

Revolutionary photonics-based medical devices

The innovation of photonic technology in medical devices provides several advantages

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PHOTONICS is the physical science of light (photon) generation, detection, and manipulation. Its application is wide-ranging in all areas, from everyday life to the most advanced science, such as telecommunications, information processing, agriculture, military as well as medicine.

Photonics in medicine cover areas such as health monitoring, vision correction, endoscopy and even surgery. It is changing the current medical practices for the better.

The innovation of photonic technology in medical devices provides several advantages. One of the main benefits is that it preserves the integrity of the biological cells being examined. Other advantages include providing sensing and imaging at the molecular level and also a collection of multidimensional data for evaluation.

According to the MIMOS Berhad's (MIMOS) Head of Photonics Technology Lab, Zalhan Md Yusof, technologies based on light are generally non-invasive and non-intrusive, with less effect on the integrity of living subjects. It can also easily be applied on site.

"When it comes to photonics technology in medical devices, people are looking to go small, go home or go for the most convenient."

MIMOS has been into biomedical sensor developments for the past 11 years. "At MIMOS Photonics Technology Lab, we have been doing applied research and development (R&D) in biomedical sensors for the past 11 years and it involves R&D activities in medical devices for different areas of applications."

The scope of R&D includes sensor design and architecture; optics component and light spectrum identification; light manipulation to collect signal; sample characterization; spectrum processing and algorithm development; opto-electronics and firmware design and architecture; and opto-mechanics study.

MIMOS photonics medical device developments

The first revolutionary device developed by MIMOS is the blood glucose



The Mi-Flobo provides multiple vital sign readings.



The GlucoSenz is a non-invasive blood glucose monitoring device.



Zalhan Md Yusof

monitoring device. The current practice of monitoring blood glucose requires pricking the patient's finger to withdraw blood and putting it into a strip for testing. Some diabetic patients need to monitor up to three times a day.

"We came up with a medical device which will make it easy for daily blood glucose monitoring as well as for people who are afraid of the needle.

"The blood glucose monitoring has three major properties. First, it is non-disruptive as it evaluates the property of the sample without causing any damage to the sample itself.

"Secondly, it's non-intrusive and pain-free, whereby it only requires flashing light to the finger and finally it's non-invasive as it does not require any penetration to the sample by pricking or cutting."

The second medical device developed in MIMOS, collaborating with UKM Dental Faculty, is the DSPP detection device.

The current practice of DSPP detection uses the enzyme-linked immunosorbent assay (ELISA) diagnostic tool. The drawbacks of this technique include the requirement of time, expensive equipment and expertise for operations.

"With the On-site DSPP Detection

Device, we can test on-site, and we are looking into reduced testing time to produce results in less than a minute."

Another photonics medical device in development is the multi-parameter vital sign screening device.

In the current practice when visiting clinics or hospitals, patients are required to measure their vital signs - pulse rate, oxygen saturation (SpO2), body temperature, respiration rate and blood pressure. Each parameter requires different equipment and devices, which consequently is time-consuming.

"We are looking into using one single device to measure all these parameters. We call it Single Measurement Multi-parameter Vital Sign Screening Device."

It is a single-point scan at the temporal that measures all the five parameters. It is also Internet-of-Things (IoT) enabled, whereby the data can be transferred to cloud and can be monitored via mobile apps.

Smart jewellery accessories

The next device development is the functional near-infrared spectroscopy (fNIRS) portable system for Neuroimaging analysis, a quantifying method for mild cognitive impairment (MCI). The device is to be used for screening and early detection of MCI and Alzheimer's.

"In the sports science area, we have the Muscle Oxygen mapping, which is a tool that can monitor muscle oxygenation."

"With it, we can also do athlete analysis, which includes monitoring their muscle analysis, heart rate variability, aerobic and anaerobic baseline," she said, adding that it is targeted to optimize sports training load and recovery analysis.

Finally, MIMOS is also working on smart jewellery accessories with integrated sensors, which function to measure step counts, calories burned and UV exposure.

"The smart jewel, designed specifically for women is IoT enabled which allows it to integrate with the healthcare system and mobile apps. It also has an added feature where it suggests a suitable cream SPF level for skin protection based on the UV exposure measured."

Zalhan made a presentation on 'Photonics in Medical Devices: Revolutionizing the Current Practices' at the MIMOS Talk Series organized by MIMOS.

The MIMOS Talk Series is available for viewing at MIMOS Malaysia YouTube channel (<https://www.youtube.com/MIMOSMalaysia>). — *The Health*

MIMOS Talk Series.

