HackMedTech 2021: The MedTech Talent Accelerator Hackathon
Sponsored by Myant Inc.

Challenge: Reducing computational and energy burdens to improve the accuracy and efficiency of wearable sensors for continuous health monitoring.

What is the problem?

Wearable devices collecting health signals generate massive amounts of data.
Raw signals can be processed in various ways, possibly repeatedly, to generate different metrics which, when combined, provide more information about the user's health condition.

Processing data requires powerful and fast processing units which are costly. Of note, the present strain on the microprocessors market is a concern for many industries, combined with a long-term risk of shortages of "rare-earth elements".

Processing and storage units are also energy-demanding, which affects battery performance and increases overall energy consumption on a global scale, at a time where climate change requires more efficiency and less consumption.

What outcome does the industry require?

The industry requires new, innovative, and efficient ways to allow the extraction of targeted health metrics while reducing the number of operations and their associated financial and energy cost.

This can be achieved with new product designs, materials, firmware, software, backend solutions, or a combination thereof, that enable smart data processing, novel use cases, and optimized use of IT resources. The goal is to allow the expansion of useful MedTech products in a world with limited resources.

The focus area of this hackathon is **wearable devices that collect Electrocardiogram (ECG) signals**, as cardiovascular disease is the leading cause of death worldwide.

About Myant Inc.

Myant is a Textile Computing™ company that knits sensors and actuators into everyday textiles, giving them the ability to sense and react to the human body. One of the aims of this continuous bidirectional interface is to help people proactively manage health and deliver treatment.

While many technological advancements necessitate radical change in behavior to be widely adopted, textiles have the benefit of being familiar to all people across society, inconspicuously integrated into our daily lives, and pervasive across all environments.

Myant is actively exploring ways to optimize the accuracy of smart textiles for continuous health data monitoring, while reducing the associated energy and computational burdens.

HackMedTech 2021: The MedTech Talent Accelerator Hackathon

Sponsored by Myant Inc.

Parameters and Guidelines

Innovators are expected to create a 10-15 minute presentation on a wearable device of their choosing with novel features or processes that minimize energy usage and computational requirements while maximizing the accuracy of **Electrocardiogram (ECG) signals**.

Please address the following parameters and provide information on the following guidelines:

1) Describe your wearables device:
    - Describe the intended use (e.g. to detect arrhythmia, atrial fibrillation, heart attacks), and settings of care (e.g. for everyday use, only in clinical settings)
    - Outline the design, materials, and user interface
    - Provide the medical device classification (per Health Canada), with rationale
    - Note: the technology should be practical and effective in accurately measuring ECG signals, and the material should be safe for use on the human body
2) Describe how your device minimizes energy and computational burdens while maximizing the accuracy of ECG signals collected:
    - Provide numerical metrics of minimized energy usage and maximized accuracy with theoretical reasoning (quantitative and qualitative)
    - Outline the data processing pipeline (acquisition, storage, analysis, display), and explain how your pipeline minimizes computational burden while maximizing accuracy
3) Discuss your plan for clinical and/or non-clinical testing of the device/technology
4) Present a risk management plan:
    - Outline the risks associated with usage of your device (e.g. safety, efficacy, environmental), and mitigation plans for each risk (e.g. design, testing, warnings)

This challenge may be approached from different perspectives to propose viable solutions from multiple disciplines (e.g. computer science, data processing, biomedical engineering, materials/chemical engineering, refined use cases/models of care, combination technologies...)

A sample ECG dataset and instructions for use have been provided by Myant Inc, which teams may use for modeling, calculations, or experiments (optional but recommended).

Teams are encouraged to survey the literature for the state of the art on wearable devices that collect ECG signals to identify different options and technologies in proposing an optimized device. Some examples include:

- Biomed Eng Online. 2020 Jun 16;19(1):48. doi: 10.1186/s12938-020-00788-x. Multichannel ECG recording from waist using textile sensors https://pubmed.ncbi.nlm.nih.gov/32546233/
- IEEE J Biomed Health Inform. 2021 May 21;PP. doi: 10.1109/JBHI.2021.3082876. Modeling and Reproducing Textile Sensor Noise: Implications for Textile-Compatible Signal Processing Algorithms https://pubmed.ncbi.nlm.nih.gov/34018942/
- ACS Appl. Electron. Mater. 2020, 2, 6, 1554–1566. Robust and Multifunctional Conductive Yarns for Biomedical Textile Computing. https://pubs.acs.org/doi/10.1021/acsaelm.0c00171