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Using mHealth Technologies to Promote Public Health and Well-Being in Urban Areas with Blue-Green Solutions

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Abstract. European and International cities face crucial global geopolitical, economic, environmental, and other changes. All these intensify threats to and inequalities in citizens' health. The implementation of Blue-Green Solutions in urban and rural areas have been broadly used to tackle the above challenges. The Mobile health (mHealth) technologies contribution in people's well-being has found to be significant. In addition, several mHealth applications have been used to support patients with mental health or cardiovascular diseases with very promising results. The patients' remote monitoring can be a valuable asset in chronic diseases management for patients suffering from diabetes, hypertension or arrhythmia, depression, asthma, allergies and others. The scope of this paper is to present the specifications, the design and the development of a mobile application which collects health-related and location data of users visiting areas with Blue-Green Solutions. The mobile application has been developed to record the citizens' and patients' physical activity and vital signs using wearable devices. The proposed application can also monitor patients physical, physiological, and emotional status as well as motivate them to engage in social and self-caring activities. Additional features include the analysis of the patients' behavior to improve self-management. The "HEART by BioAsssist" application could be used as a health and other data collection tool as well as an "intelligent assistant" to monitor and promote patient's physical activity.

Keywords. Blue-Green Solutions, mHealth, Urban Health, Well-Being

1. Introduction

European and International cities face crucial global geopolitical, economic, environmental, and other changes [1-2]. All these intensify threats to and inequalities in

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citizens' health. [3]. The implementation of Blue-Green Solutions in urban and rural areas have been broadly used to tackle the above challenges [4,5]. More specifically, several studies present the positive effect of the Blue-Green Solutions implementation on flood mitigation and optimal water managing, on air pollution and on peoples' health [4,6,7]. In general, innovative Blue-Green-Solutions-based implementation mechanisms of urban planning that embraces and promotes the health and the wellbeing as a key-planning criterion could be improve urban health and reduce health disparities.

Meanwhile, the mobile health (mHealth) technologies contribution in people's well-being has been examined and found to be significant based on the international literature [8-10]. Several mHealth applications have been used to support patients with mental health or cardiovascular diseases [11-13] with very promising results. The patients' remote monitoring can be a valuable asset in chronic diseases management for patients suffering from diabetes, hypertension or arrhythmia, depression, asthma, allergies and others. In this context, a lot of mHealth solutions have been developed to support such patients and to ensure their well-being and quality of life [14-19]. In addition, mHealth applications can also be used to promote physical activity [20,21] on patients or non-patients and to encourage users to follow a healthier lifestyle. The scope of this paper is to present the specifications, the design and the development of mobile application which collects health-related and location data of patients visiting areas with Blue-Green Solutions in the context of the HEART project.

2. Methods

Requirement analysis has been performed, based on the patient and healthcare professional needs, in order to develop a mobile application to support "activity monitoring at a glance" in areas with Blue-Green Solutions (HEART project's demo areas). User requirements were collected through interviews from August 2021 until December 2021. The application design and development were based on four main pillars: a) to monitor users' physical, physiological, and emotional status, b) to allow detection and management of potentially dangerous situations, c) to motivate users to engage in social and self-caring activities and d) to model their behavior to improve self-management. The specifications of the mobile application include the recording of specific biomarkers using wearable devices. Specifically, heartrate, SpO_2, sleep quality, stress levels and physical activity including the number of steps, daily exercise, walking/running and others can be recorded. To collect the aforementioned data, patients need to use a mobile phone and a wearable device. The user's activity data and vital signs are recorded by the wearable devices using integrated sensors and are transferred firstly to the proposed mobile application and afterwards to the cloud platform, where information from different sources is aggregated for combined analysis. The final recorded data will be further analysed to examine the impact of the NBS on citizens' well-being. Patients have the ability to complete online questionnaires regarding their healthcare status through the app.

3. Results and Discussion

A mobile application has been developed (Figure 1) based on the above requirements. The aim of this application is to monitor the users' daily physical activity and other

variables related to their health status. The mobile application is currently available for Android and iOS devices, and it is compatible with the majority of the available smart devices and wearables with biosensors, such as Apple, Fitbit, Garmin, Google Fit, Huawei, Polar, Withings Xiaomi, and others. In addition, an existing platform [19,22] was used and integrated with the presented application, that enables the provision of independent assisted living and vital signs monitoring services that incorporates Electronic Health Records for its members.

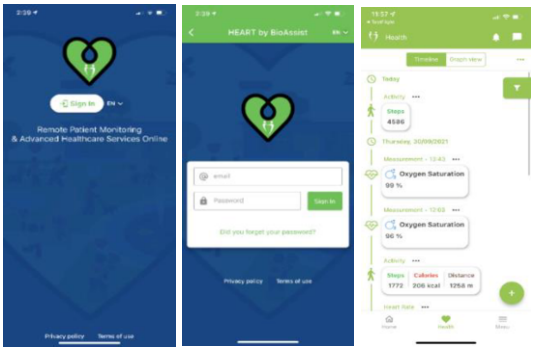

Figure 1. Mobile Application Screenshots.

This solution is leveraging innovative technologies to address the needs of chronic patients, and utilizes smart devices and a variety of non-invasive sensors that can monitor patients physical, physiological, and emotional status as well as motivate them to engage in social and self-caring activities. The platform features also support the analysis of the patients' behavior to improve self-management. Most of the platform's features are available on the suggested mobile application. For data storage and data exchange between the platform and the mHealth application or other platforms, HL7-FAIR, standards were used to ensure the validity and the reliability of the system. According to the international scientific literature, similar mHealth apps have been used to assess the users' well-being and public health [10,23].

4. Conclusions

The aforementioned application is developed in the frame of the EU-funded project "HEAlthier Cities through Blue-Green Regenerative Technologies: the HEART Approach". The HEART project will focus its research efforts on a specific range of diseases, such as mental disorders (including stress, anxiety, depression), cardiovascular-related diseases (examples are hypertension or arrhythmia), metabolic diseases (e.g., obesity, diabetes), and respiratory diseases (including asthma). HEART's integrated approach aims to systematically improve urban health and reduce health disparities through an innovative Blue-Green-Solutions-based implementation mechanisms of urban planning that embraces and promotes the health and the wellbeing as a key-planning criterion. HEART aims to use medical evidence in clinical and non-clinical setting. Future work includes the enhancement of the current mobile application with additional features for achieving more comprehensive and pervasive monitoring to support clinical studies requirements for remote monitoring, advanced study management, and higher patient adherence and compliance, as well as the application's assessment.

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