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FIT4WORK

SELF-MANAGEMENT OF PHYSICAL AND MENTAL FITNESS OF OLDER WORKERS

CO-FUNDED BY

PARTNERS

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System Architecture Definition

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1. Introduction

The Fit4Work project aims to develop an innovative easy-to-use and unobtrusive system that offers support to older workers and the relevant stakeholders in reducing and managing physical and mental stress resulting from their occupation.

The objective of the Fit4Work project is to develop an innovative system able to help “preserving cognitive and physical capacities“ of older workers. It tackles the biggest occupational challenges of older adults, which are “physical strain and mental stress”. The project thus aims to “enable older adults to continue managing their occupation” and at the same time it supports “preserving health and motivation to remain active”. Through this the proposed solution promotes “health and well-being”, both in the workplace and at home.

1.1. Deliverable purpose

This deliverable defines the fundamentals of the technical solution to be implemented. Initially, it defines the system requirements, starting from the user requirements, and it details them into use cases, creating an overview of the system from a user point of view. Subsequently, the system architecture is being described, with emphasis on:

- components involved
- detailed architecture of the system
- interactions between components
- functionalities of the PC and mobile application

All of the above will be the base for the integration activities that will lead to the construction of a solution which will conclude the project.

1.2. Applied Methodology

The Fit4Work system combines several different technological components into a coherent system capable of supporting user needs in managing their work-related physical and psychological stress. Development of the system involves several stages, starting with the gathering of user requirements, through development and adaptation of functional components of the system and integration of these components into prototypes to system validation performed within a pilot.

In terms of the system architecture, the following working methodology has been applied:

- first step was to create a high level architecture starting mainly from the document of work and initial user input;
- after the work progressed throughout the work packages, more detail has been added to the initial architecture;
- during a General Meeting, the Consortium allocated time for the technical partners to meet and finalize the system architecture;
- initially, the current state of the high-level architecture was presented;

- each technical partner presented the particularities of each component, taking into consideration the overall system;
- the partners debated and modified the several components until consensus was reached;
- the end result was designed in the Enterprise Architect software, clearly indicating where contribution from each partner is needed;

The project will follow an Agile approach: if needed, reiterations of the current architecture will be done, however this should not be the case, as each component has been thoroughly discussed and analyzed, and especially the integration of all components. If this will be the case, mitigation strategies will be evaluated in order to reduce the impact of the work needed to adapt the required components.

The current report is constructed as follows. First, we look into the requirements of the system in Section 2. The architecture of the system itself is presented in Section 3. We provide a short summary in Section 4.

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2. System requirements

Technical requirements for the Fit4Work system are the result of a combination of project goals, sensing scenarios and user needs and requirements (Blok et al, 2016; Kosiedowski et al, 2016) with organizational aspects also playing a role in the system design and development.

In general terms, Fit4Work aims to monitor users' physical and mental activity, as well as their immediate environment (e.g. their office). Based on those three main areas, a series of parameters are monitored and analyzed over time, resulting in personalized recommendations, containing information about how the user should proceed in order to improve their physical or mental well-being. Those recommendations and other information is presented to the user through specialized Fit4Work applications, called user gateways. If followed, the recommendations should result in physical and mental fitness of the end user maintained over a long period of time in the context of their professional and personal life.

Those processes need to be performed in a way which meets specific needs of Fit4Work's target users - elderly professional workers.

2.1. User requirements

User requirements and needs have been described in detail in (Blok et al, 2016). This section summarizes them here again and focuses on those relevant in the context of later described functional and architectural requirements, as well as use cases.

End user involvement

In order to provide a well-designed end product, representatives of target users need to be involved in the design, development and testing of the Fit4Work solution.

Proper user introduction

Special attention is needed in terms of introducing new users to Fit4Work and presenting its benefits and features.

Focus on main functions of the system

Including many features in the product may be distractive. Older adults specifically will be sensitive to this, so the system should focus on the main purpose of the intervention.

Focus on motivating to undertake physical activity

While the target population is generally active, a significant part of them report lack of time, laziness or lack of discipline: the system should aim to encourage the change of daily routine for such people.

Present clear short-term benefits and monitor them.

The system should clearly show the benefits of its use: personal, concrete and short-term (e.g. how many calories someone has burnt or how many kilometers they have walked).

Fit the system into user's daily routine
The system should attempt to use the devices already in use by the user as well as propose activities that do not modify the general daily routine of the user.

Focus on prevention
Fit4Work should focus on prevention and maintenance of a good fitness level.

Target physical strain related to prolonged sitting
Sitting is a relevant topic: the system should monitor the length of sitting position.

Focus on making the user undertake enough physical activity
Physical activity at work in general is limited: physical activities should be proposed in adequate amount, most likely in leisure time.

Take account of popular activities
The Fit4Work system should be ready to monitor physical activities often undertaken by target population (e.g. walking or cycling) and use those in personalized recommendations.

Mental stress is important
Fit4Work should focus rather on mental stress than physical stress: it is confirmed as an important challenge to cope with. Mental capacity and fitness of the brain is more and more important in future jobs.

Significant group of the target population suffers of chronic diseases or pains
The Fit4Work system should address the possibility of some of the users suffering of chronic diseases and/or pains.

Focus on delivering a solution for Android-based smartphones
The Android operating system is most prevalent on smartphones used by the target population (in Europe) - 62,5% of target group users use phone running the Android operating system.

Make sure of data privacy and security
The system must have adequate data privacy and security measures built in, and clearly inform the users about them.

Personalize the recommendations
To make the Fit4Work system work efficiently and effectively, the message provided by the system to the user should be very tailored. The system needs to know the user personally so it can base advice and recommendations perfectly on their needs and preferences, both from health and use point of view.

Include a social network in the system
A social network within the system is confirmed as an interest of the users.

Include the social environment of the employee
An exercise as recommendation to the user may help, but will probably be not the only solution. A supportive environment, with positive colleagues, will be of at least the same importance to reduce stress.

A recommendation may also include an advice to drink a cup of coffee or go for a walk with colleagues. The Fit4Work system should pay attention to colleagues of all ages.

Use adequate gamification for motivating the users
A focus group participant summarized this as 'I like it to play a healthy life style like a game; especially when I can win a prize'. However, comparing progress with a colleague does not seem as motivating.

Do not bother the user with too much feedback
The users seem to be willing to consult the system for advice on their own, rather than to be reminded constantly of what is going on - 'I do not want to know everything going on in my body. That makes me nervous'

Focus on simplification of physical activities to perform
A recommended exercise should in the first place be simple to execute. An easy walk to the coffee machine or the printer may already help and is easy to maintain.

