Stanley Robotics and Trimble Join Forces to Improve the Accuracy of "Stan" — A Fully Autonomous Outdoor Parking and Valet Robot


Photo Cred.: Stanley Robotics

Stan incorporates the Trimble BX992 dual-antenna enclosure for accurate, available and reliable localization.

Founded in 2015, Stanley Robotics is a developer of smart and high-density car storage solutions for the airport and car logistics industries. The company developed Stan, a fully autonomous outdoor parking and valet robot that is now operational at several airports in Europe, including the Lyon Saint-Exupéry airport in France and soon to be at the Gatwick Airport in London. The solution incorporates fully autonomous robots and intelligent storage management software that move cars into place with efficiency and ease.


Photo Cred.: Stanley Robotics

Solution

Trimble BX992

- Fully autonomous valet
- Vehicles move from outside to inside and parked with high precision navigational accuracy
- Utilizes Trimble BX992 dual-antenna enclosure
- Centimeter-level localization

Overview

Founded in 2015, Stanley Robotics is a developer of smart and high-density car storage solutions for the airport and car logistics industries. The three founders, Clément Boussard (CEO), Aurélien Cord (CTO) and Stéphane Evanno (COO), all have previous experience in driverless technology, gained at top research institutes with a world-class industrial corporation.

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Location
PARIS, FRANCE

NEED

Automated parking systems are not new to the industry—mechanical solutions have been used for over 100 years. In fact, the first use of an automated parking system was in Paris, France in 1905 at the Garage Rue de Ponthieu. It was an elevator to transport cars to various levels where attendants manually parked the cars. However, effective high-density car storage solutions require vehicles to be moved from outside to inside and parked with high-precision navigational accuracy. To avoid the costs of human drivers, a smart and fully autonomous system is required. Centimeter-level localization is vital so that these robots are able to navigate these vehicles in a canyon of cars and narrow alleys without damage or injury.

CHALLENGE

The Stanley Robotics team needed to combine perception algorithms and intelligent management software with reliable GNSS technology to achieve centimeter-level localization for a safe and efficient solution. Anthony Troublé, Robot Team Manager at Stanley Robotics, explains, "The robot must move fast to handle high traffic flow and precisely to park cars as densely as possible. When looking for an accurate, available and reliable localization solution, Trimble is the company name that comes first."

SOLUTION

For Stan, the team selected the Trimble BX992 dual-antenna enclosure and two Trimble AV59 GNSS Antennas. The BX992 is installed inside the robot and the two antennas are mounted on the robot's head with maximum separation between them. In order for the robot to attain centimeter-level localization, a Trimble BX992 base and a Trimble Zephyr Antenna are installed at the drop-off cabins where customers leave their cars until robots move them to a more permanent location. The Trimble BX992 base broadcasts RTK corrections over a WiFi link to the robots.

In addition, the robot uses two LiDAR scanners and four cameras. Stan relies on LiDAR-based simultaneous localization and mapping (SLAM) techniques to locate the robot and build a map. The LiDAR-based SLAM system is always running and fused with the GNSS localization and odometry.

"The LiDAR is mostly critical in the cabins where the GNSS availability and reliability is not sufficient," adds Troublé. He continues, "The full integration with our localization system, especially the transition from indoor-to-outdoor when the robot enters a cabin was a challenge. We have tuned and improved our localization fusion algorithm to get the best out of each component and deliver a consistent confidence index."

Secure and Safe

As a first step to implementation, the Stanley Robotics team evaluates the existing car park scope and scale. Historical parking data is compiled (incoming and outgoing cars) over the preceding 12 months and run through a simulator to optimize the number of robots and cabins needed.

Once operational, robot creates its own map in real-time for every mission by scanning vehicles and adjusting the dimensions of its ramp accordingly. When ready, Stan clamps onto the vehicle wheels and with GNSS/LiDAR precision, navigates from a cabin to a designated parking space for drop-offs, and vice versa when the customer returns.

Photo Cred.: Stanley Robotics

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Stan is equipped with three levels of safety to ensure operational effectiveness. First, Stanley Robotics continuously monitors the accuracy, availability and consistency of the RTK GNSS, SLAM and Odometry localization signals. “If these signals are too inconsistent or if the overall confidence is too low, the robots are stopped and a site supervisor is alerted,” said Troublé. “Further, the site is monitored through LiDARs and cameras on the robot to prevent any collision with obstacles.”

Finally, a trained Stan maintenance worker is assigned to every parking lot. These individuals wear a safety badge and every robot is equipped with a safe stop feature that will trigger if the operator gets within a defined proximity to the robot.


Photo Cred.: Stanley Robotics


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RESULTS

The first outdoor car park managed by robots opened to the public in 2018 at Lyon Saint-Exupéry airport. Since testing started in 2017, four Stan robots are now fully operational in the Lyon Saint-Exupéry airport car park, which can accommodate up to 500 vehicles. Stanley Robotics announced in January 2019 that they will open 2,000 spaces at Lyon in the summer of 2020. The airport is looking to eventually expand this system to up to 6,000 spaces in total. In 2019, Stanley Robotics signed a contract with Gatwick Airports, the first UK airport to use robots that valet park passengers’ cars. The Stanley Robotics team is gearing up to begin work at another airport, more information to come soon!

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