

TOWARDS AN OPEN AND INCLUSIVE CARE HOME

Concept note – SDRNode system for connected collective housing



OBJECTIVE: CONNECTIVITY

The main idea is to connect the care home, as a central node, to private homes, so as to collect signals from the sensors installed in those homes. This connectivity naturally also applies within the care home itself.

VALUE PROPOSITION

To ensure radio coverage within the care home and between the care home and private homes.

BENEFIT

To enable the care home operator and staff to focus on their care missions, relying on reliable data transmitted properly and securely. In short, the aim is to put people back at the centre of attention. To achieve this, data is regarded solely as an indicator of a condition or situation — nothing more.

General context

The care home in question comprises four floors and accommodates residents who require regular monitoring of their activities and wellbeing. To support this, a wireless sensor network is deployed to collect environmental data (temperature, humidity, presence, movement, door opening), health-related data (heart rate, activity, sleep), and safety data (fall detection, fire alarm, etc.).

Communication Architecture

The wireless sensors operate on different frequencies (868 MHz, 2.4 GHz) and use different radio protocols (for example LoRa, BLE, and proprietary protocols), depending on the intended use defined by each manufacturer. To ensure consistency and centralised supervision, all radio traffic is collected and analysed by an intelligent platform, with the SDRNode acting as the system's central orchestrator. It will be strategically located within the care home, where the density of radio communications is particularly high.

The SDRNode acts as a software and hardware hub capable of:

- | Identifying the different protocols active within the radio environment.
- | Decoding and classifying sensor frames according to their type and origin.
- | Determining the operational status of the sensors (signal presence, transmission frequency, RSSI level).
- | Communicating with and controlling a series of remote collectors deployed around the care home.

Antenna infrastructure

The main antenna system within the care home consists of a radiating cable forming an inter-floor loop. This configuration provides uniform coverage throughout the building and ensures reliable reception of health-related signals (heart rate, activity, sleep) and safety signals (fall detection, fire alarm, etc.), regardless of the floor on which the sensor is located.

Extension to individual homes

The SDRNode in the care home is connected to a number of nearby individual homes occupied by older people who are still living independently.

Each home is equipped with:

- | a set of wireless sensors used to characterise daily activities (waking up, mobility, sleep).
- | a local individual collector responsible for centralising the data from these sensors and forwarding it to the care home.

This collector acts as an intelligent interface: it has embedded processing capability and selects, according to the observed radio channel quality and the regulatory constraints set by the BIPT, the most appropriate transmission frequency and protocol for relaying the data to the main SDRNode in the care home.

Overall operation

1. The sensors installed in rooms and private homes transmit their data periodically.
2. The individual collector receives this local data.
3. The SDRNode assesses the radio environment and selects the optimal communication mode with the individual collectors to create a reliable backbone for data exchange between the hub and the remote collectors.
4. The SDRNode in the care home receives, classifies and stores the data flows, and raises an alert in the event of prolonged sensor inactivity or any detected anomaly.

System objective

The objective is to create a non-intrusive, interoperable monitoring ecosystem that complies with Belgian radio standards, in order to improve the quality of life and safety of older people while optimising sensor maintenance.

