

# Abstract

Since sensor systems are constantly shrinking in size and energy consumption, it has become possible to use them in various wearable sensor systems, measuring physiological parameters during daily tasks.

Sleep monitoring is one of the several possible areas where sensor systems can be used. Data analysis can provide useful information for the subject, helping him enjoy a more restful sleep, and diagnose minor health issues regarding sleep, with no aid of a medical professional.

Estimating the actual sleep phase may lead to a quantitative measure regarding sleep. Measured data can also be inspected by the subject, providing useful feedback when data and lifestyle parameters are juxtaposed.

Diagnosis of sleep apnea is traditionally done by an expensive and inconvenient sleep study (polysomnography). Non-life-threatening cases are believed to be present on a considerable percent of the population, and are – in numerous cases – left undiagnosed. It would be most preferable to diagnose these mild cases as well, however an expensive medical examination would be unnecessary and the apparent lack of symptoms would also make the subject reluctant to it.

Sleep quality is usually determined by a sleep study, also referred to as polysomnography or PSG. It is also possible for a patient to do simple measurements at home. These measurements are not near as accurate as a full PSG evaluation, but can be used as indicators.

This Thesis shows how microphone signals can be used for breathing pattern analysis, and a single 3D accelerometer can indicate the depth of sleep. Measurements are then processed in Matlab. Schematics for a complete design fulfilling the requirements for signal processing are described in detail. Test measurement of critical circuits are shown.