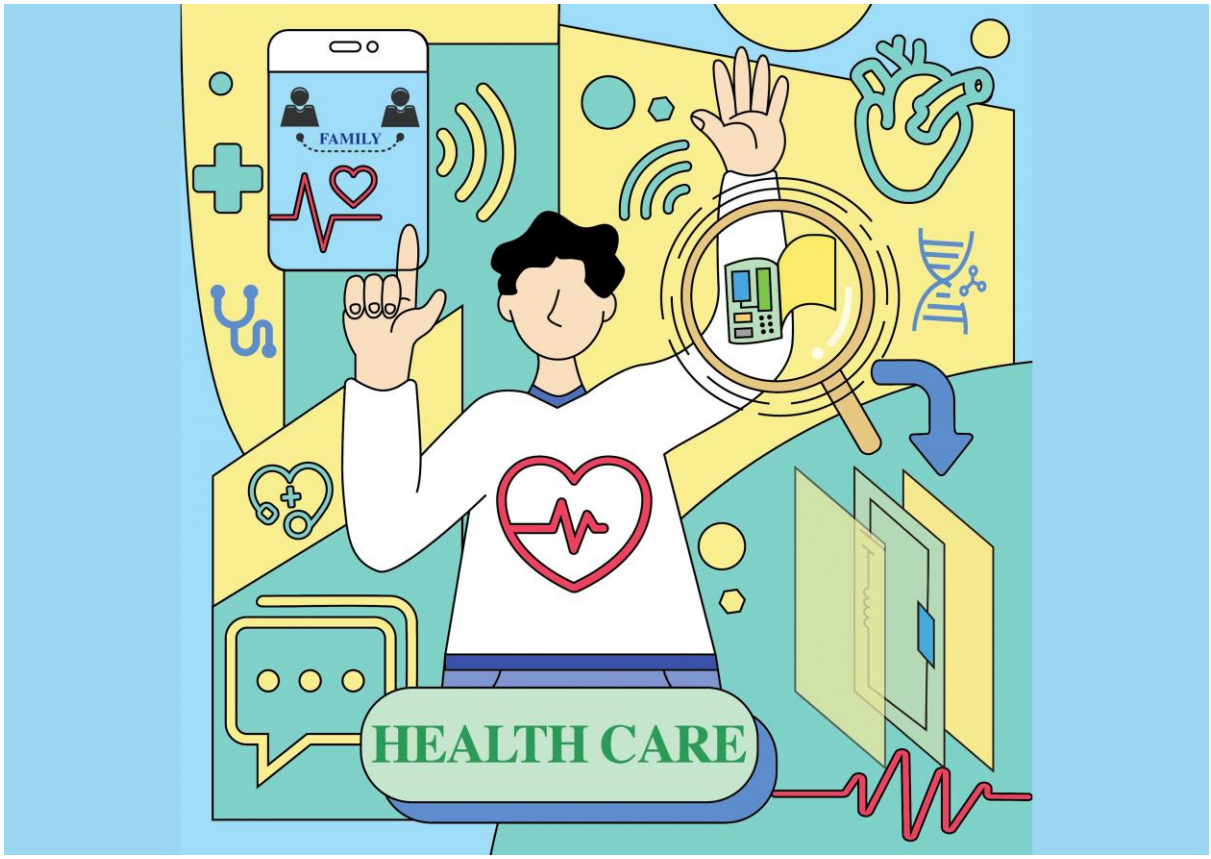