Ensure the user interface fits the needs of the target users
Although most of the participants say they want their solution to have the same possibilities as one for the younger generation, most prefer to have the features presented in a clearer way. The most important features should be presented upfront and the more complex aspects that are less easy to use, or not used as often, should be more hidden.

2.2. Functional requirements

This section presents high level functional requirements based on sensing scenarios described in (Kosiedowski et al, 2016) and user requirements (Blok et al, 2016).

2.2.1. Definitions

Basic definitions of terminology used in functional requirements specification and use case descriptions:

- **User activity** - combines physical activity, functional exercise, mental stress and environment
- **Physical activity** - lifestyle and habitual activity, including sports (e.g. walking, biking, running, swimming etc.)
- **Functional exercise** - performing specific body movement exercise (e.g. jumping jacks, squats, push-ups, etc.)

2.2.2. High level functionality list

Below, we present a high level list of the Fit4Work functionality based on information gathered by examining user requirements and aspects of sensing scenarios, as well as obtained as a result of focus group workshops conducted during Fit4Work consortium meetings. This list focuses on end user facing system functionality.

User Onboarding

Functionality related to introducing the user to Fit4Work and using Fit4Work applications for the first time:

- Introduction to Fit4Work (presenting the idea behind Fit4Work)
- Applications' feature tour
- Just-in-time tips displayed by Fit4Work applications

- Creating an account
- Logging In

Physical Activity Monitoring

Functionality related to monitoring user's physical activity:

- Initial assessment of user fitness (e.g. resting heart rate)
- Measuring and recording user activity (includes sending data to services for storage and analysis)
- Presenting current user activity progress
- Presenting recommendations
    - real-time
    - long term
- Manually adding an activity

Mental Stress Monitoring

Functionality related to monitoring user's stress level:

- Base stress level assessment (establishing the baseline)
- Presenting current stress level
- Presenting recommendations
    - real-time
    - long term
- Performing a stress relief exercise

Environment Monitoring

Functionality related to monitoring user's environment:

- Presenting current environment status
- Presenting recommendations
    - real-time
    - long term
- Environment sensors setup

Functional Exercise

Functionality related to exercises performed by the user:

- Functional fitness evaluation
- Presenting recommendations
    - daily
- Monitoring performance of functional exercise

Presenting user activity summary

This functionality includes physical activity, stress, exercise and environment aspects:

- Daily summary
- Weekly summary
    - Setting new physical activity goal
- Monthly summary

Motivation

Functionality related to motivating the user to be more active and using Fit4Work:

- **Social aspect**
    - Sharing daily activity results on social media
    - Sharing weekly activity results on social media
- **Rewards**
    - Receiving achievements for reaching specific goals

2.3. Architectural requirements

Fit4Work is a distributed system where a set of sensors, placed on the user and in their environment, monitors the user and this environment. Data coming from those sensors is, either analyzed locally by an application running on user's mobile device connected to those sensors, or sent to backend services for more complex long-term analysis and storage.

The main elements that need to be taken into account by the system's architecture are:

- **Mobile device** (i.e. a smartphone) running a specialized **Mobile Application** relaying data coming from the sensors to the Fit4Work system and giving the end user access to this data in an appropriately processed and formatted form, as well as presenting the user with recommendations based on the collected data. The Mobile Application also aids the user in correct performance of specific functional exercises recommended by Fit4Work.
- **Desktop device** (e.g. laptop or desktop computer) running a **Desktop Application** which functions as a companion application to the Mobile Application and provides similar, but limited functionality
- **Sensors**
    - **Environment Sensors** - sensors collecting parameters such as temperature, humidity, air quality, noise of user's work place etc.
    - **Activity Sensor** (e.g. a wristband activity tracker) - measuring user's energy expenditure and mental stress indicators
    - **Movement Sensor** - monitoring user's spatial movement when performing functional exercise
- **Services** - a series of backend services which receive data from the sensors and user devices through aforementioned applications for the purpose of analysis and storage. Those services also communicate with the Mobile and Desktop Applications providing data analysis, recommendations and other features.

2.4. Use cases

This section presents a set of processes, based on functional and user requirements that should be implemented in Fit4Work according to their priority. Those processes are represented in the form of use cases and their role is to facilitate a better understanding of the particular requirements imposed on the

system design and development, as well as to present a vision of how the Fit4Work system will behave from the point of view of the user. It is important to notice that the use cases present a vision of the Fit4Work solution based on the knowledge gathered so far, and will need to be verified and possibly modified in the course of testing prototype implementations with target users.

The following letter prefixes for use case IDs involving particular aspects of Fit4Work are proposed (all prefixes are followed by a number):

- **G** - General use cases (general use case is one that combines multiple aspects of Fit4Work - i.e. physical activity, functional exercise, stress, environment etc.)
- **PA** - Physical Activity
- **FE** - Functional Exercise
- **MS** - Mental Stress
- **ENV** - Environment Monitoring
- **SOC -** Social aspect

Additionally, *'alternate scenarios'*, *'extensions'* and *'exceptions'* are recommended to also have IDs following a certain convention:

- Alternate Scenarios - *USE_CASE_ID*.A.*NUMBER* - e.g. G1.A.1 for the first alternative scenario of use case G1
- Extensions - *USE_CASE_ID*.EXT.*NUMBER* - e.g. G1.EXT.1
- Exceptions - *USE_CASE_ID*.EXP.*NUMBER* - e.g. G1.EXP.1

2.4.1. General use cases

This section describes general processes involving multiple areas monitored by Fit4Work - physical activity, stress and work environment, as well as other general supporting processes.

