

ALPINE RESCUE SYSTEM

Offline GPS + LoRa mountain safety monitoring platform

FIELD-TESTED EXPERIMENTAL MVP

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QR TRIP CONTEXT

GNSS POSITION

LoRa 868 MHz

4,180 m max recorded separation · 93.9% aggregate packet delivery · 48–60 h battery runtime



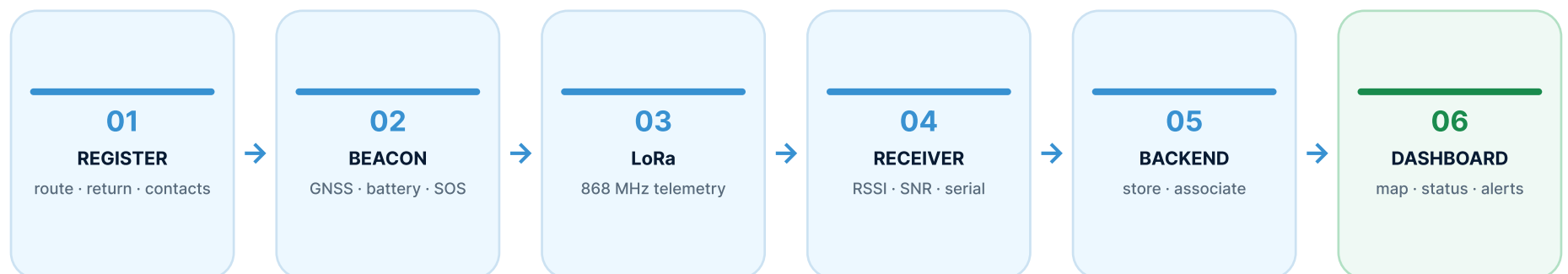
THE PROBLEM

In mountain terrain, cellular coverage can disappear exactly when location context matters most. A delayed or missing group may leave rescuers without a reliable route plan, expected return time or current/last-known position.

THE ARS RESPONSE

ARS links pre-trip QR registration to a portable GPS/LoRa beacon, receiving gateway, local backend and operator dashboard — keeping identity, route, telemetry and alert context together without requiring continuous cellular service.

HOW ARS WORKS · END-TO-END DATA PATH



Trip context is bound before departure; live telemetry is added in the field; the dashboard preserves the latest received position and explicit alert reason.

CORE SYSTEM BLOCKS

PRE-TRIP CONTEXT

QR registration binds device identity, route, expected return and emergency-contact context before departure.

FIELD TELEMETRY

GNSS position, battery state, packet sequence and deliberate ~5 s manual SOS are transmitted from the beacon.

LOCAL RADIO LINK

868 MHz LoRa carries compact device-identified packets to the receiving gateway without relying on cellular infrastructure.

OPERATOR AWARENESS

The dashboard combines trip context, breadcrumb history, last-known position, link metrics and an explicit alert reason.

OFFLINE-FIRST

DEVICE-BOUND CONTEXT

OPERATOR-CENTRIC ALERTS

MVP BOUNDARY

ARS is a field-tested engineering prototype for remote mountain monitoring. It is not a certified distress beacon and does not replace satellite communicators, emergency services or established rescue procedures.



MOUNTAIN VALIDATION · 07 AUG 2026

Six documented mountain stations validated the complete ARS data chain.

Ile Alatau · 2,264–3,604 m altitude · end-to-end receiver → backend → dashboard path confirmed in the field.

RESULTS_FREEZE_v1 · CONTROLLED BASELINE

FIELD-TESTED · DOCUMENTED · EXPERIMENTAL

VALIDATED EVIDENCE

6

DOCUMENTED STATIONS

169 / 180

PACKETS RECEIVED

93.9%

AGGREGATE DELIVERY

4,180 m

MAX RECORDED SEPARATION

4–8

GPS SATELLITES

48–60 h

FIELD BATTERY RUNTIME

WHAT THE FIELD TEST DEMONSTRATED

- QR trip registration and declared trip context
- Live GNSS / LoRa telemetry through the system
- Gateway-added RSSI / SNR after reception
- Automatic receiver → backend → dashboard data path
- Deliberate ~5 s manual SOS demonstrated end to end
- Last-known position and explicit operator alert context



WHAT THE RESULTS DO NOT PROVE

4,180 m is a recorded field separation — not a universal or guaranteed LoRa range.

No satellite communication and no automatic rescue dispatch.

Current MVP has no radio acknowledgement or automatic retry.

48–60 h runtime depends on battery condition, temperature and transmission configuration.

Enclosure is not waterproof- or impact-certified.

RSSI / SNR master values remain subject to raw-log reconciliation.

CURRENT PROJECT STATUS

ARS V1 is complete as a field-tested, documented experimental MVP.

The next controlled phase focuses on enclosure hardening, acknowledgement/retry logic, expanded range testing and operational deployment procedures.

ENCLOSURE HARDENING

RELIABILITY LOGIC

CONTROLLED PILOT