Co-Funded by the Horizon 2020 programme of the European Union

Grant Agreement: 875358

Deliverable D5.6

FAITH Activity Monitor

Work package:	WP5 – Modular, Extendible Data Capture App
Prepared By/Enquiries To:	Stefanos Venios, Stratos Eftaxiadis – SUITE5
Reviewers:	Gary McManus – WIT Tom Flynn – TFC
Status:	Final
Date:	06/05/2021
Version:	1.0
Classification:	Public

Authorised by:

Philip O'Brien, WIT

Authorised Date: 06/05/21

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FAITH Project Profile

Contract No H2020-ICT- 875358

Acronym	**FAITH**
Title	**A Federated Artificial Intelligence solution for moniToring mental Health status after cancer treatment**
URL	**https://www.h2020-faith.eu/**
Twitter	**https://twitter.com/H2020_Faith**
LinkedIn	**https://www.linkedin.com/company/faith-project/**
Facebook	**https://www.facebook.com/H2020.FAITH**
Start Date	**01/01/2020**
Duration	**42 months**

FAITH Partners

List of participants

Participant No	Participant organisation name	Short Name	Country
1 (Coordinator)	WATERFORD INSTITUTE OF TECHNOLOGY.	WIT	Ireland
2	UPMC Whitfield, Euro Care Healthcare Limited.	UPMC	Ireland
3	Universidad Politécnica de Madrid.	UPM	Spain
4	Servicio Madrileño de Salud.	SERMAS	Spain
5	UNINOVA, Instituto de Desenvolvimento de Novas Tecnologias.	UNINOVA	Portugal
6	Fundação D. Anna de Sommer Champalimaud e Dr. Carlos Montez Champalimaud.	CF	Portugal
7	Deep Blue.	DBL	Italy
8	Suite5 Data Intelligence Solutions Limited.	SUITE5	Cyprus
9	TFC Research and Innovation Limited.	TFC	Ireland

SC1-DTH-01-2019: Big data and Artificial Intelligence for monitoring health status and quality of life after the cancer treatment

H2020-SC1-DTH-2019

FAITH is co-funded by the European Commission - Agreement Number 875358 (H2020 Programme)

Document Control

This deliverable is the responsibility of the Work Package Leader. It is subject to internal review and formal authorisation procedures in line with ISO 9001 international quality management system procedures.

Version	Date	Author(s)	Change Details
0.1	07/03/2021	Stefanos Venios, Stratos Eftaxiadis (SUITE5)	Defined ToC.
0.2	07/04/2021	Stefanos Venios, Stratos Eftaxiadis (SUITE5)	Added sections 1, 2 and 3.
0.3	14/04/2021	Stefanos Venios, Stratos Eftaxiadis (SUITE5)	Updated sections 2 and 3.
0.4	26/04/2021	Stefanos Venios (SUITE5)	Implemented internal peer review comments.
0.5	27/04/2021	Tom Flynn (TFC)	QA'd version.
1.0	06/05/2021	Philip O'Brien (WIT)	Final release for submission to European Commission portal.

Executive Summary

Objectives:

The objective of this deliverable is to document the module used by the FAITH mobile app to monitor user activity.

The activity monitor is one of the four modules of the FAITH mobile app, namely the activity tracker, the sleep tracker, the nutrition tracker and the Natural Language Processing module. As a first step, each module is built as a standalone mobile app; then all four modules will be integrated in the 1st version of the FAITH mobile app due at M18 of the project. Two further versions of the FAITH mobile app, as well as each one of the modules, are expected on M30 and M42 of the project.

Results:

The primary result of this deliverable is the documentation of the 1st version of the activity monitor and includes the following details purpose served, user stories covered, data input and output, technologies employed, source code repository and screenshots of the implemented functionality.

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1 Introduction

This Deliverable D5.6 (FAITH Activity Monitor), documents the work related to the activity monitor, built in the context of task T5.3 in Work Package 5. The present deliverable accompanies the software release of the 1st version of the activity monitor. The link to the code is located in section 2.5 (below).

In section 2, the 1st version of the activity monitor is documented and covers the following details purpose, user stories covered, data input and output, technologies used, source code repository and screenshots of the mobile app.