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ID	G1
Name	**Running the Mobile Application for the first time**
Context	User runs the Fit4Work mobile application for the first time
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	Mobile Application installed on the mobile device
Post conditions	User is logged into the Fit4Work system, and has general knowledge about how the Mobile Application works
Priority	High
Trigger	User action
Main Success Scenario:	1. User starts up the Mobile Application 2. An introduction to Fit4Work is shown to the user (see G2) 3. After going through the introduction the user goes on to either creating an account or signing in (see G3) 4. The user configures appropriate Environment Sensors and associates appropriate Environment Sensors with their account (see G4) 5. The user configures their Activity Sensor and associates an Activity Sensor with their account and mobile device (see G5) 6. Mobile Application runs a short introduction of its features (see G6)
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	G9, G10
Notes	-

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ID	G2
Name	**Introducing the user to Fit4Work**
Context	Upon using the application for the first time, the user needs a short introduction about Fit4Work
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	Mobile Application installed on the mobile device
Post conditions	User has general knowledge about the Fit4Work system
Priority	High
Trigger	User action
Main Success Scenario:	1. User starts up the Mobile Application for the first time 2. A series of screens is shown to the user explaining in very general terms the idea and benefits of Fit4Work 3. The user navigates through those screens and views/reads the information 4. The user proceeds to create an account or sign in (see G3) and configure their Environment Sensors (see G4) and Activity Sensor (see G5) 5. After signing in, the main screen of the Mobile Application shows descriptions of various parts of it (see G6)
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	G3, G4, G5, G6
Notes	-

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ID	**G3**
Name	**Creating user account**
Context	User needs to create an account in order to use Fit4Work
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	Mobile Application installed on the mobile device
Post conditions	User account is created and the user is logged into Fit4Work
Priority	High
Trigger	User action
Main Success Scenario:	1. User runs the Mobile Application for the first time (see G1) 2. As part of user onboarding, they choose to create a Fit4Work account 3. The user enters the following required information: a. Basic account information i. Name ii. E-mail address iii. Password iv. Organization (this could be selected from a list of organizations already present in the Fit4Work system - e.g. based on the list of clients) b. Profile information i. Weight ii. Height iii. Sex iv. Date of birth
Alternate scenarios	3a. The user chooses to create an account based on their social network

	account (i.e. Facebook) 4a. Their basic information is fetched from the social network (if available): a. Name b. E-mail address c. Sex d. Date of birth 5a. Missing information is entered manually by the user (according to the information listed in step 3 of Main Success Scenario. 2b. If the user previously created a Fit4Work account, they choose the "sign in" option 3b. User either enters their email address and password or chooses to log in with a social network (i.e. Facebook)
Extensions	-
Exceptions	-
Referenced Use Cases	G1
Notes	-

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ID	G4
Name	**Environment Sensors Configuration**
Context	Fit4Work users will have Environment Sensors assigned to their workplace. They can also possibly share the same Environment Sensors with other users working at the same location. The Fit4Work system needs to know which Environment Sensors are assigned to which users.
Level	Subfunction
Primary Actors	User, Fit4Work Technician
Alternate actors	-
Preconditions	Mobile Application installed on user's phone, Environment Sensors installed in user's office (by a Fit4Work Technician)
Post conditions	Environment Sensors are associated with a specific user
Priority	High
Trigger	User action
Main Success Scenario	1. During the first run of the Mobile Application (see G1) the user creates an account (see G3) 2. After the account is created, the user selects appropriate Environment Sensors from a list of sensors available for their organization (the list contains names of locations in the building - for example room numbers). 3. The id of the chosen Environment Sensors is associated with the user in the Fit4Work system
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	
Notes	-

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ID	G5
Name	**Activity Sensor Configuration**
Context	Each Fit4Work user will be equipped with a third party Activity Sensor. This sensor will need to be configured and an association between the sensor and a specific Fit4Work user needs to be made.
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	Mobile Applications for the Activity Sensor (e.g. Microsoft Health) and Fit4Work Mobile Application installed on user's mobile device and the user's logged into the Fit4Work system and the service provided by the Activity Sensor's manufacturer.
Post conditions	Activity Sensor is properly configured and allows sharing its data with the Mobile Application.
Priority	High
Trigger	User action
Main Success Scenario:	1. During the first run of the Activity Sensor third party mobile application (e.g. Microsoft Health), the user creates a personal account, starts the sensor and connects it to the smartphone using this third party application. This needs to be done independently before the first run of the Fit4Work Mobile Application. 2. During the first run of the Fit4Work application, the user confirms that they allow for the Activity Sensor's data to be used by the Fit4Work Mobile Application. 3. The user activates the Activity Sensor and it starts to provide data for the Fit4Work system.

Alternate scenarios	G5 .A.1 The user can use all functionalities that the Activity Sensor (e.g. Microsoft Band 2) provides.
Extensions	-
Exceptions	G5.EXP1 The user doesn't allow for the Activity's Sensor data to be available to the Fit4Work Mobile Application. 1. Fit4Work Mobile Application displays an appropriate error message. 2. The user onboarding process of the Fit4Work Mobile Application is stopped. 3. The user sees an option to again enable access to the Activity Sensor's data.
Referenced Use Cases	-
Notes	-

ID	G6
Name	**Mobile Application Features Tour**
Context	The Fit4Work Mobile Application needs to be able to show a short tour of its main features to novice users.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	Mobile Application installed on user's mobile device and the user's logged into the Fit4Work system
Post conditions	User has knowledge about main Mobile Application features
Priority	High
Trigger	User action
Main Success Scenario:	1. User runs the Mobile Application for the first time (see G1) and goes through the setup process (see G2, G3, G4, G5) 2. Mobile Application shows a tour of the main features by highlighting specific elements of its UI on the main screen and showing short descriptions of their function
Alternate scenarios	G6.ALT.1 1. User selects the feature tour option from Mobile Application's menu 2. Mobile Application shows the same tour as in step 2. of the Main Success Scenario.

Extensions	G6.EXT.1 3. When the user navigates to a specific screen for the first time, the same kind of feature tour is shown to them as in the case of the main screen.
Exceptions	-
Referenced Use Cases	
Notes	-

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ID	G7
Name	**Viewing current state of user physical activity, mental stress and work environment**
Context	User wants to check their current progress and state, as far as goals and recommendations set by Fit4Work – e.g. they want to see their current physical activity progress
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current progress and status
Priority	High
Trigger:	User action
Main Success Scenario:	1. User navigates to the screen with the Mobile Application widget 2. Without requiring any interaction, the widget presents the following information at a glance: a. physical activity progress for the current day b. current user mental stress level c. current environment status d. information telling the user whether or not they performed a functional exercise and/or mental stress relief exercise today

	e. a limited set of recent notifications f. current time
Alternate scenarios	G7.A.1 1. User opens the Mobile Application. 2. The Mobile Application main screen presents the same information as its widget (see step 2 of main success scenario)
Extensions	G7.EXT.1 3. User can tap on a notification to see more details about it (see use case G12) 4. Tapping on a different part of the widget opens the Mobile Application
Exceptions	-
Referenced Use Cases	G12
Notes	-

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ID	G8
Name	**Viewing a combined summary of current day, week and month of user physical activity, mental stress and work environment**
Context	User wants to check on their current day/week/month activity as far as goals and recommendations set by Fit4Work
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current day/week/month of activity
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the Mobile Application 2. Main screen of the application shows, separately, an overview of the current day, week and month. 3. Each of those time periods shows a summary of user activity divided into physical activity, mental stress and work environment status
Alternate scenarios	-
Extensions	G8.EXT.1 4. User can see more details about a specific period of time by

	choosing one of the time period options – day, week, month and thereby executing the G9, G10 or G11 use case.
Exceptions	-
Referenced Use Cases	G9, G10, G11
Notes	-