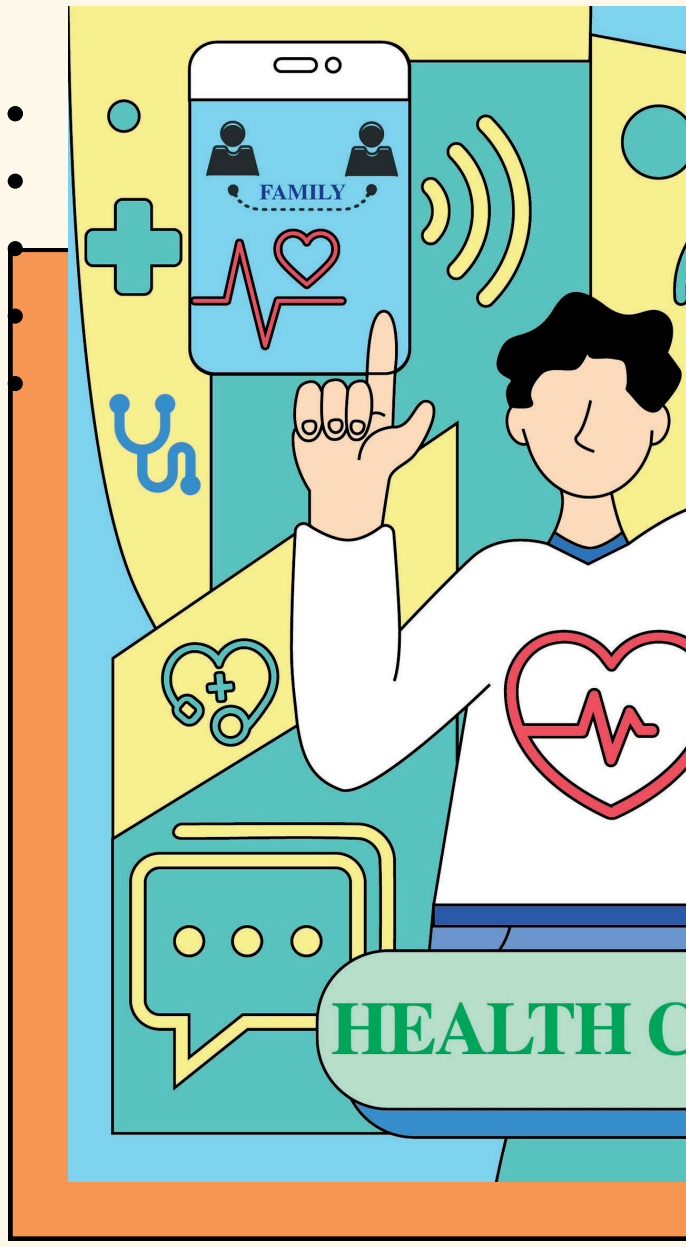