In section 3, the foreseen next steps for the upcoming releases of the activity monitor are presented.

2 FAITH Activity Monitor

2.1 Purpose of the Activity Monitor

The activity monitor is a module used to track mobility levels of the patient in the least intrusive way possible. The concept of the FAITH project is to remove the need for multiple wearables to track activity, with most of the data captured in a passive way (i.e., without need to ask input from the patient).

At the current version, the activity monitor has been implemented as a standalone app working both on Android and iOS devices. It is planned to be integrated into the FAITH mobile app, together with the other modules, in M18 of the project.

With this first release of the activity tracker, during the "Trial 1" phase of the project in the hospitals, we will be able to collect activity data from the participants and push these activity related data to a central repository, where healthcare professionals, with the help of data scientists and machine learning algorithms, will try to gain an understanding on how activity levels could be correlated with the goals of the medical study (i.e., the depression levels).

2.2 User Stories Covered

During "Trial 1" phase the following Actor interacts with FAITH Activity Monitor:

Name: Patient

Goals: Be physically and mentally healthy

Description: Patient is one of the main users and beneficiaries of the system. They are a cancer survivor who has undergone and completed the first phase of oncological treatment. They are returning to their daily lives after the period of treatment and may suffer the psychological consequences of the illness. What frightens the patient is the loss of contact with the medical support that has guided them through the treatment path.

Tool interaction: FAITH App, Sleeping Monitoring Device.

Other Interactions: Doctors, Family members, Other patients

The user stories covered in this release are:

#	As a …	I want to …	So that …
1	Patient	subscribe to FAITH AI Angel	I can enrol to FAITH mental health monitoring
2	Patient	login to AI Angel	I can have access to the monitoring of my mental health
3	Patient	have my activity data captured	it can be analysed against historical activity data

Table 1 User stories implemented in 1st version of activity monitor module

2.3 Data Input, Usage and Output

The data used as input for the Activity Tracker come from GoogleFit and Apple HealthKit respectively. In the case of iOS and the Apple HealthKit, we take input data from the device. In the case of Android, we take input data from the GoogleFit API via a secure communication channel through REST API calls.

The requirements related to what data is collected are documented in the Study Protocol of the FAITH project. In particular, in the current version of the activity monitor the following data is collected:

Measurement	Google Fit (Android)[1]	Comments	HealthKit (iOS)[1]	Comments
Steps	YES		YES	
Distance	YES		YES	
Duration	YES		YES	
Steps/Hour	YES	Calculated in the activity monitor: when (timestamps) and how many steps were taken in the day.	YES	Calculated in the activity monitor: when (timestamps) and how many steps were taken in the day.

[1] **YES: can be collected passively by the FAITH App**

NO: needs interactive input by the user and/or wearable (see comments)

Measurement	Google Fit (Android)[1]	Comments	HealthKit (iOS)[1]	Comments
Type of Exercise/Workout	NO	This measurement should be added interactively (e.g., manually by the user in the FAITH App) EXCEPT if the user provides herself the type of workout in Google Fit or carry a Google Fit wearable.	NO	Same as for Google Fit.
Active Calories	YES		NO	Calculated via the following formula: *Total calories burned = Duration (in minutes) * (MET[2]*3.5*weight in kg)/200*
Weight	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input, ELSE we need to ask the user to input it in the FAITH App	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input, ELSE we need to ask the user to input it in the FAITH App
Age	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input,	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input,

[2] Metabolic equivalent of task https://en.wikipedia.org/wiki/Metabolic_equivalent_of_task

Measurement	Google Fit (Android)[1]	Comments	HealthKit (iOS)[1]	Comments
		ELSE we need to ask the user to input it in the FAITH App		ELSE we need to ask the user to input it in the FAITH App
Gender	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input, ELSE we need to ask the user to input it in the FAITH App	YES	We presume that it will be available either through GoogleFit, OR other FAITH App related input, ELSE we need to ask the user to input it in the FAITH App
GPS location/Important Locations	NO	Collected via the FAITH App from the GPS of the phone. If the user declines access to GPS, it will not be collected. Also, there is a possibility that the process to collect GPS is terminated by the OS.	NO	Collected via the FAITH App from the GPS of the phone. If the user declines access to GPS, it will not be collected. Also, there is a possibility that the process to collect GPS is terminated by the OS.