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ID	G9
Name	**Viewing current day's activity summary**
Context	User wants to see more details about their activity for the current day
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current day's physical activity progress, mental stress and work environment status, as well as associated recommendations
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the Mobile Application 2. On the main screen, the user chooses an option representing current day's activity 3. A screen with current day's activity is shown, containing the following information: a. physical activity progress in relation to the set goal b. "relaxation score" representing the level of user's stress throughout the day (generally speaking, representing how much time they spent relaxed) c. "environment comfort score" - telling the user how good, on average, their working environment has been so far on the given day day d. recommendations related to each of the above categories

Alternate scenarios	-
Extensions	G9.EXT.1 4. User can view optional, additional long term recommendations by choosing an appropriate option.
Exceptions	-
Referenced Use Cases	-
Notes	-

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ID	G10
Name	**Viewing current week's activity summary**
Context	User wants to see more details about their current week's activity
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current week's physical activity progress, mental stress and environment status, as well as associated recommendations
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the Mobile Application 2. On the main screen, the user chooses an option representing current week's activity 3. A screen with current week's activity is shown, containing the following information: a. physical activity progress in relation to the set goal for each day in the week b. physical activity progress in relation to the weekly goal c. information whether on a given day a functional exercise was performed d. "relaxation score" for each day in the week e. Information whether on a given day a stress relief exercise was performed f. "environment comfort score" for each day in the week g. recommendations and/or notifications related to each of the above categories

Alternate scenarios	-
Extensions	G10.EXT.1 4. User can view optional, additional long term recommendations by choosing an appropriate option
Exceptions	-
Referenced Use Cases	-
Notes	-

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ID	G11
Name	**Viewing current month's activity summary**
Context	User wants to see more details about their current month's activity
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current month's physical activity progress, mental stress and work environment status, as well as associated recommendations
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the Mobile Application 2. On the main screen, the user chooses an option representing current month's activity 3. A screen with current month's activity is shown, containing the following information: a. physical activity progress in relation to the set goal for each day in the month b. number of days the daily physical activity goal has been reached c. "relaxation score" for each day in the month d. "environment comfort score" for each day in the month e. recommendations and/or notifications relating to each

	of the above categories
Alternate scenarios	-
Extensions	G11.EXT.1 4. User can view optional, additional long term recommendations by choosing an appropriate option
Exceptions	-
Referenced Use Cases	
Notes	-

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ID	G12
Name	**Receiving and viewing notifications**
Context	While monitoring user's activity, Fit4Work presents them with certain recommendations aimed at improving their physical and mental wellbeing. The user receives those recommendations in form of notifications.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about the most important recommendations
Priority	High
Trigger	Fit4Work detects a condition requiring presenting the user with a recommendation
Main Success Scenario:	1. One of the Recommender services produces a recommendation. 2. The recommendation is sent to the user's mobile device 3. User receives the recommendation: a. in form of a push notification (if the Mobile Application is not open) b. in form of an icon representing the recommendation on the main screen or the widget 4. The push notification contains a full text of the recommendation. Tapping the notification opens the Mobile Application with the recommendation text shown 5. In the Mobile Application the user can tap on the icon representing the notification and view a full text of the recommendation 6. Additionally, some recommendations may be acted upon in the

	Mobile Application (e.g. recommendations to perform a mental stress relieve exercise or a functional exercise). In this case the component showing the recommendation text will also have an "action" button. 7. User taps the "action" button and an appropriate screen is launched inside the Mobile Application (eg. a screen with the mental stress relief exercise or a functional exercise). 8. Tapping on the full text of a recommendation causes it to "collapse" into an icon representation
Alternate scenarios	-
Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

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ID	G13
Name	**Hiding notifications**
Context	User can hide a notification. Performing this action is not a desired behaviour from the point of view of Fit4Work goals and because of that the user shouldn't be able to be perform it accidentally (or easily).
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User no longer sees the given notification
Priority	Medium
Trigger	User action
Main Success Scenario:	1. The user chooses a notification to hide 2. The user performs a specific gesture on the notification icon (e.g. swiping it to the side or tapping and holding) 3. After the gesture is performed, a confirmation of the removal of the notification is required 4. The user can choose from the following options: a. hide for now b. hide for the remainder of the day
Alternate scenarios	1. The Fit4Work system detects that a specific condition requiring a notification is no longer valid (e.g. the user has opened the window in their office and the air quality has sufficiently improved, or the user turned the light on and it's no longer dark

	in the office) 2. Appropriate notification icon disappears from the the main screen of the Mobile Application
Extensions	G13.EXT.1 5. The notification can reappear after a certain amount of time.
Exceptions	-
Referenced Use Cases	-
Notes	-

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ID	G14
Name	**Running the PC Application for the first time**
Context	User runs the Fit4Work PC application for the first time.
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	The mobile application was installed on smart phone and an account was created. The user opens the PC application.
Post conditions	The user successfully use the PC application for the first time.
Priority	High
Trigger	The user decides to use the Fit4work system.
Main Success Scenario:	1. User starts up the PC Application. 2. User enters the credentials to login (see G15). 3. An introduction to Fit4Work and a feature set tour are shown to the user in order for him to get connected with the features of PC application (see G16).
Alternate scenarios	-
Extensions	-
Exceptions	-
Referenced Use Cases	G 15; G 16;

Notes	-

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ID	G15
Name	**Login (PC)**
Context	User logs in in order to use the PC application.
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	The mobile application was installed on smart phone and an account was created. The user opens the PC application.
Post conditions	The user is logged in.
Priority	High
Trigger	The user decides to use the Fit4work system.
Main Success Scenario:	1. User starts up the PC Application. 2. User enters the credentials to login (the account was created when the user opened the mobile application for the first time and completed the registration process) 3. The user access the login button. 4. The application open the Home Page.
Alternate scenarios	-
Extensions	-
Exceptions	-
Referenced Use Cases	-

