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Blog

Wearable Biomarker Detection

Posted: *August 13, 2014 by Justin*

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There's a lot of activity in the mHealth sector around the treatment and monitoring of diabetes. The key to this activity is the ability to monitor blood sugar levels in order to alert people with diabetes to subtle but important changes in blood chemistry. Biomedical engineers are creating a wearable that achieves this which could also be used to help anyone with a variety of other ailments, such as high blood pressure or lung disease, that express specific known biomarkers.

For example, according to the University of Michigan who are developing the device, acetone is a biomarker for diabetes that can be detected and monitored accordingly.

The proposed wearable uses a technique called heterodyne mixing to enable a nonoelectronic graphene vapour sensor to detect different biomarkers from the skin surface. It works by identifying what

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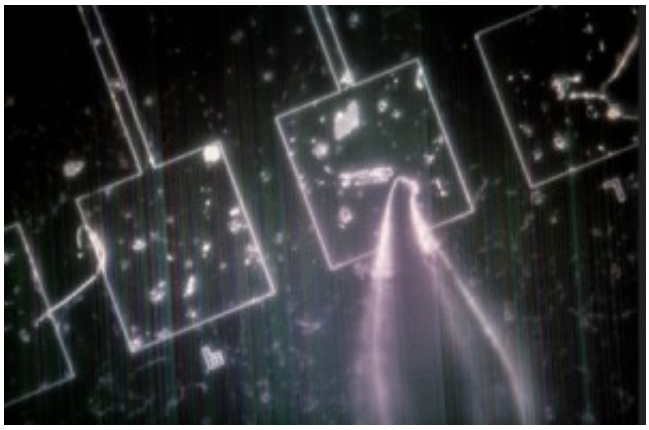
happens when dipoles for a specific biomarker interact with the sensor. A similar system relied on detecting the change in charge that occurred when molecules bind and change the charge density of the sensor. It was too slow, so heterodyne mixing was introduced.

The sensor is made using graphene. Graphene is a material made from nanotubes which are super strong, flexible and conductible. Samsung has already investigated using graphene as a substitute material for it's on wearables. Graphene allows the sensor to detect molecules that are present at several parts per billion and ensures that the wearable responds in tenths of a second rather than hundreds of seconds experienced using other materials.



A magnification of the sensor. The sensors allow for the measuring of different biomarkers, whereas other sensors can only read for one type of biomarker.

As well as being able to detect acetone the Michigan developed wearable is able to detect abnormal nitric oxide and oxygen levels that could indicate anaemia, high blood pressure or lung disease. The device is able to pick up the chemical biomarkers from a persons breath but, importantly, can also detect such biomarkers from contact with skin – an extremely important capability for wearables.

The technology is not new but the Michigan team's breakthrough is in how they've managed to shrink it down, speed it up and develop a wearable thanks to the innovative use of graphene.
Regarding the technique, collaborator Zhaohui Zhong predicated: "With our platform technology, we can measure a variety of chemicals at the same time, or modify the device to target specific chemicals. There are limitless possibilities."

Additional ideas for usage of the technology include detecting chemical leaks in laboratories and accumulating pollution statistics if members of the public wear the device.

The potential of such a device to offer preventative disease detection by alerting the person wearing the device to telltale new biomarkers could be a game changer for health management in the future.

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