SageGuard Senior
LLC
Surveillance & Compassionate Care

Technical Data Sheet

SageGuard Senior is a distributed in-home elder monitoring system. Core functionality is fully independent of any third-party cloud service except HiveMQ (MQTT broker) and Pushover (notifications). Optional integrations expand the feature set.

SYSTEM ARCHITECTURE

The system consists of distributed ESP32-based sensors communicating via MQTT to a central rule engine, with a web dashboard accessible from anywhere and push notifications to caregiver phones.

- **Bed Sensor** — Xiao ESP32-S3, USB powered. Hosts the rule engine. Reads load cells and contact mat for bed occupancy, position, and weight.
- **Health Sensor** — Xiao ESP32-S3 with external antenna. Radar presence detection, environmental monitoring, iBeacon scanner.
- **iBeacon Fall Detector** — Waveshare ESP32-S3 LCD1.28 with onboard QMI8658 IMU. Battery powered, ~25 µA sleep current.
- **Panic Fob** — XIAO ESP32-C3 with single button. Wakes on press, publishes panic event, returns to deep sleep. Battery powered.
- **YoLink Monitor** (optional) — Xiao ESP32-S3. Polls YoLink cloud and republishes events to the local MQTT broker.

PRODUCT TIERS

Standard Tier

- **Radar:** LD2410 24GHz presence detection (presence, stationary, moving, distance)
- **Fall detection:** Waveshare iBeacon with QMI8658 accelerometer
- **Bed monitoring:** Sammons sensor mat for in/out detection
- **Environment:** Temperature, humidity, ambient light, sound level
- **Motion:** PIR motion sensor for general activity
- **Emergency:** Custom panic fob
- **Alerts:** Pushover notifications to caregivers
- **BOM cost:** approximately $60-90 per installation

Premium Tier (adds vital signs)

- **Radar:** MR60BHA1 60GHz mmWave (replaces LD2410)
- **Heart rate monitoring:** ~85% accuracy, 0.4-1.5m range
- **Breathing rate monitoring:** ~90% accuracy, same range
- **Sleep state detection:** awake/asleep, sleep duration, restlessness
- **Body posture:** AMG8833 8x8 thermal sensor classifies lying/sitting/standing via on-device Edge Impulse ML model
- **Fall precursor warning:** sitting-up detection in bed often precedes a fall — gives caregivers a heads-up before the event

- **Load cell bed monitoring:** 4 load cells via 2x HX711 for weight, position (left/right/center), and two-person detection
- **BOM cost:** additional $50-75 per installation

Optional YoLink Integration

- **Smoke/CO detection:** YoLink smoke/CO combo sensor
- **Door sensors:** wandering detection, particularly at night
- **Voice announcement:** YoLink SpeakerHub for in-home spoken alerts
- **Additional motion sensors:** bathroom, kitchen, other rooms
- **Polling latency:** ~5 minutes (UAC credentials). Real-time when CSID granted.

DETECTION SPECIFICATIONS

Bed Sensor (load cell version)

Weight capacity per side: 100kg / 220lb (4 cells, 50kg each, 2 per side)
Resolution: 24-bit HX711 ADC, ~10 gram sensitivity after smoothing
Sampling rate: 10 Hz with 10-sample moving average
Position accuracy: left/right/center after calibration
Two-person detection: total weight > 1.6x calibrated single-person

Fall Detection (iBeacon)

Method: hardware accelerometer state machine (free-fall → impact → confirm)
Posture classification: standing/sitting/lying via gravity vector
Broadcast interval: 30 seconds normal, 5-burst rapid on fall event
Battery life: ~40 days on 330 mAh cell at 25 µA sleep current
Range to receiver: typically 10-20 meters in a home environment

Premium Health Sensor

Heart rate range: 50-130 BPM, ~85% accuracy at 0.4-1.5m
Breathing range: 10-30 BPM, ~90% accuracy at 0.4-1.5m
Presence detection: up to 2.5m
Sleep monitoring: valid after 5+ minutes asleep
Thermal sensor: AMG8833 8x8 resolution, 7m max range, 60° FOV
Posture ML: Edge Impulse model trained on per-installation thermal data
Privacy: 64-pixel resolution makes face recognition impossible

Response Times

Fall to caregiver notification: 5-15 seconds
Panic button to notification: 3-5 seconds
Bed exit alert: 2-5 seconds
Inactivity alarm: configurable threshold (default 12 hours)
YoLink standard events: up to 5 minutes (polling latency)

INFRASTRUCTURE REQUIREMENTS

- **WiFi:** 2.4 GHz network with internet access (each sensor connects)
- **Power:** Standard USB power for main sensors. iBeacon and fob are battery powered.
- **Cloud services:** HiveMQ Cloud (MQTT broker) and Pushover (notifications). Both have free or low-cost tiers suitable for individual customers.
- **Bandwidth:** Negligible. Typical usage well under 1 MB/day per installation.
- **Caregiver phones:** iOS or Android with Pushover app installed.

PRIVACY AND SECURITY

- No cameras anywhere in the system
- No microphones recording speech
- 8x8 thermal sensor cannot identify faces
- Local MQTT data over TLS (port 8883/8884)
- No video or audio leaves the home
- Patient data is owned by the customer, not SageGuard

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