Notes	-

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ID	G16
Name	**Introducing the user to Fit4Work System & Features Tour (PC)**
Context	After opening the PC application for the first time and login, the user will be introduced to the features of the PC application.
Level	User goal
Primary Actors	User
Alternate actors	-
Preconditions	The user opens the PC application and he is logged into the Fit4Work system.
Post conditions	The user is familiarized with the PC application feature set.
Priority	High
Trigger	The user opens the Fit4Work PC application for the first time.
Main Success Scenario:	1. User runs the PC Application for the first time (see G 14) and enters the credentials to login into the system. (G 15) 2. A series of screens is shown to the user explaining in very general terms the idea and benefits of Fit4Work system. 3. The user navigates through those screens and views/reads the information. 4. The PC Application also presents the main features of the application by highlighting specific elements of its UI on the main screen and showing short descriptions of their function.
Alternate scenarios	-
Extensions	-

Exceptions	-
Referenced Use Cases	G 14, G 15;
Notes	-

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ID	G17
Name	**Viewing current state of environment condition (PC)**
Context	User wants to check if his working environment conditions are between recommended limits.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about his current working environment conditions.
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the PC application. 2. Without requiring any interaction, the home page of the application presents the following information at a glance: a) current environment status b) physical activity progress for the current day c) current mental stress d) a set of recommendations to follow at the current time. (if needed) e) newsfeed/tips & tricks for how to maintain a proper environment to work in.
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

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ID	G18
Name	**Viewing user profile and editing user personal information (PC)**
Context	User wants to see his profile and personal information.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	The personal information of the user are up to date.
Priority	High
Trigger	User action
Main Success Scenario[AM1] :	1. User opens the PC application. 2. From the Home Page, user accesses the User Profile. 3. The application opens the User Profile interface. 4. The user can visualize his personal information but also can edit it.
Alternate scenarios	-
Extensions	-
Exceptions	-
Referenced Use Cases	-

Notes	-

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ID	G19
Name	**Viewing a combined summary of current day, week and month of user physical activity, mental stress and work environment (PC)**
Context	User wants to check on his current day/week/month activity history as far
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about their current day/week/month of activity
Priority	High
Trigger	User action
Main Success Scenario:	1. User opens the PC application. 2. From the Home Page, user accesses the Activity button 3. If accessed, the Activity button will open a page where is a combined summary of the current day/week/month of user physical and mental stress and work environment.
Alternate scenarios	-
Extensions	-
Exceptions	-

Referenced Use Cases	-
Notes	-

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ID	G20
Name	**Receiving and viewing notifications (PC)**
Context	While monitoring user's activity, Fit4Work presents certain recommendations aimed to improve the working environment of the user. The user receives those recommendations in form of notifications.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User has knowledge about the most important recommendations
Priority	High
Trigger	Fit4Work detects a condition requiring presenting the user with a recommendation
Main Success Scenario:	1. One of the Recommender services produces a recommendation. 2. The recommendation is sent to the user's PC application. 3. User receives the recommendation: ● in form of a push notification ● in form of an icon representing the recommendation on the home page 1. The push notification contains a full text of the recommendation. Clicking the notification opens the PC Application with the recommendation text shown. 2. In the PC Application the user will see an icon which will represent the recommendation visually, alongside with the full text of the recommendation.
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

2.4.2. Physical activity use cases

Physical activity processes are those involving user's everyday habitual physical activity, like activities performed while working, walking, sports (biking, running, swimming etc.).

ID	PA1
Name	**Setting physical activity goal**
Context	User's physical activity goal employed by Fit4Work is set based on WHO recommendations, and follows the rule of burning at least 200 kcal daily above the number of calories required to maintain base body functions. Fit4Work will set the initial goal for the user, but the user will also be able to adjust it.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	New user's physical activity goal is set
Priority	High
Trigger	User action
Main Success Scenario:	1. After a week of being monitored by Fit4Work, the Mobile Application presents a summary with a new suggested physical activity goal for the next week based on user's activity over the past week

	a. Increased goal if user reached or exceeded the weekly physical activity goal b. Same or lowered goal if the user has failed to reach their physical activity goal over the past week 2. The user confirms the new goal or changes it: a. The goal can be increased up to two times the recommended minimum (400 kcal/day) b. The goal can be decreased down to the recommended minimum (200 kcal/day)
Alternate scenarios	-
Extensions	-
Exceptions	
Referenced Use Cases	-
Notes	-

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ID	PA2
Name	**Manually adding a physical activity**
Context	User can manually enter a physical activity that was not monitored by Fit4Work.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	Energy expenditure of the physical activity has been added to the total energy expenditure for the specified day.
Priority	Low
Trigger	User action
Main Success Scenario:	1. The user chooses an option to add an activity in the Mobile Application's menu 2. The user enters: a. Date the activity was performed b. Duration c. Type of activity from a predefined list of activities 3. Fit4Work converts this data into an energy expenditure and adds it to total energy expenditure for the specified day 4. Mobile Application shows a confirmation that the activity was added.
Alternate scenarios	-

Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

2.4.3. Functional exercise use cases

These processes are related to performing specific exercise by the user as instructed by the Fit4Work system.

ID	FE1
Name	**Performing a functional exercise**
Context	In order to maintain good overall fitness, including a full range of movement, the user should perform specific functional exercise. This kind of exercise can also be used to evaluate the user's fitness.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User performed the functional exercise
Priority	Medium
Trigger	User action
Main Success Scenario:	1. User chooses an appropriate option on the main screen of the Mobile Application. 2. Screen showing the following information is displayed: a. User current fitness level b. User progress towards the next level c. Last exercise date and length d. Total time spent exercising with Fit4Work 3. User chooses an option to start performing the exercise 4. An external functional exercise application is launched 5. After the exercise is complete the user is presented with a

	summary a. Exercise time b. Calories burned c. Score
Alternate scenarios	FE1.AS.1 3. User can choose an option to set up the Movement Sensor first 4. Help on how to setup the sensor is shown 5. After finishing the Movement Sensor setup, the user can choose to start performing the exercise 6. An external functional exercise application is launched
Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

2.4.4. Mental stress use cases

The following processes relate to maintaining a good mental health of the user.