Table 2 Measurements collected in 1st version of activity monitor module

The output data (either coming directly from GoogleFit and Apple HealthKit or calculated in the activity tracker) are stored locally on the device following the FHIR[3] compatible data model.

The output data during "Trial 1" phase are pushed to a central repository in an anonymised manner, where healthcare professionals, with the help of data scientists and machine learning algorithms, will try to gain an understanding on how activity levels could be correlated with the goals of the medical study (i.e., the depression levels).

[3] http://hl7.org/fhir/

2.4 Technologies Used

The development language used for the creation of the activity monitor is React Native. The software has been ported to both Android and iOS platforms without the need to write code in the native development languages of the two platforms.

The following main libraries were used:

Library	Description
react / react-native	React Native libraries
react-native-google-fit, react-native-health	Access Google Fit and Apple HealthKit data for Android and iOS devices respectively
react-native-async-storage	An asynchronous, persistent, key-value storage system for React Native. Will be changed to another library once encryption specifications are decided
react-redux, redux, redux-thunk	Predictable state container in order to share data across all app's components
react-navigation/bottom-tabs, react-navigation/native, react-navigation/stack, react-native-screens	Essential for mobile app's navigation through different screens
formik, yup	Provide form and error checking capabilities
react-native-calendars	Adds a calendar
react-native-paper, react-native-vector-icons	UI libraries that combined provide customizable and themed components in order to implement FAITH's design
react-native-svg-charts, react-native-svg	SVG Charts support to visualise health data
moment	Editing datetime parameters in an efficient way
prop-types	Helper library for implementing reusable components
react-native-community/masked-view, react-native-gesture-handler,	Basic libraries that improve UI interactions

Library	Description
react-native-reanimated, react-native-safe-area-context	

Table 3 Main libraries used in the implementation of the app

2.5 Code Availability

The source code of the FAITH Activity Monitor resides in the following URL:

https://gitlab-ee.tssg.org/faith/faith-mobile-app/activity-tracker

2.6 Application Screenshots

The following screenshots are taken from the installed activity tracker app on iOS and Android devices respectively.

