Toward Development of an IoT-based Portable Sensor System for Disease Detection from Human Breath

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Project Goals

Canines can be trained to alert the subject with type 1 diabetes when the subject suffers from a hypoglycemic attack. Here we aim to design and develop a nanosensor system that can replace the diabetes alert dogs and alert the patients more accurately at low cost.

Aim 1: Design, fabricate, and test nanomaterial-based sensor arrays to detect volatile biomarkers related to hypoglycemia from breath.

Aim 2: Develop a portable internet of things (IoT) based smart sensor system that integrates the nanosensor array and performs signal conditioning, amplification, data analysis and communicate with patient and/or caregiver.

Introduction

- Nanomaterial based sensors can detect volatile organic compounds (VOCs) linked to hypoglycemia from simulated breath.
- The sensors show sensitivity in humid environment and selectivity towards specific VOC in a mixture.
- IoT based system can read values of resistance change from sensor and display the results on computer.

Sensor System

Sensor System Components
- Arduino microcontroller with Bluetooth
- Multiplexer
- Signal amplification and preprocessing circuit
- 8 sensors with connector

Fig 4 Schematic of sensor system

Results

Sensor Development and Testing

Gas Sensor Development
- Photolithography
- Sensor fabrication

Experimental Set-up

Selective sensors in humid environment
- System with linear response to sensor resistance change
- Portable system with compact design

Fig 5 Sensor response to simulated breath

Fig 6 Sensor system performance when simulated on software and tested with resistors

Fig 7 HypoAlert: Smart sensor system prototype.

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