan Government supports the safe operation of autonomous vehicles at intersections by providing private companies with traffic signal information stemming from major intersections. This allows autonomous vehicles on test beds to receive real-time information on the signal operation status ahead and operate safely on the intersections.

3. Operational Results

Since the selection of the Sangam autonomous driving testbed in 2021, the Seoul Metropolitan Government has submitted an annual operational report to the Ministry of Land, Infrastructure, and Transport, which includes the distance traveled by autonomous vehicles and the occurrence of accidents. The city has also been promoting the issuance of temporary driving licenses through operational tests in order to offer the first paid autonomous vehicle service. In addition, a preferred fare survey has been conducted for paid transportation services, and various autonomous driving expos and hackathons are being hosted to increase citizens' acceptance of autonomous vehicles. The Seoul Metropolitan Government is also providing subsidies to autonomous vehicle operators based on their operational performance to promote the autonomous vehicle industry. These efforts culminated in 2022, with Seoul being selected as the most well-operated region among the seven Korean cities and provinces operating autonomous driving testbeds [2,3].

4. Conclusions

The Seoul Metropolitan Government is currently operating three autonomous driving testbeds and plans to expand the area of autonomous vehicle services throughout the city in the future. As part of this plan, the city is introducing a shuttle bus that will operate around the recently renovated park near Cheong-Wa-Dae and is preparing for autonomous vehicle operation tests on late-night bus services. Additionally, the city plans to introduce autonomous vehicles in the public sector, including road cleaning, snow removal, and patrol services, as well as expanding the scope of autonomous vehicle services beyond transportation services. Although the private sector has mainly led the autonomous vehicle industry thus far, various support policies from local governments or the government, such as restructuring urban infrastructure, providing necessary safety facilities, and supplying traffic signal information, will be essential factors for the successful establishment of autonomous vehicles. By creating a well-established governance system through consultations with industry, research, and government in addition to a public-private collaboration system, we can expect a safer and more convenient era of autonomous vehicles to arrive sooner.

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