ALFRED

Personal Interactive Assistant for Independent Living and Active Ageing

WP6 – Pillar III: Effective & Personalized Care

D6.5.1: App Building and Deployment

Deliverable Lead: TUDA

Contributing Partners: AITEX, ASC

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This document describes the additional applications that have been developed within WP6 besides this work package's main contribution to the ALFRED system, the health monitor component. These "extensions" to the ALFRED core, a number of which is being provided by all technical partners of the project, are based on ALFRED's user stories and meant to extend the system's usefulness. This deliverable has information on the scope of those five extensions that have been created within WP6, and additionally provides instructions on how to install and run them individually without relying on the ALFRED core.

SEVENTH FRAMEWORK PROGRAMME

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Executive Summary

This deliverable describes the five applications that were developed during the project months 24 to 30 in the context of WP6: “Medical Reminder”, “Alarm Clock”, “Health Monitor”, “Body Posture”, and “Weight Control”.

The Medical Reminder sends notifications to users when they are supposed to take their medicine. In a similar fashion, Alarm Clock wakes users in the morning, but additionally also asks them for their wellbeing. Users can reply by voice and the application will react in an adequate manner, for instance offer to reach out for assistance. Both applications are feature complete, but will see further usability and reliability improvements during months 31 to 36. The Health Monitor application presents health related data to the user that has been gathered using external sensors, i.e. the ALFRED shirt. It is available in a first, prototypical version. The Body Posture application instructs users how to maintain a healthy body posture. The current version of the application merely demonstrates this functionality, but will be extended during the next months. Finally, the Weight Control application will gather information about the user’s body weight – both by manual input and automatically via digital body weight scales – and visualizes changes in time. Similar to the Body Posture application, the Weight Control app is currently only available as a conceptual prototype, but will be available in full during the next months.

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1 Introduction

ALFRED – Personal Interactive Assistant for Independent Living and Active Ageing – is a project funded by the Seventh Framework Programme of the European Commission under Grant Agreement No. 611218. It will allow older people to live longer at their own homes with the possibility to act independently and to actively participate in society by providing the technological foundation for an ecosystem consisting of four pillars:

- **User-Driven Interaction Assistant** to allow older people to talk to ALFRED and to ask questions or define commands in order to solve day-to-day problems.
- **Personalized Social Inclusion** by suggesting social events to older people, taking into account their interests and their social environment.
- A more **Effective & Personalized Care** by allowing medical staff and caretakers to access the vital signs of older people monitored by (wearable) sensors.
- **Physical & Cognitive Impairments Prevention** by way of serious games that help the users to maintain and possibly even improve their physical and cognitive capabilities.

This deliverable describes five of the 25 initial additional applications that come with the ALFRED system, specifically the “Medical Reminder” app, the “Alarm Clock”, the “Health Monitor” application, the “Body Posture” application, and the “Weight Control” app.

1.1 ALFRED Project Overview

One of the main problems of western societies is the increasing isolation of older people, who do not actively participate in society either because of missing social interactions or because of age-related impairments (physical or cognitive). The outcomes of the ALFRED project will help to overcome this problem with an interactive virtual butler (a smartphone application also called ALFRED) for older people, which is fully voice controlled.

The ALFRED project is wrapped around the following main objectives:

- To empower older people to live independently for longer by delivering a virtual butler with seamless support for tasks in and outside the home. This virtual butler (the ALFRED app) aims for a very high end-user acceptance by using a fully voice controlled and non-technical user interface.
- To prevent age-related physical and cognitive impairments with the help of personalized serious games.
- To foster active participation in society for the ageing population by suggesting and managing events and social contacts.
- And finally, to improve caring by offering direct access to vital signs for carers and other medical staff as well as alerting in case of emergencies. The data is collected by unobtrusive wearable sensors monitoring the vital signs of ALFRED’s users.

To achieve its goals, the project ALFRED conducts original research from a user centred perspective and applies technologies from the fields of Ubiquitous Computing, Big Data, Serious Gaming, the Semantic Web, Cyber Physical Systems, the Internet of Things, the Internet of Services, and Human-Computer Interaction. For more information, please refer to the project website at http://www.alfred.eu.

1.2 Deliverable Purpose, Scope and Context

The purpose of this deliverable is to describe the scope and state of the additional applications (“extensions”) that are developed within WP6 besides this work package’s main contribution, the Health Monitor subcomponent.

1.3 Document Status and Target Audience

This document is listed as “public” in the Description-of-Work (DoW), as it provides general information about ALFRED’s software extensions. While the document mainly aims at the project’s contributing partners, this public deliverable can also be useful for the wider community.

