



Insight commercial case studies

Sector: **Health**

Insight

Centre for Data Analytics

Correlating physiological signals with glucose levels



InsulCheck works with Insight to research new methods for noninvasive monitoring using wearable sensors to help diabetics manage insulin levels

Executive Summary

Challenges

InsulCheck was founded to help people with diabetes avoid double-injecting by using a clip-on device that records the time since the last insulin injection. The company wants to expand this capability further to identify new methods for noninvasive monitoring of blood glucose using wearable sensors to include:

- Research on noninvasive wearable sensor to monitor blood glucose levels
- Detection in patients with diabetes of hypo-glycaemic episodes

What Insight Delivered

Insight conducted a research project to explore available technologies for noninvasive monitoring of blood glucose levels to include:

- Identification of a range of physiological signals sensitive to glucose
- Monitor physiological signals using wearable technologies
- Use data analytics to correlate signals with glucose levels

Measurable Impacts

The project provided proof-of-concept for the development of noninvasive monitoring using wearable technologies:

- Identified correlation between physiological signals and glucose levels
- Identified effect on electrical muscle activity due to changes in blood glucose levels



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Background

Diabetes is a long-term condition (LTC) in which the body is unable to control the level of blood glucose. Type 1 diabetes occurs when the immune system destroys the insulin-producing cells. It is sometimes known as juvenile diabetes or early-onset diabetes because it usually develops before the age of 40, often during teenage years. Type 1 diabetes is managed best with intensive insulin therapy e.g. 4-6 injections of insulin each day or by using an insulin pump to deliver insulin throughout the day via a cannula. This maintains glycaemic control and prevents the occurrence of complications. However, double-injecting insulin by mistake when you have Type 1 diabetes can lead to a hypoglycaemic event. Technology can be used to supplement healthcare provided to diabetes sufferers care by providing both educational and motivational support.

The device currently provided by Insulcheck removes the doubt for insulin pen users while offering their care team an extra level of security as their patients deal with their complex condition. Using a simple, light, add-on that clips to their existing pen, the time since the last injection is recorded on a digital display. This project seeks to expand this capability further to identify new methods for noninvasive monitoring of blood glucose using wearable sensors.

Solution and Outcome

The project looked at non-invasive methods for monitoring blood glucose levels initially in healthy individuals. Insight identified a range of physiological signals, which could potentially be monitored noninvasively using existing wearable technologies, to provide a robust and reliable estimate of blood glucose levels in diabetes patients. The range of physiological signals examined includes: electromyographic (EMG), electroencephalogram (EEG), electrocardiogram (ECG), accelerometry, pulse, skin temperature and galvanic skin response (GSR) data. Electrophysiological signals were also measured noninvasively and blood glucose levels were simultaneously recorded using a glucose monitor. A range of features was then extracted from the physiological data and the correlation between various features and blood glucose was explored to identify a set of features closely correlated with blood glucose levels. In particular, Insight examined for the first time the effect of changes in blood glucose levels on the electrical activity of muscle, as detected in the surface EMG signal. The next phase of the study will involve measurement of physiological variables and blood glucose in individuals with Type 1 Diabetes.

InsulCheck

For further details see InsulCheck.com

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"Working with Insight has allowed us to accelerate our research goals in diabetes, drug adherence and condition management while also giving us access to the many talented people and facilities at Insight."
William Cirillo, Technical Director