FAMILY
HEALTH CARE

12-May-2023

Flexible wearable e-textiles for home healthcare monitoring using IoT technology

Introduction

The need for health monitoring has been gradually extended from the medical environment to people's daily life. The detection system of physiological signals (such as ECG, EEG, blood oxygen, etc.) made of e-textiles is becoming the application trend. The signals are collected, processed and transmitted in a unified way using the IoT technology to achieve the functions of long-term monitoring, remote diagnosis and automatic prediction and alarm. The combination of flexible wearable e-textiles and IoT not only meets the requirements of signal processing, but also conforms to people's clothing habits.



In this research, we focus on sensor-based monitoring systems that collect various data from people as well as diagnostic devices and mine this data for efficient and real-time healthcare monitoring and IoT healthcare systems that provide effective monitoring and tracking and help improve the management of people's resources. (Sureshkumar Selvaraj 2020)

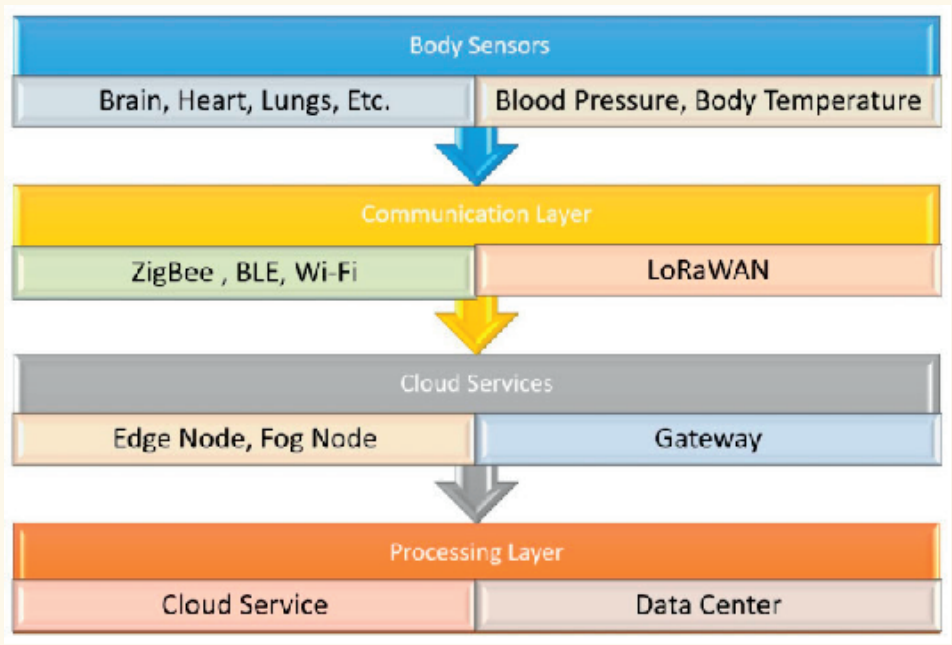
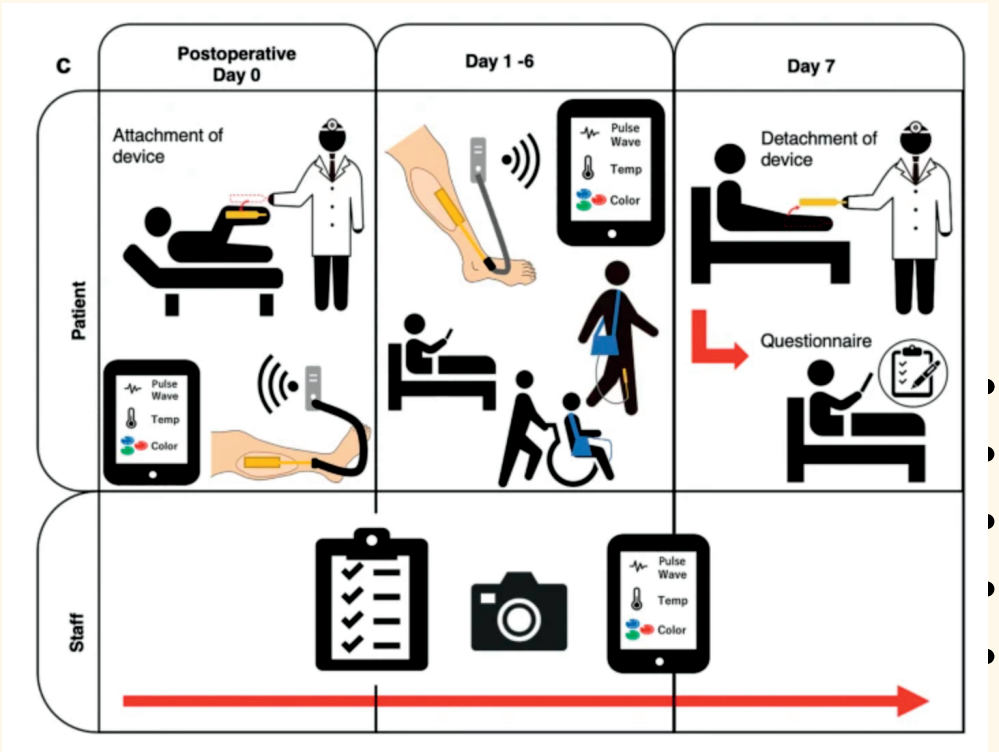


Figure 11 A brief overview of IoT-assisted wearable sensor systems for healthcare monitoring(Shwetank Dattatraya Mamdiwar et al., 2021)



The combination of electronic devices and textile materials provides flexibility and comfort.