1.4 Abbreviations and Glossary

A definition of common terms and roles related to the realization of the ALFRED project as well as a list of abbreviations is available in the supplementary document “Supplement: Abbreviations and Glossary”, which is provided in addition to this deliverable. Further information can be found at http://www.alfred.eu.

1.5 Document Structure

This deliverable follows the structure of all other “prototype deliverables”. This first chapter gives a general introduction to the ALFRED project. It is followed by a description of this document’s context and scope in chapter 2. Chapter 3 describes the five applications that have been developed within WP6. Chapters 4 to 6 have information on how to install and run these applications on an off-the-shelf Nexus 5 device. Chapter 7 details the test schedule for the applications; chapter 8 lists the applicable key-performance-indicators. Finally, chapter 9 provides a summary.

2 Context and Scope

As pointed out in the introductory chapter, the ALFRED project aims to develop a mobile assistant for elderly users in order to empower them to maintain their wellbeing and independence. To this end, the project relies on four pillars, one of them being “Effective & Personalized Care”. The majority of contributions to this pillar derive from the project’s work package 6, led by project partner AITEX.

The main outcome of work package 6 is the Health Monitor component which is part of the ALFRED Personal Assistant. The tasks 6.1 to 6.4 are all contributing to the development of this system. However, task 6.5 focuses on the development of additional applications meant to support the user’s health and wellbeing. These applications are derived from the ALFRED user stories that were compiled during early focus group discussions and the functionality of each applications aims to fulfil one or multiple of the expectations towards the ALFRED system as formulated by the participants of these discussions.

This document describes the five prototypical applications for “Effective & Personalized Care” that are being developed in task 6.5 by the project partners AITEX, ASC, and TUDA. What these applications are – and how they relate to their respective user stories – is described in the next chapter. Note that the deliverable is a “prototype deliverable”, meaning it is accompanied by the actual application files. How they are installed and executed is described in chapters 4 to 6.

3 State of the Development

This chapter describes the functionalities of the five applications developed in task 6.5. As all of these applications are based on user stories compiled in the context of task 2.3 (see deliverable D2.3 for more information), the respective user stories that sparked the development of an application are also specified. The applications are listed in alphabetical order. You can find a couple of screenshots of the applications at the end of this chapter.

3.1 Alarm Clock

The “Alarm Clock” app is based on User Story 036 (see deliverable D2.3, p.44) and mainly developed by partner AITEX.

ID	US036	Title	Wake up call	Priority	1
User Group	Older Person	Tasks	T4.3, T6.3	Use Case	UC2.3
Summary	As an older person I would like to receive a wake up call from ALFRED in the morning checking on me if I am ok				

The idea of the Alarm Clock application is to connect a regular alarm with a short dialog that asks the user how she is feeling. Depending on the user’s answer, the app then provides a suggestion on what to do next.

The user’s interaction with the app starts with setting a time for the alarm, similar to other alarm applications. At the specified time, the application then wakes the user with the phrase “Good morning, how do you feel today?”. The application then listens for specific keywords in the user’s answer such as “excited”, “fine”, or “depressed”, which are in turn associated by the system to a 1-to-5 mood hierarchy (5 being the optimum). This rating system is based on scientific findings on the development of mood-reporting applications (see: Pieter Desmet et al.: “*Pick-A-Mood; development and application of a pictorial mood-reporting instrument.”* In: Out of Control: Proceedings of the 8th International Conference on Design and Emotion, London, 2012).

For each mood rating, multiple fitting answering phrases are predefined and depending on the user’s answer, the application replies with randomly choosing one of those. The following listing provides a few examples for possible dialogs between the user and the Alarm Clock app. Note how the app offers assistance to the user if she indicates being in a bad shape. For instance, it can initiate a call to a medical carer or a relative.

Listing 1: Alarm Clock Dialog Examples

```
--- feeling excited (mood score = 5)
S> Good Morning. How do you feel today?
U> I am excited
S> You feel excited. That's great!

--- feeling very happy (mood score = 5)
S> Good Morning. How do you feel today?
U> I am happy
S> Choose normal, very or really?
U> Very
S> You feel very happy. That's fantastic!

--- feeling fine (mood score = 3)
S> Good Morning. How do you feel today?
U> Today I feel fine
S> You feel fine. Do you want me to suggest a game?

--- feeling very bad (mood score = 1)
S> Good Morning. How do you feel today?
U> I feel very bad
S> You feel very bad. Do you need help? Do you want me to make a call?

--- feeling painful (mood score = 1)
S> Good Morning. How do you feel today?
U> I have pain
S> You feel pain. That sounds bad. Do you want me to make a call?
```

3.2 Body Posture

The “Body Posture” application is based on User Story 104 (see deliverable D2.3, p.61) and mainly developed by partner ASC.

