🌙 Nightwatch

Open-source, non-contact epilepsy monitoring system for Raspberry Pi

Nightwatch monitors a sleeping child for signs of seizure activity using multiple non-invasive sensors. No wearables or contact required.

Features

- **Non-contact monitoring** - Nothing attached to the child
- **Multiple sensors** - Radar, audio, and bed vibration (BCG)
- **Real-time alerts** - Audio alarms + push notifications
- **Web dashboard** - Monitor from any device
- **Remote access** - Check on things while out (via Tailscale)
- **Open source** - Build your own, modify as needed

Sensors

Sensor	Detects	Hardware
Radar	Respiration rate, movement	HLK-LD2450 (24GHz mmWave)
Audio	Breathing sounds, vocalizations	USB microphone
BCG	Heart rate, bed occupancy	Piezo sensor under mattress

Quick Start

Hardware (~$130 for basic setup)

See SHOPPING_LIST.md for complete parts list.

Minimum:

- Raspberry Pi 5 (4GB)
- HLK-LD2450 radar module
- CP2102 USB-to-UART adapter
- USB extension cable
- Power supply, SD card

Software Setup

```
# Clone the repository
git clone https://github.com/yourrepo/nightwatch.git
cd nightwatch

# Install Python package
pip install -e .
```

```
# Run with mock sensors (no hardware)
./bin/mock

# Run with real hardware
./bin/dev
```

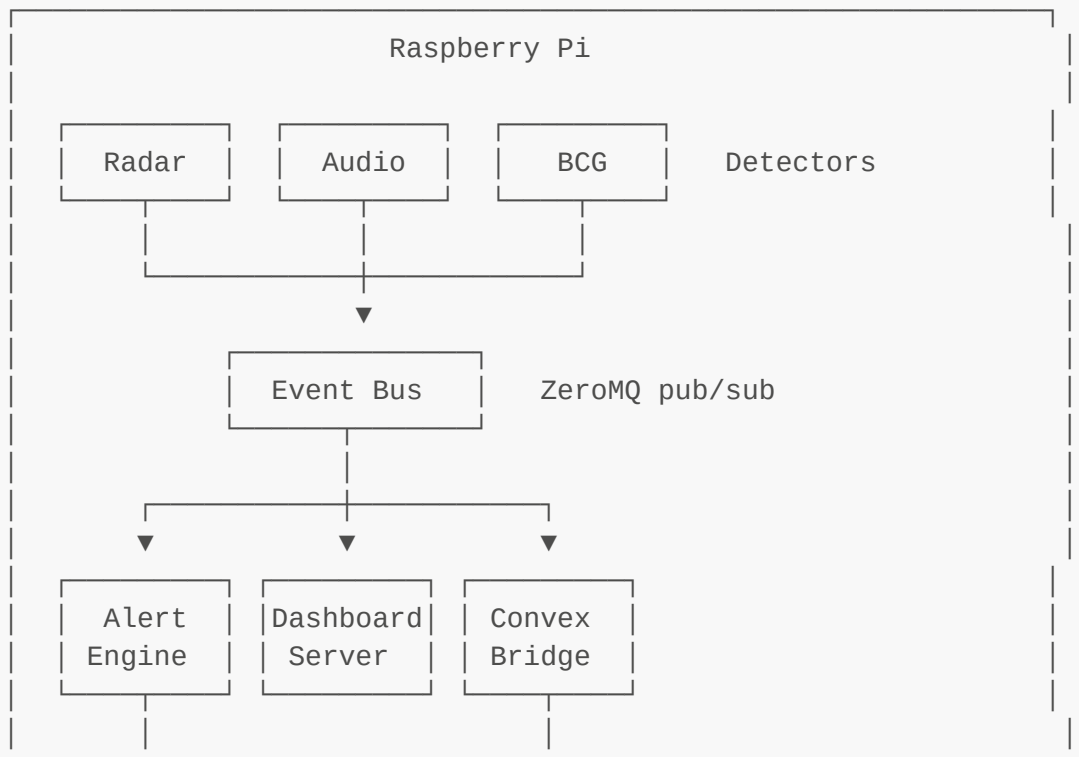
Dashboard

Open **http://localhost:3000** for the web dashboard.

