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Tele-DM: development of a mobile health technology for non-invasive type-2 diabetes mellitus patients with assistive physical activities and vital signs monitoring

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Abstract
Health experts have identified tailored physical activity (PA) and heart rate measurement as critical components in assisting type-2 diabetes (T2D) patients in improving their health. When performing PA, heart rate monitoring can be useful in figuring out the right intensity level for diabetic patients, helping them to benefit from the non-invasive treatment. Previous research has shown that mobile health (mhealth) applications have emerged as a viable option for enhancing health outcomes during the rehabilitation process. Regrettably, the current mhealth applications have constraints in facilitating a bidirectional interaction between the healthcare provider (HPC) and the patient. Moreover, the majority of mhealth applications designed for T2D treatment cannot directly capture real-time heart rate data from smartwatches or medical wearable devices. As a result, users are compelled to manually input this data into the applications. Thus, in this study, a Tele-diabetes mellitus management (Tele-DM), a remote monitoring system consisting of a mobile application and a smartwatch is developed to address these challenges by using the Flutter framework, Nodejs, Express, Heroku, and database management system (DBMS) MongoDB. A feature has been implemented to provide healthcare professionals (HCPs) with an interactive feedback page. This page allows HCPs to review and comment on the progress of their patients, facilitating more effective remote monitoring. In addition, through the utilisation of a multi-platform approach, the heart rate can be obtained in real-time from commercially available smartwatches and subsequently synchronised with the Tele-Dm apps following PA. The HCPs can monitor the performance and progress of the patients in real-time using this method. Functionality tests of this app have shown a remarkable success rate of almost 100%. From the user acceptance rating, it received an average of 4.03 rating for a user-friendly mhealth application. Ultimately, the Tele-DM system is an innovative solution for tackling the difficulties associated with diabetes self-care. It provides personalised guidance and remote monitoring of heart rate during rehabilitation sessions.

Author Keywords
Apps development; Diabetes management; Mobile health technology; Rehabilitation; Remote monitoring; Type-2 diabetes mellitus

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