2.6.1 iOS

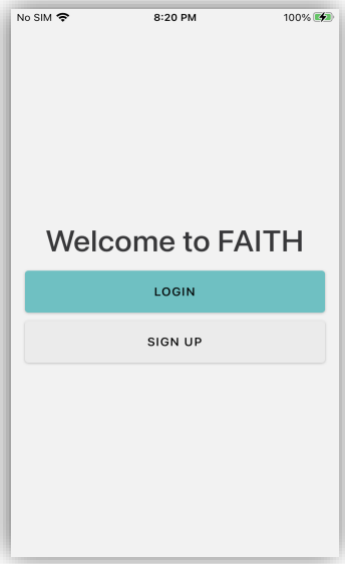

Figure 1 - Splash screen

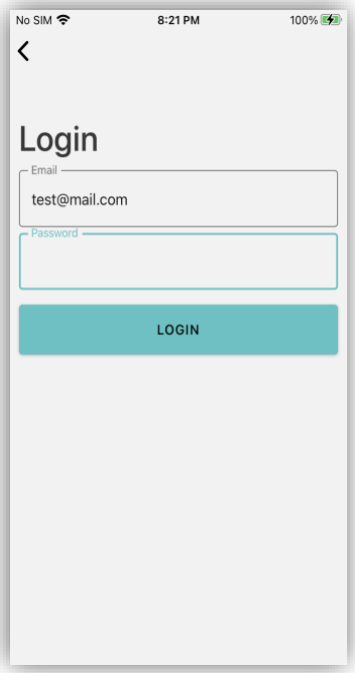

Figure 2 - Login screen

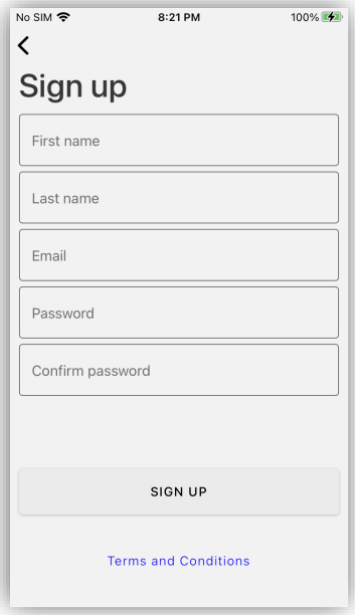

Figure 3 - Sign up screen

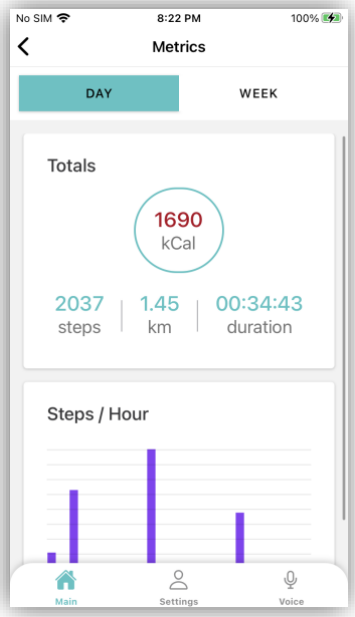

Figure 4 - Daily activity (1/2)

Figure 5 - Daily activity (2/2)