ID	MS1
Name	**Performing a mental stress relief exercise**
Context	In order to maintain good mental health, the user occasionally should perform a mental stress relief, or a relaxation exercise.
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User performed the mental stress relief exercise
Priority	Medium
Trigger	User action
Main Success Scenario:	1. User chooses a mental stress relief (or relax) option on the main screen of the Mobile Application. 2. Screen showing the following information is displayed: a. User current relaxation exercise level b. User progress towards the next level c. Last exercise date and length d. Total time spent relaxing with Fit4Work 3. User chooses an option to start performing the exercise 4. A stress relief exercise application is launched 5. After the exercise is complete the user is presented with a summary screen containing:

	a. Exercise time b. Current stress level vs stress level before the exercise
Alternate scenarios	-
Extensions	-
Exceptions	-
Referenced Use Cases	-
Notes	-

2.4.5. Social aspects

ID	SOC1
Name	**Sharing daily activity on a social network**
Context	User can choose to share their daily Fit4Work activity on a social network
Level	User goal
Primary Actors	Registered User
Alternate actors	-
Preconditions	User is logged in
Post conditions	User daily activity has been shared on their social network
Priority	Medium
Trigger	User action
Main Success Scenario:	1. User navigates to the daily activity screen of the Mobile Application 2. User chooses an option to share this activity on a social network 3. User chooses the social network (e.g. Facebook) 4. A social network share sheet appears with basic statistics for the chosen day (physical activity, relaxation score, environment score) presented in a graphical way 5. User confirms posting the entry to their profile
Alternate scenarios	-
Extensions	-

Exceptions	-
Referenced Use Cases	-
Notes	-

3. Overview of general system architecture

3.1. Introduction

The architecture of the Fit4Work system distinguishes two major realms of functional components: front-end which is in direct contact with the user, and the back-end that supports the front-end with functionality requiring higher computing power or storage resources and runs in the background. The central point of the front-end is a smartphone, while the back-end assumes using the Cloud infrastructure to host and provide its services. The architecture is presented in Figure 3.1.

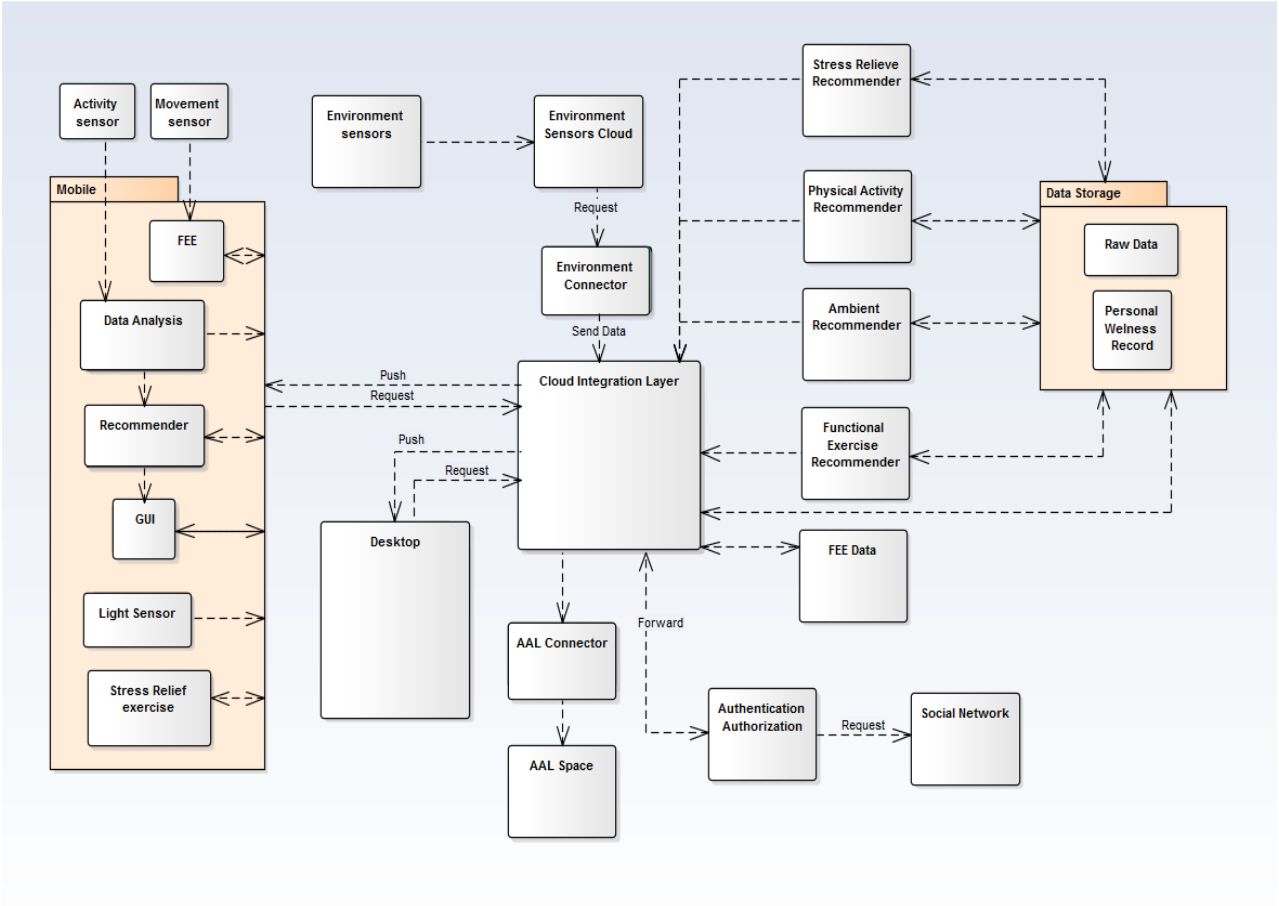

Figure 3.1. General architecture of the Fit4work system

The Fit4Work system is divided into four different categories of components:

1. Sensors (activity, movement and environment)
2. User Gateways (mobile & desktop)
3. Cloud Services
    a. Cloud Integration Layer

   b. Recommenders
   c. Data Storage
   d. Authorization
   e. Functional Exercise Engine (FEE) Data
4. Connectors
   a. Environment Sensors Connector
   b. AAL Connector

The sensors gather information that is being used by the system to compute the recommendations.

The Fit4work Mobile and Desktop Applications are the user gateways to the Fit4Work system. They provide the user with information about the Fit4Work environment. The Mobile Application also supplies other components with data from the various sensors connected to the mobile device.

The Mobile Application retrieves data from the devices connected to the smartphone and can both process it locally or send it for further processing to the Cloud.

The Desktop Application will focus on the recommendations that are to be received by the user and on the current conditions (current stress level, current physical activity level, current environment conditions). It will be complementary to the Mobile Application and will also offer the possibility of viewing activity history and profile information.

The Cloud components are classified into core service components and connectors.

The core components are:

- Cloud Integration Layer
- Data Storage Service (Raw Data and Personal Wellness Record)
- Stress Relieve Recommender
- Physical Activity Recommender
- Ambient Recommender
- Functional Exercise Recommender
- Functional Exercises Engine Data (FEE Data)

Because the core components are developed by different teams of developers, the fact that they might use different software architectures or services was taken into consideration. Therefore, they will be interconnected using the Cloud Integration Layer which functions as a proxy in the Fit4work system and is defined by a series of services that will lay out diverse methods of accessing and delivering data to each and every component integrated in the system.

