



TECHNOLOGY

Mini driverless city gives Singapore edge in race to robot buses

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(June 5): In the race to deploy driverless public transport, Singapore has built a mini town that could vault it into pole position.

The 2-hectare complex, unveiled in November, has intersections, traffic lights, bus stops and pedestrian crossings, all built to the specifications that Singapore uses

for its public roads. There's a mini hill to check how vehicle sensors perform when they can't see directly ahead, mock skyscrapers to mimic the radio interference from tall buildings and a rain machine to simulate the island's frequent tropical downpours.

The advantage for the city-state is that the test circuit, and the information provided by companies vying to put driverless buses on Singapore's streets, is helping it build an unrivalled database of information on the challenges and solutions that would allow the government to introduce the technology safely.

"We're probably the only country that's looking at this in such a pro-active and systematic way," said Lee Chuan Teck, former deputy secretary at the Ministry of Transport. "What we're looking at is actually deploying regulations."

Lee said the data being gathered should allow the government to draft regulations for autonomous vehicles by the second half of this year. The nation's small size, advanced road infrastructure and highly regulated traffic system make it an ideal petri dish for companies that are developing driverless systems.

There are now more than 10 companies testing vehicles at the facility at Nanyang Technological University in the west of Singapore, said Niels de Boer, program director for Future Mobility Solutions at the university. Two buses from Volvo AB will join them early next year and more are coming, he said.

With so many hazards and intersections on the route, the speed limit at the site is about 20 to 25 kilometers an hour. De Boer said that they want to see what happens under a "controlled environment."

Seven 360-degree cameras stream live video to the Land Transport Authority's Intelligent Transport Systems Centre downtown. Together with information collected from the vehicles, the government is building a database that will allow it to evaluate whether EVs are ready for public roads and how they should be deployed.

Nanyang Technological University is testing a 15 passenger driverless minibus built by French company Navya SAS, which researchers can operate using the autonomous software, or manually via a video-game style handset.

On a recent, hot morning, it trundled round the course with air-conditioning on full, cutting its seven-hour battery life in half. The bus navigated lanes, halted in front of a wayward pedestrian in the road and stopped at bus shelters to collect and deliver passengers, though some functions, such as moving off at traffic lights, still had to be manually initiated. On one occasion, it made an emergency stop for some unseen obstacle, throwing passengers onto the floor.

The only place the bus didn't go was the rain simulator, which de Boer said wasn't working after being damaged in a recent thunderstorm. So far, vehicles that had been tested in the rain machine hadn't performed well, according to staff at the site. In about 70% of cases, the sensors on the vehicles were unable to operate successfully in heavy rain.

The university's test bus may not be the most sophisticated experimental autonomous vehicle in use, but it did demonstrate that driverless vehicles still have many obstacles to overcome. While the use of AI means that the machines will learn rapidly from their errors, the real lesson from the test park is the need for a sophisticated infrastructure outside the vehicles.

"Infrastructure will become more important," said de Boer. "It's not enough to know where the vehicle is." Operators and traffic officials must also monitor many other possible events -- an elderly passenger falling down inside a bus, an unusually large queue at a bus stop, breakdowns and other events.

Singapore "has a unique advantage of the progressive government machinery, which is proactively pushing for new initiatives in its AV efforts," said Sharad Mohan Mishra, executive director and automotive consulting leader at Deloitte Southeast Asia. That will "very much help Singapore in achieving a car-lite future," he said.

Still, the country's rule-heavy approach to transport and its high taxes on vehicles have brought criticism from some entrepreneurs. Elon Musk's Tesla electric-vehicle company exited from the country after six months in 2011, and Musk recently tweeted that Singapore wasn't supportive of EVs after a customer who imported a Tesla Model S into Singapore was asked to pay an additional \$15,000 in taxes.

The nation, home to one of the biggest oil-refining hubs in the region, expects to earn about \$2.8 billion in motor vehicle taxes this fiscal year, 4% of total tax

revenue. The Land Transport Authority said there were 25,496 electric or hybrid vehicles on the island in 2017, about double the number from the previous year.

While the nation may be a laggard in electric cars, its efforts to certify driverless public transport could put it in the lead for autonomous buses as more companies bring vehicles to NTU's test track.

"It's getting harder to find a time slot," said de Boer, adding that as many as four vehicles have been on the circuit at the same time for testing.

Volvo will be trialing an autonomous electric bus at the site using a system developed with NTU. The centre, which is currently opens five days a week, will begin night trials soon.

The university in April announced plans to start driverless routes on its campus by 2019. Singapore aims to operate scheduled services using autonomous buses during the off-peak periods in three residential areas away from the city center by 2022.

Last week was the deadline for Singapore's request for information from companies pitching to operate the services. The 122-page document called for a huge amount of information, adding to the vast dataset that Singapore is building on autonomous technology.

"Nobody else is putting all three pieces -- the trials, the regulations, and the town planning -- together," said Lee, who this month moved to a job at the Ministry of Trade and Industry.

DRIVERLESS PUBLIC TRANSPORT

SINGAPORE

NAVYA SAS

NANYANG TECHNOLOGICAL UNIVERSITY (NTU)

First in the morning.