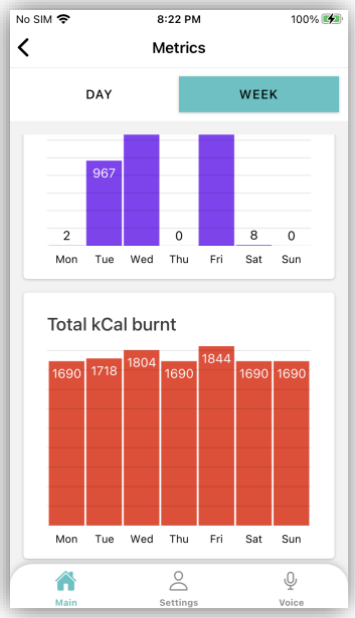

Figure 6 - Weekly active calories consumption

2.6.2 Android

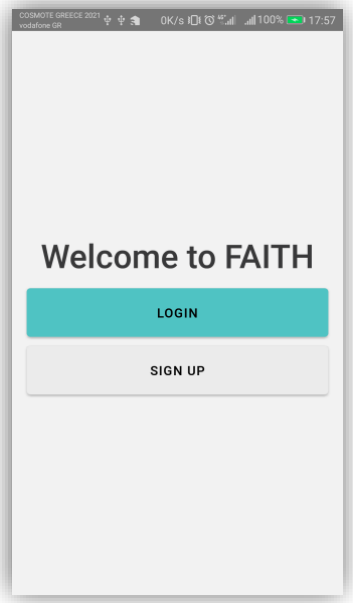

Figure 7 - Splash screen

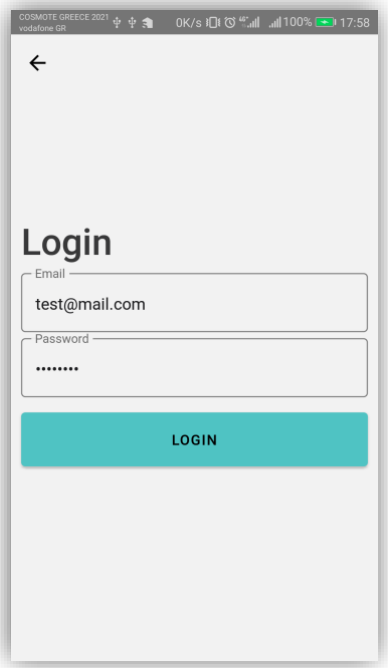

Figure 8 - Login screen

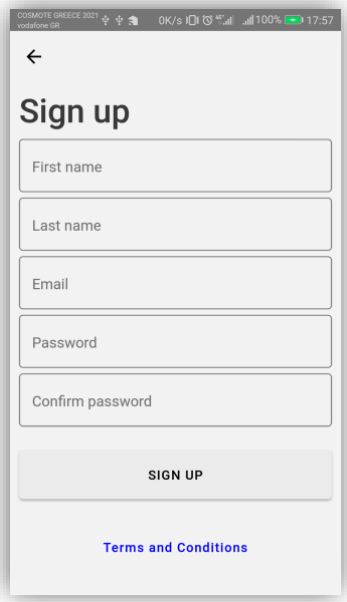

Figure 9 - Sign up screen

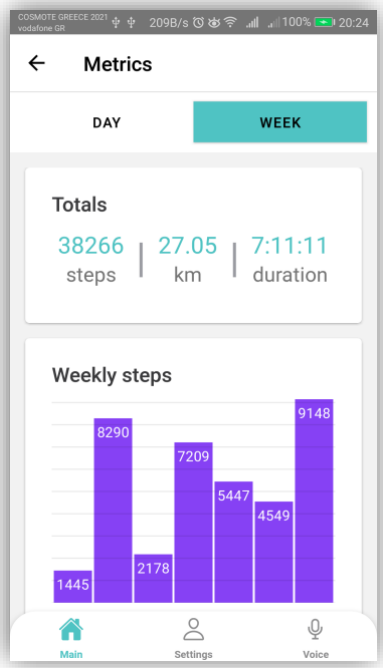

Figure 10 - Weekly activity

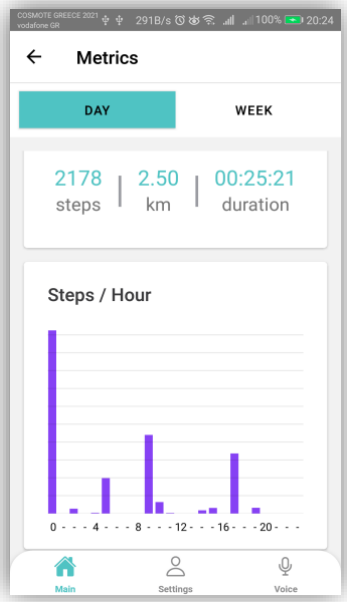

Figure 11 - Daily activity

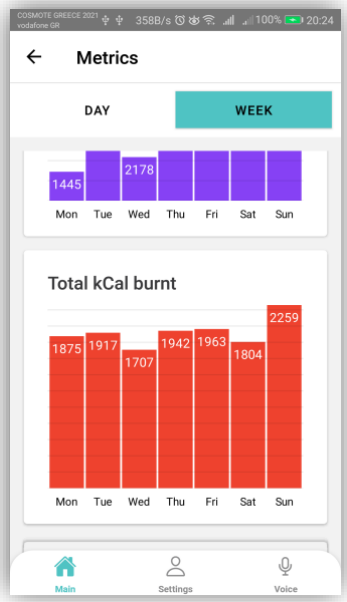

Figure 12 - Weekly active calories consumption

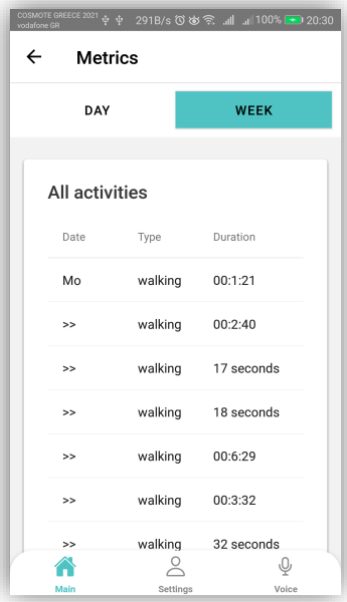

Figure 13 - Weekly activity log

3 Next Steps

As described above, the activity monitor will be integrated as a module in the 1st version of the FAITH mobile app on M18 of the project.

Two further versions of the activity monitor are planned for M30 and M41 of the project; they will be equally integrated in the respective versions of the FAITH mobile app, planned for M30 and M42 the project.

In line with the project's goals, the collected data (including but not limited to activity data) will be used in order to implement federated learning algorithms.

Other metrics which will be necessary for the needs of the project and that will be defined by the Study Protocol, such as "pace" (cadence) will be calculated in the 2nd version of the activity tracker.

Development of the activity monitor shall continue based on the user stories in the backlog of the FAITH App and new user stories which could be eventually added.