



Smart Sheep Surveillance, Monitoring and Geolocation System — Executive Overview

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GREENFIELD – GREEN TECHNOLOGY proposes an integrated livestock surveillance, monitoring and geolocation system that gives one farm operation continuous visibility of every sheep in the customer's herd at a site in Africa; the number of animals is designated by the customer (country and farm to be confirmed).

Overview

The system is a complete livestock management infrastructure, not a set of standalone trackers. It is built on four integrated layers:

Layer	Component	Quantity	Role
1	Smart GPS sheep collars	One per sheep (herd size designated by the customer)	Identify each animal, determine its position, sense activity, report battery and device health
2	Field communication gateways	Set by site survey	Receive collar radio transmissions and forward them over a backhaul link
3	Central monitoring & communication base station	1	Network and application servers, livestock database, alert engine
4	Web dashboard / livestock management software	1 platform	Maps, geofences, alerts, reports and administration for authorised operators

Delivery includes installation, integration, commissioning and operator training on site by GREENFIELD specialists.



Sheep in a managed feeding area. The monitoring system identifies and locates every animal in the flock.

Why it matters

A sheep herd spread across open grazing land is hard to count, locate and protect by observation alone. Losses to straying, theft and unnoticed illness are often found late, and staff time goes into searching rather than managing.

The system addresses this with:

- **Individual identification** — a digital inventory of every animal, linked to its collar.
- **Location visibility** — GPS/GNSS positions, movement history and map views of grazing use.
- **Boundary security** — virtual pasture fences with alerts for boundary crossings, possible escape or theft.
- **Early attention** — activity monitoring that flags unusual movement or inactivity for staff follow-up.
- **Equipment supervision** — collar battery, device and gateway status in one place.
- **Records and reporting** — position history and configurable reports to support herd management decisions.

The system supports operational decisions; it does not replace veterinary assessment.



Greenfield hydroponic fodder production: seeded trays, growing racks and finished fodder mats.

System architecture

Every collar reading reaches the operator through four layers

Customer-designated herd size, field gateways set by site survey, 1 central station, 1 web dashboard

On the animal

Radio uplink
LPWAN, e.g. LoRaWAN

Field gateways

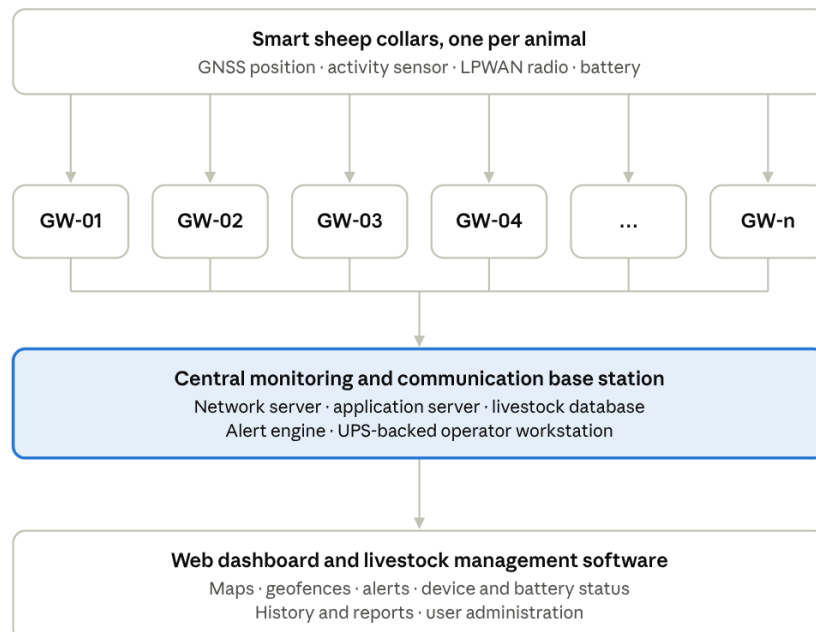
outdoor, IP-rated

Backhaul: Ethernet,
fibre, radio link
or cellular

Central station

Secure web access

Operators



The number and placement of gateways are set by the RF site survey.

system architecture · 4 layers

Collars send short radio messages to the nearest gateway; gateways pass them over a backhaul link to the central station, which stores the data, raises alerts and serves the dashboard.

