

February 20, 2024
CORE Corporation
ACSL Ltd.
Rakuten Group, Inc.

Cabinet Office, "Michibiki Demonstration Project 2023"
CORE Corporation, ACSL Ltd., Rakuten Group, Inc.,
Successful demonstration of GNSS anti-spoofing in drone delivery
CORE and ACSL jointly developed world's first drone supporting GNSS authentication service



Demonstration experiment at the Otaki General Branch in Chichibu City

CORE Corporation (Head Office: Setagaya-ku, Tokyo; President and Chief Executive Officer Masanobu Matsunami; hereinafter referred to as "CORE") jointly conducted a GNSS anti-spoofing demonstration with ACSL Ltd. (Head Office: Edogawa-ku, Tokyo; Representative Director: Satoshi Washiya; hereinafter referred to as "ACSL") and Rakuten Group, Inc. (Head Office: Setagaya-ku, Tokyo; Chairman and CEO: Hiroshi Mikitani; hereinafter referred to as "Rakuten") in Michibiki(*Note*) demonstration project. We developed GNSS receiver and drone supporting the Michibiki authentication service, and used it in the demonstration.

(NOTE) The Quasi-Zenith Satellite System, QZSS

At present, autonomous driving technologies such as vehicles and drones are spreading as measures to improve working efficiency and safety. In these technologies, GNSS (Global Navigation Satellite System) is widely used to obtain its position. However, GNSS spoofing attack, which causes the GNSS receiver to be mispositioned and diverts drones and automobiles to other route than that originally intended, is a major threat.

Based on this background, we have developed the "ChronoSky PF2-AE", the world's first drone (*Note*) that supports QZSS authentication service, by mounting the "Cohac[∞] Ten++" receiver, developed by CORE, on ACSL's drone "PF2-AE Delivery". In this demonstration experiment, it assumed that Rakuten, which provides drone delivery services, deliver relief supplies under the influence of GNSS spoofing in the Otaki area of Chichibu City, Saitama Prefecture. As a result of this demonstration, we confirmed that the GNSS spoofing was correctly detected, interrupted, and notified by utilizing QZSS authentication service.

(NOTE) CORE research (as of February 20, 2024).

1. Background and objectives

Security measures are required in GNSS

GNSS spoofing attack is a major threat in the spread of autonomous driving and drone flight technology. To tackle GNSS spoofing, Michibiki plans to launch a signal authentication service in fiscal 2024. In this service, the digital signature information distributed from Michibiki and the public key held by the receiver are used for determining whether the signal is correct from the satellite or not. This GNSS security measures by blocking the interference signals will be an important initiative for the dissemination of autonomous driving and flying technology in the near future.

2. Demonstration outline

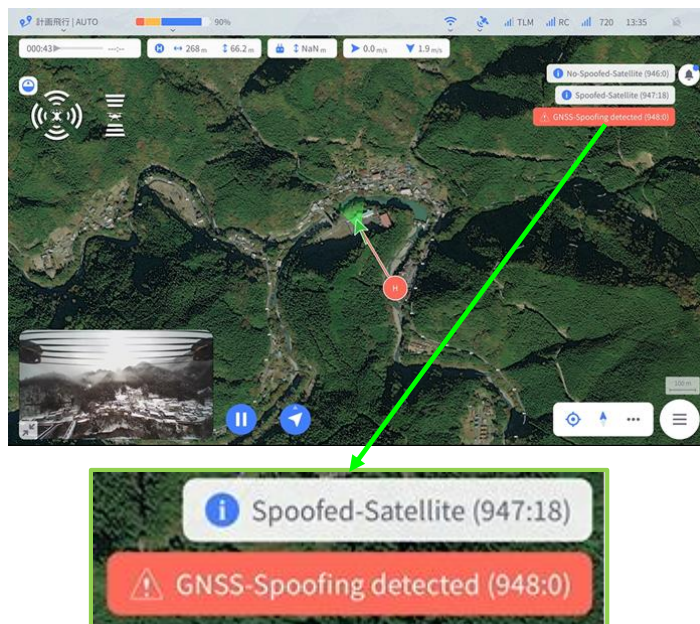
In this demonstration, we assumed relief supplies delivery by drone in the case of a disaster that severed the road. We verified and confirmed the following two points.

