Real-time Hallucinations Monitoring and Detection for Schizophrenic Patients

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Background

• People suffering from Schizophrenia experience auditory and visual hallucinations.

• Research shows that feedback and assurances will help patients cope with, and in some instances, reduce the frequency of hallucinations

Goal

• A system that monitors the patient’s environment, and provides immediate, real-time, feedback to whether what the patient is experiencing is a hallucination or real.

Related work

• HW: Commercial motion sensing products. Focus on security, surveillance, and home automation.

• SW: Apps for Schizophrenia patients with mood tracking, medication reminders, and activity planners.

About the project

• Stream motion and audio sensors readings to the cloud.

• Provide a companion app for live monitoring, history viewing, and system configurations.

• Allow for patient specific configurations (motion hallucinations only, sound hallucinations only.)
Hardware

Sensors Node
- Arduino Uno R3
- 3x HC-SR501 PIR Motion Sensor
- KY-038 Microphone
- Nordic nRF24L01+ 2.4GHz Wireless Transceiver

Master Node
- Raspberry Pi 2
- Nordic nRF24L01+ 2.4GHz Wireless Transceiver
Software

- FreeRTOS 8.2.3
- RF24 v1.1.5
- Libwebsockets v1.7
- WiringPi 2.31
- RF24 v1.1.5
- Heroku Platform
- PostgreSQL database
- Java 8
- Spring 4 Framework

Sensors Node  2.4GHz RF  Master Node  Web sockets  Cloud  Messaging Channel

- Message broadcast
- Web socket
- Subscribe

Client

- Java 8 backend
- Frontend:
  - Stomp 2.3.3
  - Sockjs-0.3.4
  - Highcharts
Results

Motion & sound monitoring (real-time and history)

- Instant display and visualization of motion and sound status in the environment.
- History of past activities. Timestamped for future cross referencing with hallucinations episodes.

Rang & Coverage

- Tests: RF transceivers (15 feet), motion sensing (15 feet), audio sensing (12 feet).
- 360° coverage using 3 motion sensors (arranged in triangle shape) and a microphone.

Two-way communications

- Configure sensors node from the companion app.
- Turn-off all monitoring, turn-off motion monitoring, turn-off sound monitoring, and adjust sound sensitivity.

Power optimizations

- Enter “power down” mode when monitoring is turned off.
- Use low data rate (250Kbps) and low payload (1 byte) to be able to use the minimum power setting for the RF transceivers.