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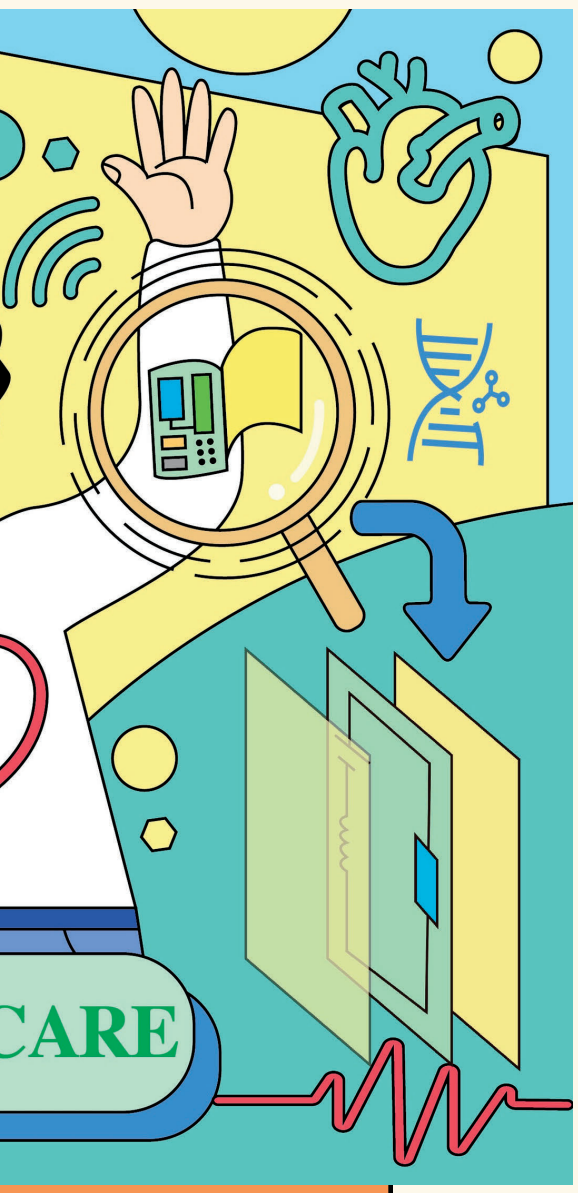
KEY WORDS

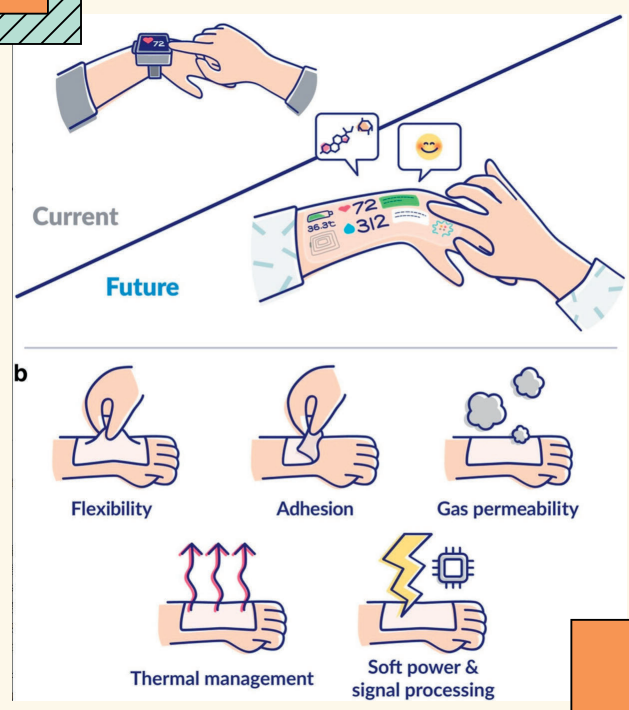
Home healthcare monitoring
Internate of Things
Textile-based wearable Technology

Future market analysis



A. Telemedicine Market

Telemedicine can help medical staff or medical teams to check the health status of subjects remotely.
With the development of telemedicine, people may have the opportunity to acquire health care that is more efficient, better co-ordinated and closer to home. Users can be seen online from anywhere, such as at home or in the car, and online visits do not require any travel arrangements. (Mayo Clinic Staff, 2023)
With the advent of the post-pandemic period, users of all ages are placing increased importance on monitoring their body's daily condition.Telemedicine systems equipped with textile-based sensors have gained a huge advantage in this market because of the comfort they offer.