The connectors are:

- AAL Connector
- Environment Sensors Connector

These connectors will provide interfaces with sensors or systems which are external to the Fit4Work system. The AAL Connector will be described in detail in deliverable D5.2, whereas the environment sensors connector will be referred in the following chapters.

3.2. User gateways

User gateways function as a way of accessing the Fit4Work system by the end user. In very broad terms, they provide user interfaces to the Fit4Work system - on mobile and desktop devices.

Both the Mobile and Desktop Application provide specialized user interfaces and user experience for the platforms they are deployed on.

3.2.1. Mobile Application

The Mobile Application acts as the primary way of accessing the Fit4Work system by the end user. It also works as the gateway to the Cloud Services for the stream of processed data coming from the Activity Sensor monitoring user's physical and mental activity.

The Mobile Application serves the following functions:

- Providing a way of registering and authenticating the end user
- Gathering information coming from sensors monitoring the user and performing local analysis of this data
- Sending data from sensors to backend Cloud Services for further analysis and storage
- Providing the user with personalized recommendations based on local and remote analysis of sensor data
- Presenting the user with information coming from various Fit4Work Cloud Services and relating to:
    - user physical activity - energy expenditure in the context of goals set by the Fit4Work system
    - user mental activity - presented in the form of relaxation level, decreasing with detected stress
    - environment status - presented in the form of a environment comfort score combining various environmental parameters into one value score
- Providing historical data for user activities and environmental data measured by Fit4Work
- Aiding the user in the performance of functional and stress relief exercises

Because of the very wide range of functionality, the Mobile Application has been further divided into subcomponents performing specific roles. Those components are presented in the following subsections.

3.1.1.1 Data Analysis

The Data Analysis module collects the data from sensors, estimates parameters with virtual sensors, preprocesses and transforms the data, and models parameters needed to solve tasks for physical activity monitoring, functional fitness exercises, stress monitoring and ambient conditions monitoring.

The tasks of this component are:

- Physical activity monitoring recognizing user's activities and estimating expended energy
- Functional exercise engine recognizing the performed exercises from user's movement
- Stress monitoring detecting whether the user is in stress or not

The results of the data analysis are utilized by the recommender module.

3.1.1.2 Recommender

The recommender utilizes the results of the data analysis module to understand the user's current context (activity progress, stress state, progress on the functional fitness exercises, ambient conditions) and recommends short-term actions which will improve the respective context of the user.

The short-term recommendation for activity monitoring involve motivating the user to achieve daily goals in terms of number of active calories burn, to move each hour and to achieve predefined duration of certain activity.

The short-term recommendations for functional fitness exercises suggest activities to perform at the end of the day (when user is not at workplace).

The short-term recommendations for stress relief suggest an exercise from the list of exercises to be performed by the user.

The short-term recommendations for ambient conditions monitoring are recommendations of actions which will improve the state of the environment.

3.1.1.3 Stress Relief Exercise

The module for stress relief is composed of two types of exercises (breathing and muscle exercise) which are presented to the user on the mobile phone. The user follows the instructions and once the exercise is completed, the user is presented with the questionnaire about the exercise performance on reducing stress.

3.1.1.4 Functional Exercise Engine

The functional exercises engine will be built using the notion of serious gaming or gamification.

Serious games in general have an impact on users such as a change in knowledge, behavior, physical state, cognitive function, as well as health and mental well-being (McCallum, 2012), combining gaming and exercise resulting in maintenance and improvement of physical status, focusing on large muscle groups.

The developments will be done using Unity3d game's engine which allows implementing 3d environments both for computers and mobile platforms. User interaction is monitored by a kinect-like sensor. The sensor will capture user movements, linked to events in the game environment and stored for reporting purposes.

The functional exercise software is responsible for presenting exercises in the form of challenges. The user needs to perform some particular activity to receive positive feedback or reward. The serious games will be developed along with experts in order to make the game visuals assets with an approach according to the target users.

When the user receives a functional exercise recommendation and chooses appropriate option in the Mobile Application, a functional exercise game will open on an appropriate exercise level according to the recommendation. Once the exercise session is over, the performance indicators will be stored in the user's profile.

3.1.1.5 GUI

The GUI is a component playing a central and integratory role in the context of the Mobile Application.

On the one hand, it provides an intuitive user interface, a visual layer presenting properly formatted information about user's activity and recommendations coming from the system. On the other hand, it communicates with the Recommender, Stress Relief Exercise and Functional Exercise Engine application components and Fit4Work Cloud Services in order to provide the user with said information.

The GUI also gives the user means of navigating through exposed functions of the Fit4Work system and manipulating certain aspects of the system, for example updating user preferences.

3.2.2. Desktop Application

The Desktop Application represents a secondary user gateway after the mobile application. It is complementary to the Mobile Application and it is being developed for the users working in offices and using desktop computers on a daily basis to easily visualize the information about their environment, physical activity level and mental stress level and receive recommendations that the Fit4work system provides, as well as see their activity history on a daily/weekly/monthly basis without the need for reaching for their mobile phone.

The Desktop Application receives and requests data from the Cloud Services through the Cloud Integration Layer in order to display summarized information on physical activity level, mental stress and environment status. The envisioned role of the Desktop Application is to focus on providing the user with statistical information about their activities monitored by Fit4Work, whereas the Mobile Application will focus more on the current state analysis.

3.3. Cloud services

Cloud services provide functionality necessary for the long-term operation of the Fit4Work system, as well as integration of various separate services, including external services, and synchronization of data between user gateway applications.

The following sections describe each component in general terms, as far as the role played by it within the Fit4Work system, and its high-level functionality.

3.3.3. Cloud Integration Layer

The Cloud Integration Layer functions as a link between the components in the Fit4work system and it is defined by a series of services that will lay out diverse methods of accessing and delivering data to each and every component integrated in the system.

The Cloud service is similar in behavior to a proxy server that is able to adapt both the request from the client and the response from the target server.

This architecture, having the Cloud Integration layer in the center, is very similar to an Enterprise Service Bus architecture and it is preferred in order to facilitate seamless integration between various components present in the system, which are heterogeneous in terms of technologies being used.

The inputs for the Cloud Integration Layer will come from the user gateways, mainly the mobile application, but also from external interfaces, through specialized connectors. This information will serve as input for other Fit4Work cloud services. The Cloud Integration Layer will also process responses from Fit4Work cloud services to user gateways, and route communication between those services.