- (1) In a GNSS spoofing environment at a level where automatic navigation is possible, the spoofing signal is blocked and the drone operator is immediately notified that parts of satellite signals are being spoofed, and then the drone continues automatic navigation to transport the cargo safely.



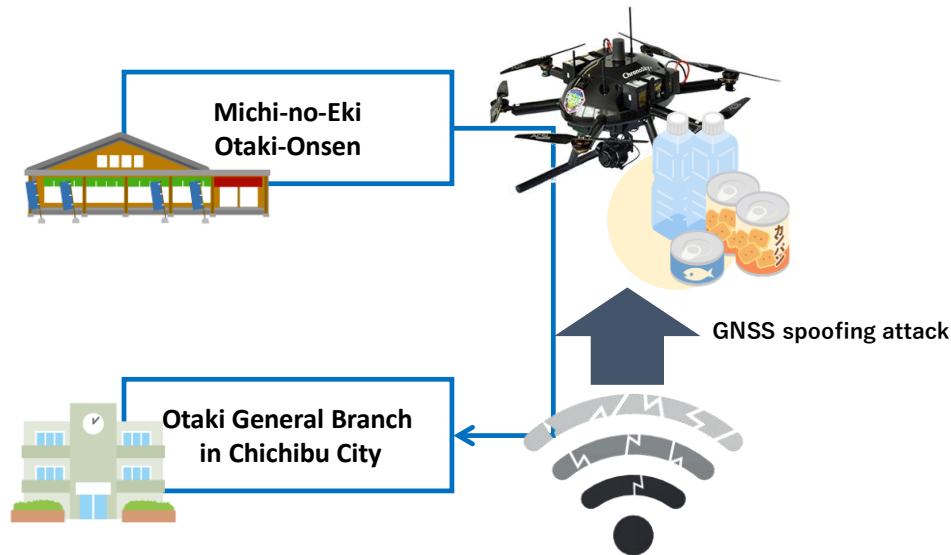
Receiving baggage

- (2) In a GNSS spoofing environment at a level where automatic navigation is impossible, the spoofing signal is blocked and the drone operator is immediately notified that all of satellite signals are being spoofed, and then the drone operator transports the cargo manually.



Notification to drone pilot

Demonstration scenario



- (1) We loaded relief supplies such as food and sanitary goods into a drone at Michi-no-Eki Otaki-Onsen. While the drone was subjected to spoofing on the way to the Otaki General Branch in Chichibu City, it immediately notified the Ground Control Station (*Note*) that we were subjected to a GNSS spoofing attack but we blocked the spoofing signal. But since the number of satellites subject to spoofing was small and automatic positioning was possible, it continued automatic flight. Then it separated the cargo at the Otaki General Branch and safely returned to Michi-no-Eki Otaki-Onsen.
- (2) We loaded relief supplies such as food and sanitary goods into a drone at Michi-no-Eki Otaki-Onsen. While the drone was subjected to spoofing on the way to the Otaki General Branch in Chichibu City, it immediately notified the Ground Control Station (*Note*) that we were subjected to a GNSS spoofing attack but we blocked the spoofing signal. Since the number of satellites subject to spoofing was large and automatic positioning was impossible, switched to manual operation. Then it separated the cargo at the Otaki General Branch manually and safely by the drone operator.

(NOTE) Software for controlling drones from the ground.