Smart sheep collars (one per animal)

Each collar combines a satellite positioning receiver, an accelerometer, a low-power radio and a battery in a rugged housing on an adjustable livestock-grade strap. The final hardware model will be confirmed at detailed engineering against these requirements.

Function	Proposed capability
Identification	Unique electronic ID per collar, linked to an individual sheep record (ear tag, breed, sex, age class, group) in a digital inventory
GPS / GNSS geolocation	Outdoor positioning with timestamped coordinates, position history, movement tracking and configurable reporting intervals
Activity monitoring	Accelerometer-based activity and inactivity periods, movement patterns and unusual-activity notifications (where supported by the final hardware)
Geofencing & security	Virtual pasture boundaries, boundary-crossing alerts, out-of-area detection, possible theft or escape notifications
Environmental protection	Sealed IP67 dust- and waterproof housing, heat and UV tolerance, impact and abrasion resistance, smooth edges for animal comfort
Power management	Battery life of up to 5 years with no recharging; low-power sleep architecture, optimised reporting, battery level reporting, low-battery warnings, defined replacement provisions
Wireless communication	Low-power wide-area radio (e.g. LoRaWAN) to the field gateways; final technology and band subject to engineering and national spectrum rules

Two points matter for planning:

- **Positioning is not communication.** A GPS receiver only works out where the animal is. Getting that position to the farm office needs the collar radio, the gateways and the backhaul working together.

- **Battery life of up to 5 years.** Collars are IP67 waterproof and need no recharging. Actual life depends on the reporting interval, GPS use, radio conditions and climate, and will be confirmed once the hardware and reporting settings are agreed.

Field communication gateways (number set by site survey)

Industrial outdoor gateways link the collars in the field to the central station. Each receives collar transmissions in its coverage area and forwards them over a backhaul link.

Each gateway includes:

- LPWAN radio compatible with the selected collar technology, with external antennas and low-loss cabling.
- Protected industrial enclosure, surge and lightning protection, and earthing provisions.
- Backhaul interface — Ethernet, fibre, point-to-point radio or cellular, chosen by site survey.
- Power arrangement — grid supply or a solar/battery kit, confirmed per location.
- Remote diagnostics and connectivity supervision from the central station.
- Pole or mast mounting on existing structures.

Network design inputs. The number of gateways, their locations and antenna heights will be set by a radio-frequency site survey that considers:

Factor	What it decides
Farm area and distances	How far each gateway must reach and how far it sits from the base station
Terrain	Line of sight across hills and valleys
Vegetation and structures	Signal loss through trees and buildings
Radio technology and frequency	Data rate, range and device capacity per gateway
Permitted spectrum	Licence-exempt or licensed bands and power limits in the country
Antenna placement	Mounting height, available structures and antenna gain
Backhaul availability	Which link type is feasible at each gateway site
Local regulations	Type approval and operating authorisations for radio equipment

Gateway count therefore scales with the size and layout of the grazing area, not with herd size alone. Coverage is checked on site during acceptance testing.

Central base station and software platform

The central base station is the operational core: it receives data from all field gateways, stores it, raises alerts and serves the web dashboard. Indicative hardware is a server-class computer sized for the

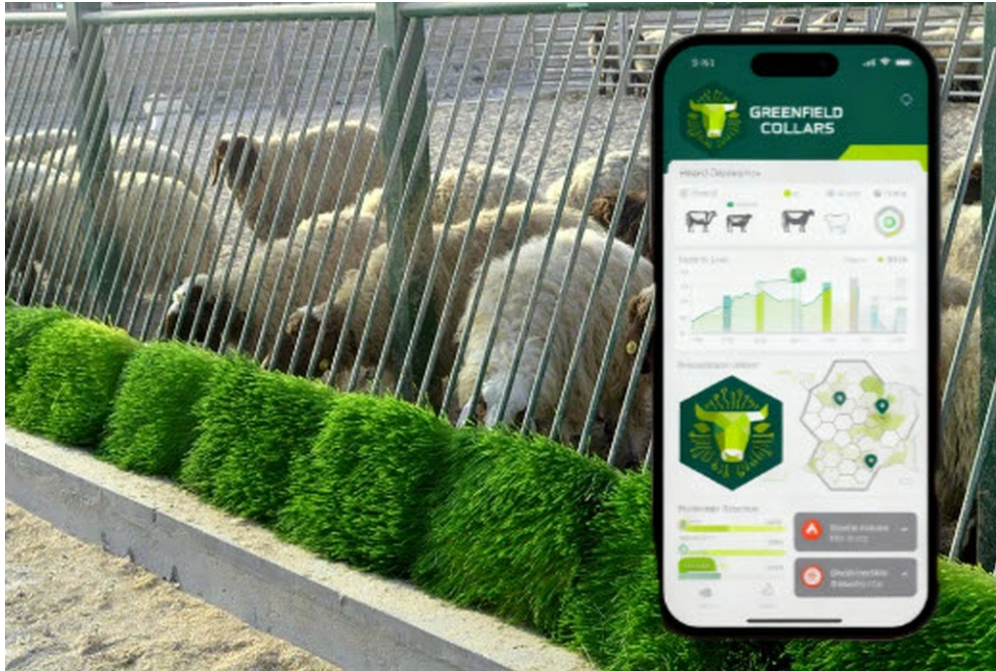
customer-designated herd with growth margin, a network switch and firewall, an uninterruptible power supply, an operator workstation, and a rack with cabling.