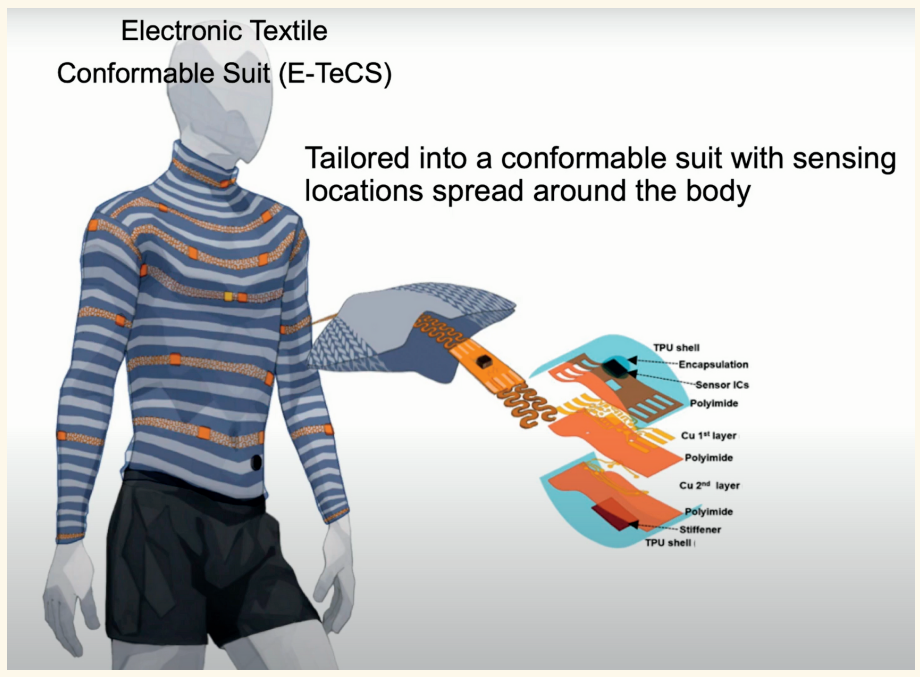
The benefits of textile-based weable devices

Better wearing comfort.

Innovations in medical structures

B. Wearable Market

The wearable healthcare market has entered a booming and competitive phase with the progress of electronic technology in recent years. The market is currently characterised by rapid product innovation and fierce competition. Based on the presence of highly established service providers and the continued interest in maintaining good health, more " sensory-free " everyday use has become a popular race track in this market.
However, it must not be overlooked that further research and development is still needed to determine whether new materials and new forms of sensors can be used for higher precision medical monitoring.



The combination of electronic devices and textile materials provides flexibility and comfort.

The development of IOT in wearable flexible e-textile

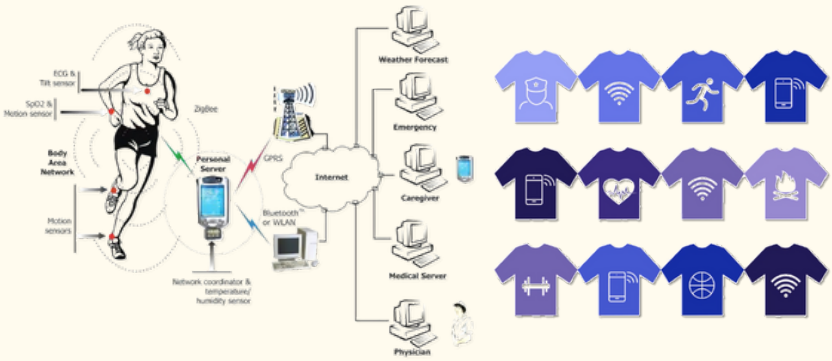
Jiapeng Wang
10930649

Introduction to macro topic

Flexible wearable e-textile for health monitoring using IoT technology，This is a technology in which physiological signals are collected by flexible wearable electronic textiles and then uniformly processed and transmitted through the Internet of Things technology to realize long-term health monitoring, remote diagnosis and automatic alarm prediction.