Deliverable 5.3 will describe in more detail the Cloud Integration Layer (Carjan, Bogdański, i Stroiński, Cloud Services Specification, 2016).

3.3.4. Stress Relief Recommender

Stress relief recommender takes the long-term stress data from Personal Wellness Record for the specific user; the stress state and the data about the performance of the stress relief exercises to understand what has the best influence on the user under what conditions. The result of the analysis serves as an input to the short-term recommendation system running on the user's gateway and provides additional information for the recommendations presented to the user through the GUI.

3.3.5. Physical Activity Recommender

The physical activity recommender takes the long-term activity data for the specific user from the Personal Wellness Record; the type of activity and estimated expended energy to analyze the long-term physical activity behavior of the user. For example, what is the physical activity pattern during a week, what are the most frequently performed activities, etc. This serves as an input to the short-term recommendation system running on the user's gateway and provides additional information for the recommendations presented to the user through the GUI.

3.3.6. Ambient Recommender

The ambient recommender utilizes ambient data for the user, as measured by the sensors and predicted by virtual sensors, as well as historic ambient data retrieved from its database. The historic data is used for training the prediction models which are used in the simulator to evaluate the most suitable actions which should be performed by the user. Once the simulator outputs the best action, it is sent as a recommendation to the user's gateway and presented in the GUI.

3.3.7. Functional Exercise Recommender

The functional exercise recommender computes daily activities performed by the user and retrieved by the sensors. The recommendations change according to the tasks performed during the day and are intended to improve endurance, strength, balance, posture, coordination and agility. The execution of functional exercises will enhance the movement capabilities of Fit4Work users in terms of prevention and work-readiness physical skills.

3.3.8. Authentication and Authorization

The Fit4Work user will have to authenticate in order to be able to use the Fit4Work system. The authentication will be enforced on both the Mobile Application and the Desktop Application. Prior to the authentication, a user account must be created, this will be possible from the Mobile Application.

The possibility to authenticate using Google or Facebook services and identity providers is considered.

Each user will use different sensors which will have to be correlated with the profile of the user. This will be done either at account creation, or at a later stage and will be decided upon during the development phase.

3.3.9. Environment Sensors Connector

The environment sensor stores its data on a proprietary system, which is accessible through an API. In order to gain access to the data, a connector will be built. The data that will be pushed to the Cloud Integration Layer is the following:

Outdoor data:

- Temperature
- Humidity
- Atmospheric pressure

Indoor data:

- Temperature
- Humidity
- CO2
- Noise

There will also be an identifier for the specific environment sensor that is being used and a timestamp.

3.3.10. AAL Connector

AAL Connector is a service functioning as a connection point between Fit4Work services and other external AAL services. The AAL Connector exposes selected contextual Fit4Work information or functionality to the AAL Space containing multiple AAL services and applications.

The AAL Connector will intercept certain events associated with the user (e.g. user is stressed, user is performing an exercise etc.) and make them available for other AAL applications running in the same smart space as Fit4Work.

Details about the role of the AAL Connector and its usage scenarios have been described in AAL Middleware Specification (Bogdański, Stroiński & Kosiedowski, 2016).

3.3.11. Social Networks

From the Mobile Application, the user will have the possibility of publishing (posting) information about their activity within Fit4Work to social networks, like Twitter or Facebook. This information will be based on the achievements of the user. For example, the user will be able to tweet to their followers that they have met their daily physical activity goal for 7 days in a row.

3.4. Security considerations

Every complex and distributed system, such as Fit4Work, storing personal and sensitive data must be highly secured from unauthorized access protecting system and data integrity and user privacy. This kind of overall protection is based on proper user authentication and authorization, as well as providing communication channel security, data storage security and introducing proper security procedures in system maintenance development.

3.4.1. User authentication and authorization

The Android mobile operating system has been selected as the platform for the Mobile Application development. Because Android is highly integrated with Google services and a user Google account, it is proposed to use Google Sign In (Google, 2016) as a way to securely provide user identity to the Fit4Work system.

In addition to simplifying the creation of a user account and of signing into Fit4Work, from the user point of view, this approach also provides potential increase in data privacy and security, because personal health data collected by Fit4Work can be separated from other user personal user information which is managed by an external identity service.

Each Fit4Work component must also perform user authorization, checking whether the user or other component associated with a specific request is permitted to perform the desired operation. Individual components, including the Cloud Integration Layer, should be responsible for managing their own request authorization.

3.4.2. Communication security

Information exchange between distributed Fit4Work components will occur, in large part, over the public network and must therefore be secured from being intercepted by a malicious third party. To this end, HTTPS - secure and encrypted version of the HTTP protocol – will be used.

HTTPS (HTTP Secure) is an adaptation of the Hypertext Transfer Protocol (HTTP) for secure communication over a computer network, and is widely used on the Internet. In HTTPS, the communication protocol is encrypted by Transport Layer Security (TLS).

Additionally, each request within the system must contain information allowing Fit4Work components to identify the user sending the request. In order to convey this information, it is proposed to use a combination of JSON Web Token (Internet Engineering Task Force, 2015) and HTTP Basic Authentication (Mozilla, 2016) based security.

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3.4.3. Data security

Fit4Work is storing information related to user's physical and mental activity. While this is not strictly medical information, it should nonetheless be considered as very sensitive (information security and privacy has been identified as a very important aspect by Fit4Work potential users (Blok et al, 2016)).

In addition to protecting sensitive system data by means outline above, in paragraphs 3.3.1 and 3.3.2, it's also proposed to store data collected by Fit4Work in an encrypted form in Data Storage, within the Personal Wellness Record, as well as physically separate sensitive user information, like physical and mental activity, from other user personal information. This would make it much more difficult for potential attackers to identify a particular person based on just user activity data.

3.4.4. Security procedures

In order to maintain a high level of overall system security, a series of procedures should be implemented on the organizational level. These should include:

- proper security policy documentation
- access to sensitive parts of the system (i.e. cloud infrastructure) should be limited to a selected and properly trained group of software engineers and system operators
- system backups should be regularly performed and securely stored
- system security audits should be conducted on regular basis

4. Summary

This document presents a comprehensive technical vision for the Fit4Work system. Based on previously collected user requirements (Blok et al, 2016) and state-of-the-art analysis of sensors and wellness devices (Kosiedowski et al, 2016), a general system architecture has been proposed.

Individual system components have been characterized in terms of their functionality resulting from Fit4Work requirements and an overall system architecture has been developed based on those components and other aspects, like system flexibility and security.

The described architecture also takes into account competences of various member teams of the consortium, as well as further system development, beyond the project lifetime.

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