جامعة
حمد بن خليفة
HAMAD BIN KHALIFA
UNIVERSITY
عضو في مؤسسة قطر
Member of Qatar Foundation

HBKU Thematic Research Grant 3rd Cycle– Project Highlight

Project Title: Direct-Printed Micro-Supercapacitor Biosensor for Painless Glucose Monitoring

Dr Shawkat Ali

Executive Summary

Diabetes is a growing global health concern, with Qatar experiencing some of the highest prevalence rates in the region. Traditional glucose monitoring methods, such as finger-prick tests, are invasive and limited in capturing real-time fluctuations. This project introduces a novel wearable biosensing system for continuous, non-invasive glucose monitoring. The device provides real-time data, enabling patients to make informed lifestyle and treatment decisions while allowing clinicians to remotely monitor and respond to glycemic changes. The system features high sensitivity and resolution, ensuring accurate glucose detection with minimal discomfort. Its core innovation lies in inkjet-printed biosensors made from advanced nanomaterials, integrated with microneedles and solid-state electrolytes. Locally manufactured using regionally sourced materials, the device supports Qatar's push for biomedical self-sufficiency. Bluetooth connectivity allows seamless smartphone integration for automatic data sync and personalized feedback. The successful development of this platform is expected to improve patient comfort, enhance clinical decision-making, and reduce healthcare burdens. Its affordability and scalability promote widespread adoption, while aggregated data can inform national diabetes strategies. Aligned with Qatar's digital health vision, this project advances smart diagnostics and sustainable healthcare innovation, offering a transformative solution for chronic disease management and public health planning.

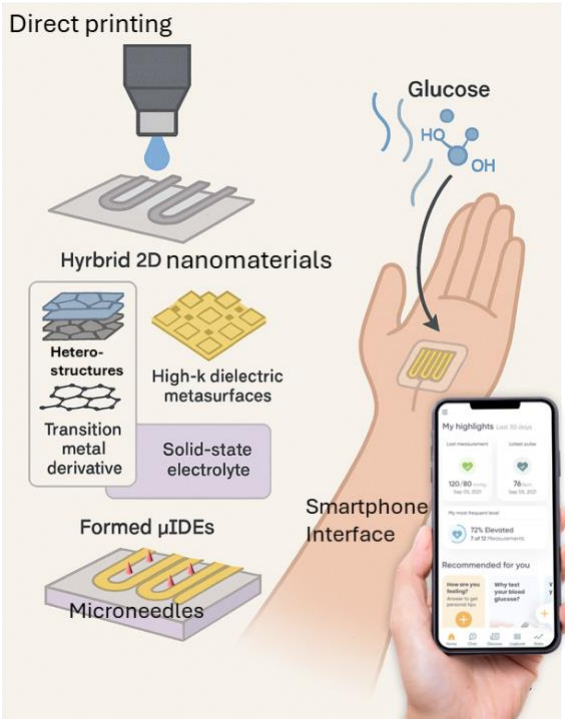
Expected Outcome

The project successfully introduces a novel wearable biosensor for non-invasive, continuous glucose monitoring. The invention integrates inkjet-printed nanomaterial electrodes, microneedles, and solid-state electrolytes, enabling real-time data capture and remote care. A functional prototype demonstrates high sensitivity, skin comfort, and seamless smartphone connectivity. Feasibility studies confirm technical viability, economic scalability, and clinical relevance, supported by stakeholder validation and lab testing. The system enhances patient experience, supports personalized treatment, and aligns with Qatar's digital health goals. Local manufacturing using regional materials promotes biomedical self-sufficiency, while aggregated data can inform national diabetes strategies, contributing to long-term healthcare sustainability and innovation.

Collaborating HBKU entities:

1. ICT division, College of Science and Engineering, Hamad bin Khalifa University (ICT, CSE, HBKU)
2. Qatar Biomedical Research Institute, Hamad bin Khalifa University (QBRI, HBKU)

Photos – please insert photos, schematics, graphs…etc. relevant to the project



Schematic diagram of the Glucose sensing system