HealthSonar: A System for Unobtrusive Monitoring of Elders and Patients with Movement Disorders

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The HealthSonar project's aim was:

**The development of an unobtrusive health monitoring system based on ultra-wideband (UWB) radar technology targeted towards elders and patients with sleep and movement disorders.**

The system was designed to be (1) unobtrusive, (2) privacy-preserving and of course (3) accurate.

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The prototype monitoring radar-based device of the HealthSonar system.
The HealthSonar system comprises the following three software components.

- The web dashboard
- The radar’s web portal
- The mobile application
The web dashboard is the main UI of the system used for:

1. Manually initiating and terminating recording sessions.
2. Manually selecting data for upload to the cloud storage.
3. Accessing telemetry data (logs) for connected devices.
4. Accessing system information (metadata) about each device.
5. Assigning users (e.g., elders, patients) to specific devices.
6. Viewing the connection status of each available device.
7. Managing the recorded stored data of all connected devices.
8. View reports and notifications for the health analytics.
The radar’s web portal

The web portal is a configuration and research tool used for:

1. Setting up the radar through Wi-Fi.
2. Configuring the settings of a device.
3. Initiating and terminating a recording.
4. Setting up a scheduler for a recording.
5. Accessing previously-stored radar data.
The mobile application is meant for the end users in order to:

1. Facilitates the initial setup of the system.
2. Present to the user the generated health metrics.
3. Initiate a Timed Up and Go Test for gait evaluation.
The System’s Functionality

The HealthSonar system is capable of...

- **Nighttime monitoring**
  1. Sleep apnea detection
  2. Sleep staging classification

- **Vital sign extraction**
  1. Heart rate extraction
  2. Respiratory rate extraction

- **Fall detection/alerting**
  1. Fall event detection
  2. Fall event alerting

- **Mobility evaluation**
  1. iTUG\(^1\) facilitation
  2. Gait metrics generation

\(^1\) An instrumented Timed Up And Go Test

Most of the HealthSonar’s functionality is based on presence detection which is run constantly.

It is a prerequisite for initiating the sleep monitoring or the fall detection pipeline.
The HealthSonar system stores and processes data both locally and on the cloud based on the application.

**Locally**
1. Fall detection
2. Gait evaluation

**Cloud**
1. Nighttime monitoring
2. Vital sign extraction
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Thank you!

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