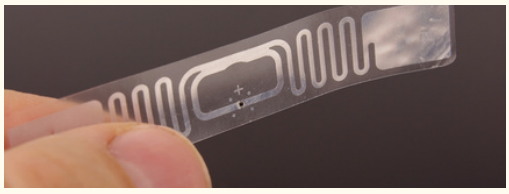
Micro solution and evidence

In terms of health detection, the IoT uses the link between electronic devices and sensors to detect a person's heart rate respiratory rate, breathing volume activity status and sleep. These can be used to detect the health status of people at home during leisure.（Ebling, 2016）



The IoT can be used not only to monitor the health of people at home during leisure time, but also to detect the movement of people during outdoor sports, people working in extreme conditions and high-risk environments. For example, it can take hours or even days for news of a mountain climbing accident to reach search and rescue teams, and for searchers to determine where the accident occurred, which is dangerous. By monitoring climbers' vital signs in real time through smart clothing and monitoring their location with the Internet of Things, their survival rate can be greatly improved.（Garg et al，2021）

The IoT can do much more than this. In terms of fashion, the rfid function of the IoT is also useful in supply chain management to manage the supply chain and reduce counterfeit products. With RFID chips, information can be stored not only about the product in which the tag is embedded, but also for inventory or identity verification, and also for customer information. This data may include information provided in the uncomfortable labels currently attached to the garment, or even details of the date of purchase, thus eliminating the need for sales receipts.（Alonso-Gonzalez et al，2019）



reference

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Garg, R. K., Bhola, J., & Soni, S. K. (2021). Healthcare monitoring of mountaineers by low power wireless sensor networks. Informatics in Medicine Unlocked, 27, 100775.

L. Alonso-Gonzalez, et al , "Multifunctional Fully Textile-Integrated RFID Tag to Revolutionize the Internet of Things in Clothing [Wireless Corner]," in IEEE Antennas and Propagation Magazine, vol. 61, no. 3, pp. 104-110, June 2019,

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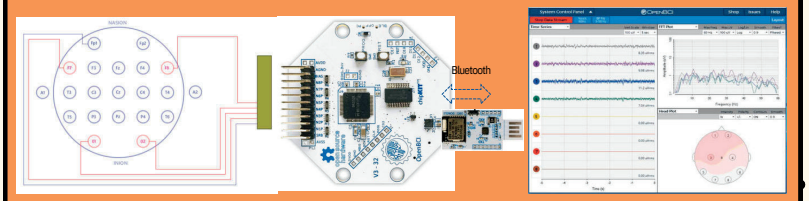
Textile-based EEG sleep monitoring Headband

From Vision to End-use

In the telehealth market, monitoring systems for physiological signals (e.g. ECG, EEG, blood oxygen, etc.) made of electronic textiles are becoming a trend of application. The content of this report is precisely to present a few studies on a daily monitoring system of EEG in the home sleep environment, to propose a concept for textileised electrodes and to test the performance of the electrodes in use, as well as to propose a concept for a whole home EEG monitoring system.

The aim of this brainwave detection system is to enable remote, real-time collection and early warning of abnormal sleep conditions, particularly during the N3 stage of sleep, and to enable data collection and recording. The main purpose of this data recording is to help the subject and their family or hospital to get an objective picture of the subject's sleep condition. It provides the doctor with an additional diagnostic basis for the physiological and mental state of the monitored person during subsequent treatment. The data obtained can be used to assist the doctor in medical diagnosis, medication control and follow-up of the patient's condition. (Uusberg, A. et al.,2013)



Flexible electrodes in the headband

OpenBCI open source hardware

EEG acquisition and analysis software

The experimental focus in this report concentrates on the enhancement and development of EEG sensors in terms of comfort and practicality.

