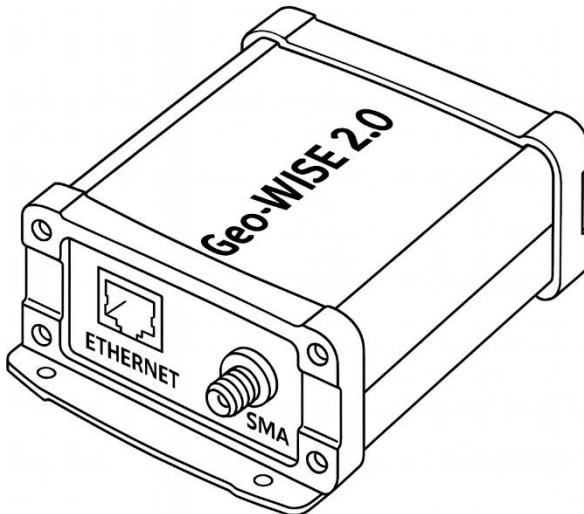


Overview

Geo-WiSE 2.0 is a fixed, multi-constellation GNSS base station that continuously measures its own position, the state of received satellites, and accuracy values.

The station transmits this information both as **standardized NMEA sentences** and as **pre-parsed JSON messages** via the MQTT protocol.



It can be used for example in

- GNSS signal accuracy and quality visualizations
- Modeling of correction-data services
- Analysis of environmental and ionospheric effects
- Combining real-time positioning data with other sensors

MQTT Structure

Element	Example	Description
Topic (NMEA raw)	base/geo-wise-001/nmea	Raw NMEA string
Topic (parsed)	base/geo-wise-001/parsed	Pre-interpreted JSON data
Topic (status)	base/geo-wise-001/status	Device status and diagnostics
Update rate	1 Hz	Sufficient for continuous monitoring
QoS level	0–1	Lightweight, real-time transmission



Available Data

Below is a simplified list of all data categories transmitted by Geo-WiSE 2.0.

Position and Time Information

- latitude, longitude — fixed station coordinates, small variation due to random error
- altitude_m — altitude above sea level
- timestamp_utc — UTC time in each measurement (ZDA/RMC)
- fix_quality — measurement quality:

0= no fix	1 = autonomous	6 = HAS-corrected
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(Disclaimer: applies if HAS-corrected firmware is ready by hackathon)

Satellite Status

- satellites_visible — number of satellites in view (GSV)
- satellites_used — number of satellites used in solution (GSA)
- constellations — systems in use (GPS, Galileo, GLONASS, BeiDou)
- cn0_list — signal-to-noise ratios per satellite

Accuracy and Quality Metrics

- hdop, vdop, pdop — DOP values based on geometry
- rms_error_m — estimated standard deviation of measurement error (GST)
- estimated_hacc_m, estimated_vacc_m — estimated horizontal and vertical accuracy
- correction_age_s — age of correction data in seconds

HAS and Correction Status

- has_status — HAS service status: ACTIVE / INACTIVE
- fix_type — solution type: Autonomous / DGPS / PPP / HAS
- rtk_status — if applicable: Fixed / Float
- service_id — identifier of correction source (e.g., Galileo HAS E6)

(Disclaimer: applies if HAS-corrected firmware is ready by hackathon)

What Participants Can Do with the Data

Hackathon participants can utilize the Geo-WiSE 2.0 data stream to:

- Draw real-time satellite visibility maps (azimuth/elevation data from GSV messages)
- Analyze accuracy variations using DOP and RMS values over time
- Model the effect of HAS correction on measurement error (fix_quality 6 vs. 1)
(if HAS-correction is available)
- Combine positioning data with other sensor streams (e.g., air quality, temperature, magnetic field)
- Study ionospheric or weather effects on signal strength (C/N₀ data)

Data Summary Table

Data Category	Example Fields	Update Rate	Use Case Example
Position Data	latitude, longitude, altitude_m	1 Hz	Real-time map visualization
Satellite Data	satellites_visible, cn0_list	1 Hz	Satellite visibility & signal strength
Accuracy Metrics	hdop, rms_error_m, hacc_m	1 Hz	Accuracy analysis
Correction Status	has_status, correction_age_s	1 Hz	HAS service monitoring

Geo-WiSE 2.0 operates during the hackathon as an open **GNSS base-station**, providing participants with:

- Real-time satellite and positioning data in standardized formats
- An MQTT interface accessible with any programming language
- The opportunity to develop, test, and visualize GNSS-based solutions without physical hardware