Project Structure

```
nightwatch/
├── nightwatch/           # Python backend
│   ├── core/             # Event system, config, alert engine
│   ├── detectors/        # Sensor modules (radar, audio, bcg)
│   ├── dashboard/        # Built-in web server
│   └── bridge/           # Convex integration
├── dashboard-ui/         # Next.js dashboard
├── hardware/             # Hardware docs & 3D prints
│   ├── SHOPPING_LIST.md  # Parts to buy
│   ├── SENSOR_SPECS.md   # Technical specs
│   └── 3d_prints/        # Enclosure designs
├── config/               # Configuration files
├── tests/                # Test suite
└── bin/                  # Run scripts
```

Architecture



Configuration

Default config is in `config/default.yaml`. Key settings:

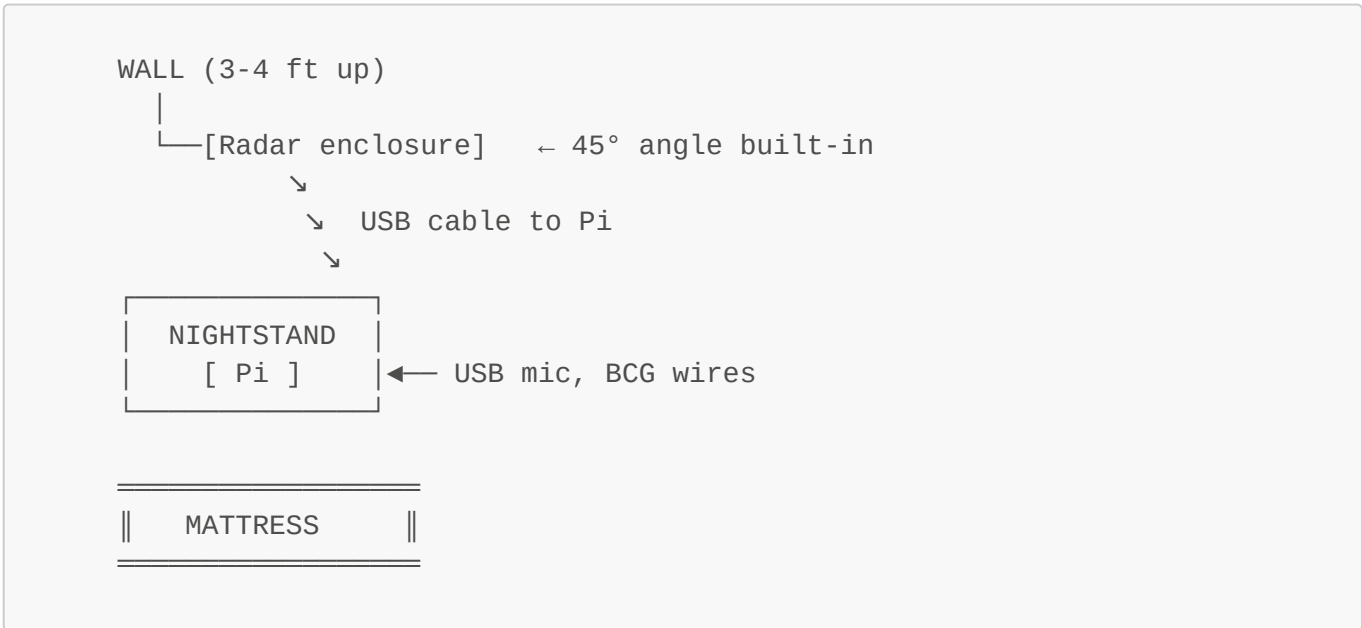
```yaml
detectors:
  radar:
    enabled: true
    device: /dev/ttyUSB0   # CP2102 adapter

alert_engine:
  rules:
    - name: respiration_low
      detector: radar
      condition: respiration_rate < 8
      duration_seconds: 15
      level: warning
```

Hardware Setup

Wall-Mount Radar

The radar needs to look down at the bed. Use the 3D printed enclosure:



See 3D print designs.

Remote Monitoring

For checking on things while out (dinner, etc):

1. Install Tailscale on Pi and your phone
2. Access dashboard via Tailscale IP

No port forwarding or cloud service needed.

Development

```
# Run tests
pytest

# Run with mock sensors
python -m nightwatch --mock-sensors

# Just the dashboard
cd dashboard-ui && npm run dev
```

Roadmap

- [x] Radar respiration detection
- [x] Audio breathing detection
- [x] BCG heart rate detection
- [x] Alert engine with rules
- [x] Web dashboard
- [ ] Push notifications (Pushover/Ntfy)
- [ ] Setup wizard (WiFi captive portal)
- [ ] Recording/playback for debugging
- [ ] ML-based seizure pattern detection

Safety Notice

⚠️ **This is not a medical device.** Nightwatch is an open-source project for monitoring and alerting. It should supplement, not replace, proper medical supervision. Always consult healthcare providers for medical decisions.

Contributing

Contributions welcome! This project exists to help families like ours. If you build one, find bugs, or add features, please share back.

License

MIT License - Use it, modify it, share it.

Built with love for Miles and families like ours.