

Wireless Biosensors in Everyday Life: Quantified self meets the Internet of Things

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Presentation summary:

1. What is Quantified Self (QS) biosensors?
2. Advantage of QS biosensors
3. Sensor, algorithm and app turn-key solution
4. Showcasing devices
5. Showcasing projects
6. Challenges

1. What is QS biosensors

QS biosensors are sensors that track, quantify, and measure users' body conditions, for example heart rate, respiratory rate, glucose level, steps count, humidity, and temperature using wearable or portable sensors and turn them into electronic data in order to help people lead a healthier life.

2. Advantage of Quantified Self (QS) biosensors

2.1. Non-invasive sensors

- A single sensor for brainwave monitoring which only takes two to three seconds to wear
- An instant gel-free ECG measurement with a finger touch
- A biochip as small as 3 mm x 3 mm x 3 mm, which is believed to be the smallest biochip in the world so far
- Applicable to everyone and can be operated by users themselves

2.2. Continuous monitoring

- A plug-and-play device that generates easy-to-understand data
- A total solutions that combines activity tracking, biosignal tracking, such as brainwave, heart rate, EMG, muscle signals, pressure, etc

2.3. Meaningful data

The convenient device allows continuous monitoring of data and interpret into something everybody understands.

3. Sensor, algorithm and app turn-key solution

3.1. Chip and sensor

Start with a chip that is small, fast, powerful, robust enough to get real-time biosignals.

3.2. Device

Design a comfortable, stylish, easy-to-wear, and robust device that users are willing to wear long enough to collect valid and continuous data for further analysis.

3.3. Analytics

Interpret advanced biosignals like stress level or mental states by recording users' cognitive load using algorithm to harvest hidden information behind. The idea is to create a biosensor that can sense conditions of a human body and adaptively change the system. For example, a computer detects level of cognitive load from its user, and adaptively changes the level of automation: it operates in a manual mode when it detects that users wants to have more control; or changes to an automation mode when user is tired.

3.4. App

Develop an app that operates in a close-looped flow, which is an important user-oriented gateway to connect device with users.

4. Showcasing devices

4.1. *Cardiowave (ECG) measurement*

4.1.1. Life Beat™

Sensing ECG with a touch of finger and reminding user to undergo further checkup if data abnormality is observed.

4.1.2. CardioStik™

Sensing cardiac circulation with the placement of two fingers on the device.

4.2. *Brainwave (EEG) measurement*

4.2.1. mindwave™ mobile

Sensing brainwave with only three elements: the biosensor, the chip, and the algorithm in form of SDK.

4.2.2. necomimi™ Brainwave Cat Ears

Detecting emotion and presenting it by raising or dropping the ears.

4.2.3. Application in education

To cope with the phenomenon which students being evaluated by scores doing the same task, personalised education is made possible with the help of brainwave readers.

If the device senses the cognitive load or mental effort of the lower-scored students, teachers will have a better idea of whether the materials are too difficult for them or they are simply not working hard enough. Vice versa for the higher-scored students. Eventually, the observation helps teachers to adjust the materials or teaching methods, which help students learn more effectively.

5. Showcasing projects

5.1. ALS patient enabler: Think-typing

It restores communication and control ability of ALS patients with Brain-Computer Interface (BCI) technology as users can type by thoughts alone. Whenever the target letter flashes, the users think to themselves “yes”, then the device captures their thought to generate a letter, a word and eventually a sentence. BCI senses the brain signals when users classify the target or non-target characters. With the same operational protocol, BCI can also enable smart home control. For example, a Chinese electrical appliances company is using a blink to control television volume.

5.2. Insurance company enabler: Stress level measurement (ECG monitoring system)

As stress is one of the triggering factors to many diseases, an insurance company cooperates with NeuroSky by giving its clients a device to detect stress level. The continuous monitoring of data does not only help clients to prevent from cardiovascular diseases, but the algorithm also assists the insurance company to suggest the most customised insurance plan.

The device only takes a biosensor, the biochip, a waistband, and an app. Data collected is automatically stored in a cloud system. Dr Mak claims that whoever owns such data can conquer the field eventually.

5.3. Music industry enabler: Auto song detection

Songs are selected by users’ brainwaves through biosensor, which detects users’ real-time enjoyment level and emotional status while listening to a song. When the system detects a good mood, the song continues to play; otherwise, it skips to the next song automatically. As man-and-machine interface is not prevalent in the market yet, Dr Mak sees positive outlook on such connection between men and machine.

6. Challenges

6.1. Sensor variability

Continuous monitoring has made easy and cool using a small chip. However, the future calls for more than that with rising demand on healthcare.

Solution 1: Smart clothing

Composed by sophisticated biosensor module, IoT platform, and conductive textile, users can wear it like regular clothing to collect continuous data, and observe body conditions through an app.

Solution 2: E-skin

A flexible and stretchable skin-thin sensor is designed for continuous monitoring. Although it is still developing in an early stage, Dr Mak foresees it to be the future of biosensors.

6.2. Connectivity

To consume less power, bluetooth is preferred to other wireless options. However, it is limited to connect to seven devices at maximum, calling for a multiple user applications.

The end

To learn more, please visit the presentation video at [here](#).