RADAR-base: A Novel Open Source m-Health Platform

THE RADAR-base PLATFORM

Smartphones with embedded and connected wearable sensors are playing a vital role in healthcare through various apps and mHealth platforms. RADAR-base is a modern mHealth data collection platform built around Confluent and Apache Kafka. RADAR-base provides flexible tooling for active and passive remote data collection with backend infrastructure to facilitate secure data transmission and scalable solutions for streaming, data storage, management and access. The application is used presently in the RADAR-CNS study to collect data from patients suffering from Multiples Sclerosis, Depression and Epilepsy. Beyond RADAR-CNS, RADAR-base (open source under Apache 2 licence) is being deployed across a number of other funded research programmes studying different diseases.

AIMS & COMPONENTS

To facilitate the reusability by the wider mHealth community the RADAR-base platform was released under open source Apache 2 licence in January 2018. RADAR-base is composed of back-end infrastructure and two Android mobile apps. The cross-platform Cordova apps include aRMT for active monitoring of participants aRMT, requiring conscious action (e.g. questionnaires, audio questions, timed tests), and pRMT, a native Android app for passive monitoring of participants via phone and wearable sensors. The key components of our software stack include: Data Ingestion and Schematisation (using Apache AVRO), Database Storage and Data Interface, Data Analytics, Front-end Ecosystem, Privacy and Security.

HOW IT WORKS

The Confluent Platform is a key component in the data pipeline architecture, this open source suite of streaming tools is built around Apache Kafka. Patient data is collected from passive (e.g. hardware sensor streams) and active (e.g. questionnaires, digital assay apps) data sources. These data payloads are then ingested via an HTTPS interface which translates REST calls into native Kafka calls. After a restructuring phase, data are simultaneously analysed and persisted. Two different data warehouse layers (cold and hot storage) are deployed to provide low latency and high performance data access via controlled interfaces. RADAR-CNS Platform runs on Docker to achieve extremely light and easy to deploy infrastructure.

EPILEPSY, DEPRESSION & MULTIPLE SCLEROSIS STUDY

- Epilepsy patients are undergoing study at KCL and Freiburg.
- Depressions patients are enrolled and undergoing study at KCL.
- 200 patients will be enrolled for Epilepsy study 1.
- 600 patients will be enrolled for the depression study.
- Multiple Sclerosis study will target 640 patients.
- Other IMI studies using the platform:
- Alzheimer’s study is envisioned with RADAR-AD platform.
- BigData@Heart.

RESULTS AND VISION

The catalog of currently integrated devices includes onboard Android smartphone sensors along with Empatica E4 Wristband, Pebble 2 Smartwatch, Biovotion VSM, Faros 180, Fitbit devices. Capability is provided to integrate all wearable devices offering a native SDK to passively collect raw data or through vendor REST-API data access. Beside the pRMT app (passive data source), a questionnaires app built with Cordova (aRMt) offers an active remote monitoring data source which can render questionnaires from a simple JSON configuration file.

RADAR-base aims to stimulate the field of mHealth by providing an off-the-shelf platform for general data collection. The project has long term goals to improve patient care by predicting and pre-empting relapses with the use of remote assessment technologies in a wide variety of disorder areas.

This work has received support from the EU/EFPIA Innovative Medicines Initiative Joint Undertaking 2 (RADAR-CNS grant No 115902) www.imi.europa.eu

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We would like to acknowledge The Hyve (http://thehyve.nl) and RADAR-CNS Consortium (http://www.radar-cns.org/partner) for their support. Backend infrastructure facilities were provided by King’s College London’s Research private cloud. The Authors receive funding support from the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King’s College London.