

Review of a Multisensor, Low Cost, and Non-invasive Approach to Detect Movements in SIT and Sleep

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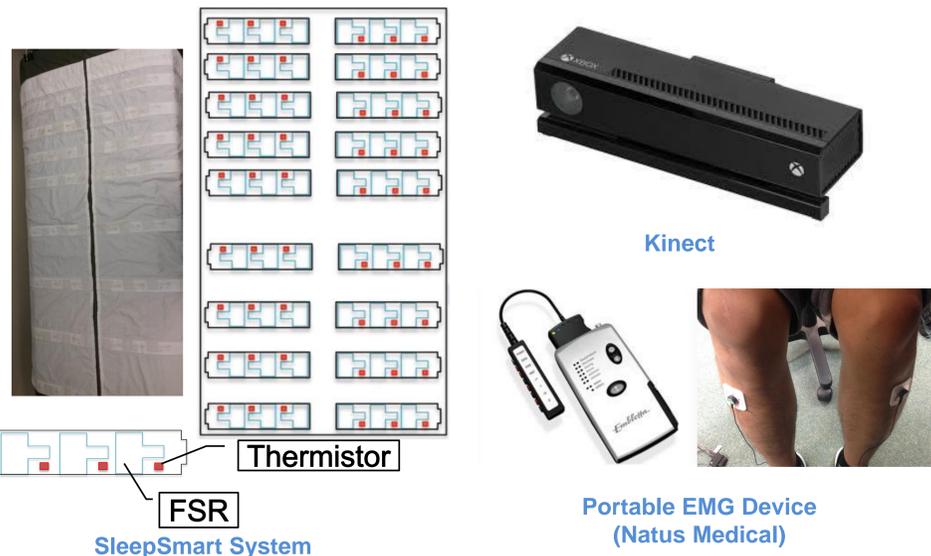
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Introduction

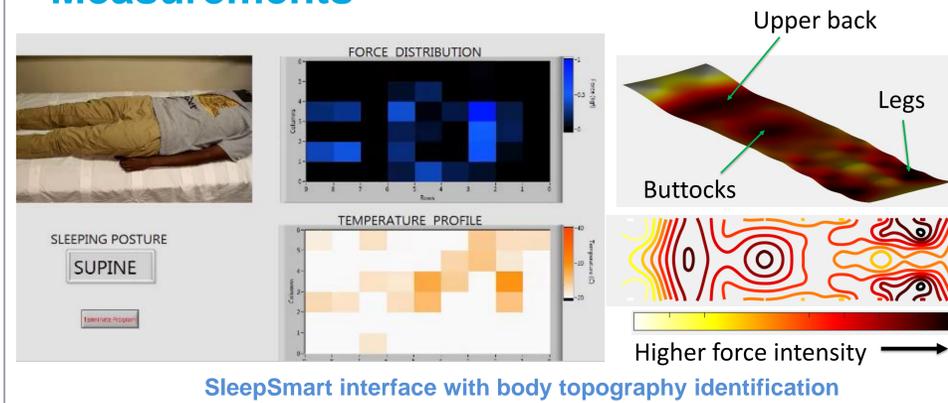
- Movement measurements in Suggested Immobilization Test (SIT) and sleep recordings are typically measured by polysomnography (PSG) with electromyography (EMG).
- However, PSG studies sometimes compromises natural sleep and is often restricted to short samples. Moreover, certain cohorts, such as children with NDDs have difficulties tolerating intrusive monitoring. PSG are also expensive and not easily accessible in certain regions.
- This poster introduces an approach to detect movements in SIT and sleep, and discusses about guidelines within the current measurement framework.

Methods

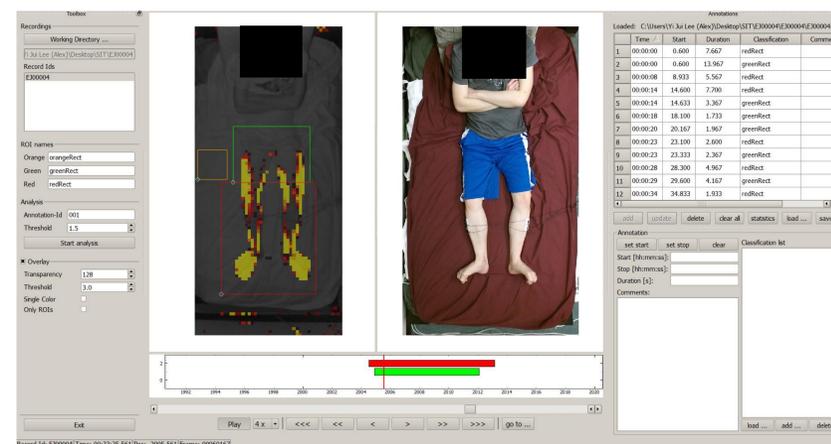
- 19 participants were administered the study (SIT and sleep). The subjects lay on an angled bed for 30 minutes and slept for up to 30 minutes.
- A combination of the Kinect videography system, a portable EMG device, and a mattress topper sheet fitted with flexible sensors (force and temperature sensors) were used to collect data from the subjects.
- Electrodes were placed on the tibialis anterior muscle on each leg.



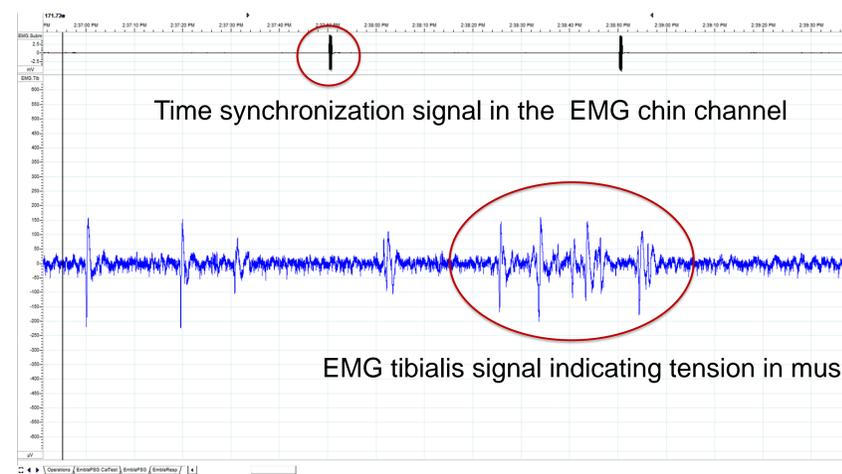
Measurements



SleepSmart interface with body topography identification



Videography interface with automated movement identification and event annotation



REMLogic software with EMG tibialis and timesync signal from EMG recorder

Key Findings

- **Pitfalls** in the EMG setup and study protocol were identified and corrected.
 - **Different EMG montage** (two electrodes configuration) were used for the tibialis anterior muscle to reduce noise from ECG artifacts.
- **Bit encoded timesignal was sent to the EMG recorder to allow for the synchronization of data** between EMG, videography and mattress.
 - The millisecond-level time stamping system will **support identification of movement characteristics (development and peak) for Periodic Limb Movements (PLMs)**.
- **Machine learning in the videography system enabled** the automated identification and annotation of movement events in recordings.
- **Control of external factors** - ambient light, clothing elements, and hardware setup is important to ensure video data integrity.
- New sensors will be introduced to the mattress sensor system to **improve sensing performance and incorporate detection of physiological signals (HR and RR)**.

Acknowledgement

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References

1. PSG Image: Wikimedia commons
2. Kinect Image: Wikimedia commons
3. Embletta Image: Natus Medical Incorporated