Embroidered electrodes (forehead)

Plain weave electrodes

pictures owned by the author

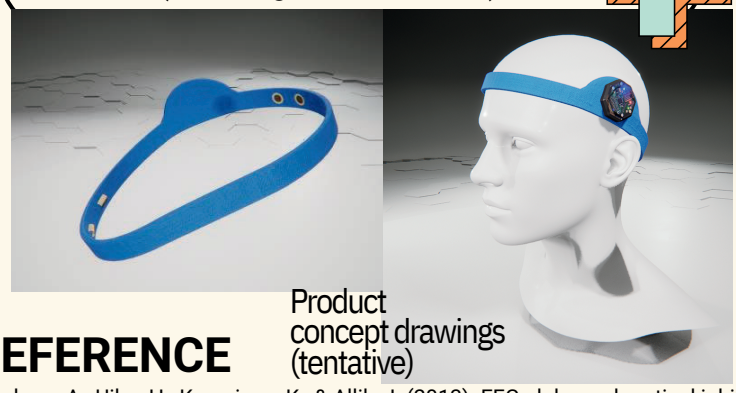
Tufted electrodes (O1,O2)

Feasibility of fabric electrodes:

- *Technical feasibility (impedance and contact impedance)*
- *User acceptance (comfort)*
- *Expandability (product upgrade methods)*

The advantages of textileisation of the Sensor:

- Dry electrodes are the trend of the future
- Flexibility leads to a better fit, reducing body curvature and movement discomfort and increasing comfort during sleep
- The shape of the electrodes has been modified to take advantage of the properties of the textile material, making them more suitable for environments with hair.



Product concept drawings (tentative)

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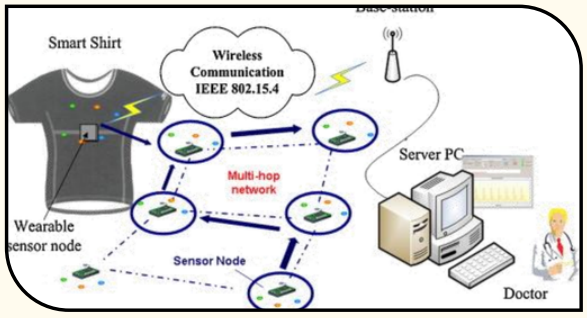
The Development of Non-invasive Sweat Blood Glucose Monitoring Sensor

Written by: Zhiyue ZHANG 10930183

A. Introduction to macro topic

Flexible wearable e-textiles for health monitoring using IoT technology are an innovation that allows for continuous monitoring of vital human signs in ordinary contexts (work, home, physical activity, etc.) or clinical situations. It offers the benefit of minimising the pain and disturbance to regular human activity associated with traditional testing (João J. Ferreira et al., 2018).

With the rising interest in wearable devices and IoT technologies, research efforts into non-invasive monitoring technologies have increased. This shows promise for the development of non-invasive sweat glucose monitoring sensors.



B. Outline of micro solution and evidence

There are three known ways for determining glucose: Invasive, Minimally invasive and Non-invasive methods. Currently, used glucose tracking techniques, such as finger prick blood tests, are often intrusive. However, this is not a continuous monitoring strategy and can be painful or potentially and microbially infectious to the users. With technological advances, collecting and assessing glucose levels in biological fluids such as sweat, tears, tissue fluid, and saliva are now possible. Sweat-based non-invasive glucose sensors, on the other hand, are thought to be one of the least invasive ways for indirectly assessing glucose levels.

<u>The scientists believe:</u>

- Creating an entirely non-invasive blood glucose monitoring technology and method will make it easier and more convenient for people with diabetes worldwide to monitor their blood glucose levels and receive timely care. (Hima Zafar et al, 2022)
- Sweat has advantages in use over other biological fluids (blood, interstitial fluid, and saliva) in wearable devices, including the capacity to assess glucose levels, according to Jayoung Kim et al. in "Wearable non-invasive epidermal glucose sensors: A review.".

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- Jayoung Kim.; Alan S. Campbell.; Joseph Wang. 'Wearable non-invasive epidermal glucose sensors: A review'. *Available online 30 August 2017.*