The software is organised in eight modules:

Module	Scope
1. Livestock Registry	Digital identification, collar assignment, groups and individual animal records
2. Real-Time Location Monitoring	Latest available positions on a map (currency depends on reporting interval)
3. Geofencing and Security	Virtual pasture boundaries, movement alerts, unauthorised exit notifications
4. Activity Analysis	Movement and activity patterns, dependent on supported collar sensors
5. Device and Battery Management	Collar connectivity, reporting schedules, battery indicators, diagnostics
6. Gateway Network Management	Gateway status, network statistics and network alarms
7. Historical Reports	Position records, movement history, connectivity events, configurable reports
8. Administration	User accounts, role-based permissions, configuration and data management

Dashboard. Authorised operators use a standard web browser to see total registered livestock, active and inactive collars, latest positions, battery status, network status, alerts, geofence violations, movement history, individual animal profiles and herd groups.

The hosting model (on-premise, cloud or hybrid), mobile apps, SMS or e-mail alerting and third-party mapping services will be confirmed with the client.



Illustrative concept: mobile monitoring view alongside the flock. Mobile app delivery is confirmed with the client.

Deployment and acceptance

GREENFIELD delivers the system on site in six phases:

1. **Mobilisation and planning** — project coordination, infrastructure assessment, final network deployment plan.
2. **Infrastructure installation** — gateways and central station installed, backhaul integrated.
3. **Device deployment** — one collar per sheep in the customer-designated herd, registered and assigned to individual animals; collar fitting supervised.
4. **Software configuration** — platform, geofences, alert rules and user accounts set up.
5. **Testing** — connectivity, system verification and end-to-end data transmission tests.
6. **Training and handover** — operator training, technical documentation, commissioning and handover.

Acceptance testing. The system is accepted against documented tests run jointly with the client: device registration, GPS positioning, collar-to-gateway and gateway-to-station communication, device status, alarms, geofences, dashboard, data storage and retrieval, initial coverage assessment, and operator acceptance. A signed System Acceptance and Commissioning Certificate closes the handover.

Deliverables at handover: final network plan, installed and configured equipment, populated livestock registry, test records, trained operators, user and administrator manuals, as-built network documentation.

Items for engineering validation and scope boundaries

Confirmed system scope	Confirmed during detailed engineering
Smart GPS sheep collars, one per sheep in the customer-designated herd	Final collar model, sensor set and certified radio band
Field communication gateways (number set by site survey)	Gateway locations, antenna heights and achieved coverage
1 central monitoring & communication base station	Hosting model and software licensing
Web dashboard with eight software modules	Backhaul method at each gateway
On-site installation, commissioning and training	Spectrum authorisation in the installation country
	Reporting intervals and resulting battery service intervals

Not part of the core system: predictive veterinary diagnosis, disease detection, AI analytics, and integration with third-party farm or national traceability systems. These can be assessed as later enhancements once the sensor technology and data are confirmed.

Client provides: site access, local permits, electricity, internet or backhaul availability, local operational support, and animal handling for collar fitting.

Next steps: confirm the country and farm site, carry out the RF site survey, select the final collar hardware, and agree the hosting model.

Contact

Allan M. Olbur

Chairman, Green Technology Global

Email: amo@GreenTechnologyGlobal.com

Phone: 224-425-9236

Web: www.GreenTechnologyGlobal.com