※Emitting GNSS interference signals outside is prohibited in Japanese Radio Law. In the demonstration experiment, the interference signals were not emitted. Instead, a simulated spoofed environment was constructed and drones were navigated. As for the actual operation by interference signals, we also conducted wired spoofing demonstration. The receiver supporting QZSS authentication service correctly detects and shuts off spoofing signals. It can provide the correct position by using only actual satellite signals.



Wired GNSS spoofing demonstration

- Left image: Positioning result by Cohac[∞] Ten++ supporting QZSS authentication service
The result indicates the correct location with detecting and shutting off spoofing signals.
- Right image: Positioning result by GNSS receiver un-supporting QZSS authentication service
The result indicated the wrong location without detecting and shutting off spoofing signals.

Future Prospects

This demonstration is conducted on the assumption that drones will be used for distribution. However, in recent years, not only drones, but also self-driving technology is spreading, and it is becoming increasingly important to improve safety in the automatic driving of vehicles and ships. This demonstration has shown the superiority of this service and the first step toward realizing safe automated operation. We will continue to contribute to the realization of a convenient, safe and automatic driving society.

Michibiki Demonstration Project

Please refer to the following about details.

<https://qzss.go.jp/ex-demo/index.html>

Drone and receiver for QZSS authentication service

The results of this demonstration are scheduled to be exhibited at the following exhibition.

In addition to “ChronoSky PF2-AE” and “Cohac[∞] Ten++”, we plan to exhibit 3D visualizing solution, “ChronoSky Eyes”, and position management solution, “QzLocation”.

①Construction and Survey Productivity Improvement Exhibition (CSPI-EXPO 2024)

Date: May 22, 2024 (Wednesday) to May 24 (Friday) 10:00-17:00 for three days

Place: Makuhari Messe 1-6 Hall, outdoor and outdoor exhibitions ANNEX

URL:<https://cspi-expo.com/>

②Japan Drone 2024

Date: June 5, 2024 (Wednesday) to June 7 (Friday) for 3 days from 10:00 to 17:00

Place: Makuhari Messe

URL:<https://ssl.japan-drone.com/>

Please refer to the following about details of the receiver, “Cohac[∞] Ten++”, used in the drone, “ChronoSky PF2-AE”.

URL:<https://www.core.co.jp/service/industrial/gnss/receiver/tenplusplus>

■About CORE Corporation.

A company established in 1969 and listed on the TSE Prime Market. As a manufacturer of social solutions, we are working to realize SX as a company that solves social issues through ICT and co-creates value. <https://www.core.co.jp>

■About ACSL, Ltd.

Location: 2F, Hulic Kasai Waterfront Building, 3-6-4, Rinkai-cho, Edogawa-ku, Tokyo

Representative: Satoshi Washiya, Representative Director

Established in November 2013

Business: In order to save manpower and unmanned operations in the industrial sector, we are developing domestic industrial drones. In particular, we are providing cutting-edge autonomous control technology with image processing and AI edge computing technology and industrial drones with the same technology. It has already been adopted in a variety of fields, including infrastructure inspection, mail, logistics, and disaster prevention. <https://www.acsl.co.jp/>

■About Rakuten Group, Inc.

Rakuten Crimson House, 1-14-1, Tamagawa, Setagaya-ku, Tokyo

Representative: Chairman and CEO Hiroshi Mikitani

Established in February 1997

Business: Rakuten Group, Inc. is a global leader in internet services that empower individuals, communities, businesses and society. Founded in Tokyo in 1997 as an online marketplace, Rakuten has expanded to offer services in e-commerce, fintech, digital content and communications to approximately 1.7 billion members around the world. The Rakuten Group has approximately 32,000 employees, and operations in 30 countries and regions. For more information visit <https://global.rakuten.com/corp/>

■To Shareholders

This press release is intended to inform us of our qualitative business progress and is not intended to solicit investment. Please refer to the Financial Closing Brief for information on our business performance, progress, and forecasts.

Contact Information

■ About the product

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*Please convert “at” to @

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