Connected Healthcare Group
at Digital Health Center
Prof. Dr. Bert Arnrich
Bachelor Project 2019/2020

Unobtrusive Health Monitoring for Driving Lifestyle Changes using Wearables

Non-communicable diseases, like myocardial infarction, stroke, chronic respiratory diseases, or diabetes, impose a great burden on societies all over the world, causing 71% of all deaths globally. However, these diseases are evitable since risk factors, such as smoking, unhealthy diet, or lack of physical activity, are known and can be avoided. Hence, lifestyle changes play a major role in the prevention and management of non-communicable diseases.[1]

Nowadays, it is possible to collect different types of data from daily life with consumer wearables, like smartwatches or fitness trackers. Based on that, we can give patients feedback on their health status and provide healthcare professionals with insight on the progression of lifestyle interventions, such as changed diet, exercise routines or even smoking avoidance.[2]

Project Goals

The main objective of this project is to develop tools for monitoring the health status of a person going through lifestyle interventions. The focus will be on accompanying patients at risk of non-communicable diseases. We want to analyse how parameters such as heart rate (HR), heart rate variability (HRV), blood oxygen saturation (SpO2), respiratory rate, sleep quality, and activity levels change when patients go through interventions. The idea is to build a pipeline to collect and analyse this data obtained from daily life and to provide information to healthcare professionals, regarding the patients' adherence to a prescribed intervention.

Methodology

You will get access to a variety of sensor devices which are able to track a number of parameters, for example HR, movement, or electrodermal activity (EDA). We plan to use multiple of these devices to collect data which is aggregated in a smartphone app. The data can then be transferred to a secure cloud storage where they are saved in a standardized format like PCHAlliance Continua[3] or FHIR[4]. From this cloud storage, researchers and healthcare professionals can access the data for further usage. This pipeline is shown in Figure 1. Your work will build upon our latest master project, so you will not have to start from scratch.

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[1] WHO Factsheet on Noncommunicable Diseases
(www.who.int/en/news-room/fact-sheets/detail/noncommunicable-diseases)
[2] Uni Freiburg: Wearable Smoking Detection
(earth.informatik.uni-freiburg.de/research/wearable-smoking-detection)
[3] Personal Connected Health Alliance: Continua Design Guidelines
(www.pchalliance.org/continua-design-guidelines)
[4] HL7 FHIR (www.hl7.org/fhir/)

Figure 1. Possible Workflow for Data Sharing[5]

Learning Expectations

Firstly, you have to understand the patients' needs and issues. You will learn how to collect data from daily life and use it to give meaningful insight to users and healthcare professionals. Your work will help to best tailor and monitor interventions.

Secondly, there will be the technical challenge of building a pipeline for data streaming and storage using standard protocols. Also, you will learn about app development and how information can be presented to give meaningful insight to patients, physicians, and researchers.

About You

You should be interested in working with a multidisciplinary team with backgrounds ranging from computer science to biomedical informatics and medicine. Good programming skills are required.

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[5] Image Sources:
Empatica E4: static-content.empatica.com/fE997/img/e4/e4-front_light.png
Samsung Gear S3:
news.samsung.com/de/wp-content/uploads/2016/11/Samsung-Gear-S3-frontier_R_30-1.jpg

You should have an interest in developing mobile applications and working with sensor devices.

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