ID	US104	Title	Good Posture	Priority	1
User Group	Older Person	Tasks	T6.1, T6.2	Use Case	UC2.4
Summary	As an older person, I would like ALFRED to remind me to keep a good body posture				

Keeping a good posture, especially while sitting, is important for avoiding damage to the musculoskeletal system, such as slipped disks. To this end, the body posture application will demonstrate to the user, how to stand and/or sit correctly. Future versions of the application may rely on the sensors of the ALFRED device and the ALFRED shirt to actually determine the user’s posture and offer personalized instructions for corrections, if necessary. The user interacts with the application by asking “How to posture?” or “How do I sit [stand/lie] correctly?”.

3.3 Health Monitor

The “Heath Monitor” application is based on User Story 087 (see deliverable D2.3, p.58) and mainly developed by partner AITEX.

ID	US087	Title	Vital parameters on Phone	Priority	1
User Group	Older Person	Tasks	T6.2	Use Case	UC1.4
Summary	As an older person, I would like to see my vital parameters myself on the phone				

The ALFRED system supports the utilization of external sensors to assess a user’s vital data, such as her current heart rate, or her respiratory rate. One way of assessing such information is using the ALFRED shirt, although other external sensors are also supported. All information gathered can in turn be made accessible to third-party applications that are built on top of the ALFRED platform.

To showcase this functionality, the prototypical application “Health Monitor” was developed. It displays essential information captured by the ALFRED shirt, such as the user’s current body temperature, her heart rate, her respiration rate, and the amount of her physical activity measured in “steps”. To do this, the application relies on a clean user interface that is constructed using eye-friendly colours and large fonts. The coloured boxes specify the state of each measurement: green indicates a functioning, normal measurement. Red indicates that while the measurement is working as intended - meaning that the application receives plausible values from the external sensors -, the values received are not within acceptable bounds (such as a critically high heart rate). A yellow box indicates that the external sensors are probably initializing at the moment, since the values received cannot be correct. Grey states that the external sensors are not connected at all.

3.4 Medical Reminder

The “Medical Reminder” application is based on User Story 053 (see deliverable D2.3, p.48) and mainly developed by partner TUDA.

ID	US053	Title	Medicine	Priority	1
User Group	Older Person	Tasks	T3.1, T4.3, T4.4, T6.1	Use Case	UC2.3
Summary	As an older person I would like to receive a medicine reminder from ALFRED				

It is well known that chances for suffering from multimorbidity, that is, having at least two chronic morbidities in parallel, significantly increase with age and are highest for elderly persons above the age of 65 (see: Karen Barnett et al.: "*Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study*." In: The Lancet, Vol. 380, No. 9836, 2012). These morbidities are usually at least partly treated with oral medications – pills – and thus the amount of pills the user needs to consume over the course of the day may increases significantly. However, it is also known that there is an inverse relationship between the number of pills a patient has to take and her therapy compliance (see: Ami Claxton et al.: "*A systematic review of the associations between dose regimens and medication compliance*." In: Clinical Therapeutics, Vol. 23, No. 8, Elsevier, 2001). As such, frequent reminders to stay compliant to the therapy plan may at least in part help to reduce the number of "skipped" pill intakes.

To this end, ALFRED's Medical Reminder application can be configured to remind the user on specific times during the day (and on specific days during the week), that it is time to take her pills. Once set up, the application will then send reminders at the corresponding times, asking the user to confirm that she has done so.

3.5 Weight Control

The "Weight Control" application is based on User Story 082 (see deliverable D2.3, p.56) and mainly developed by partner TUDA.

ID	US082	Title	Control of Body Weight	Priority	3
User Group	Older Person	Tasks	T6.1	Use Case	UC1.4
Summary	As an older person, I would like to help me to control my body weight				

The Weight Control application uses a graph to visualize the user changes of her weight during the course of a week, month, or year. This should allow her – as well as caregivers and relatives – to easily identify tendencies in body weight changes. The user can either enter her weight manually, or rely on a digital scale for automatic inputs. In the latter case, the scale's values are uploaded via ALFRED's Sensor Abstraction Framework subcomponent (SAF) and also available to ALFRED's core components, especially the Personal Assistant (PA).

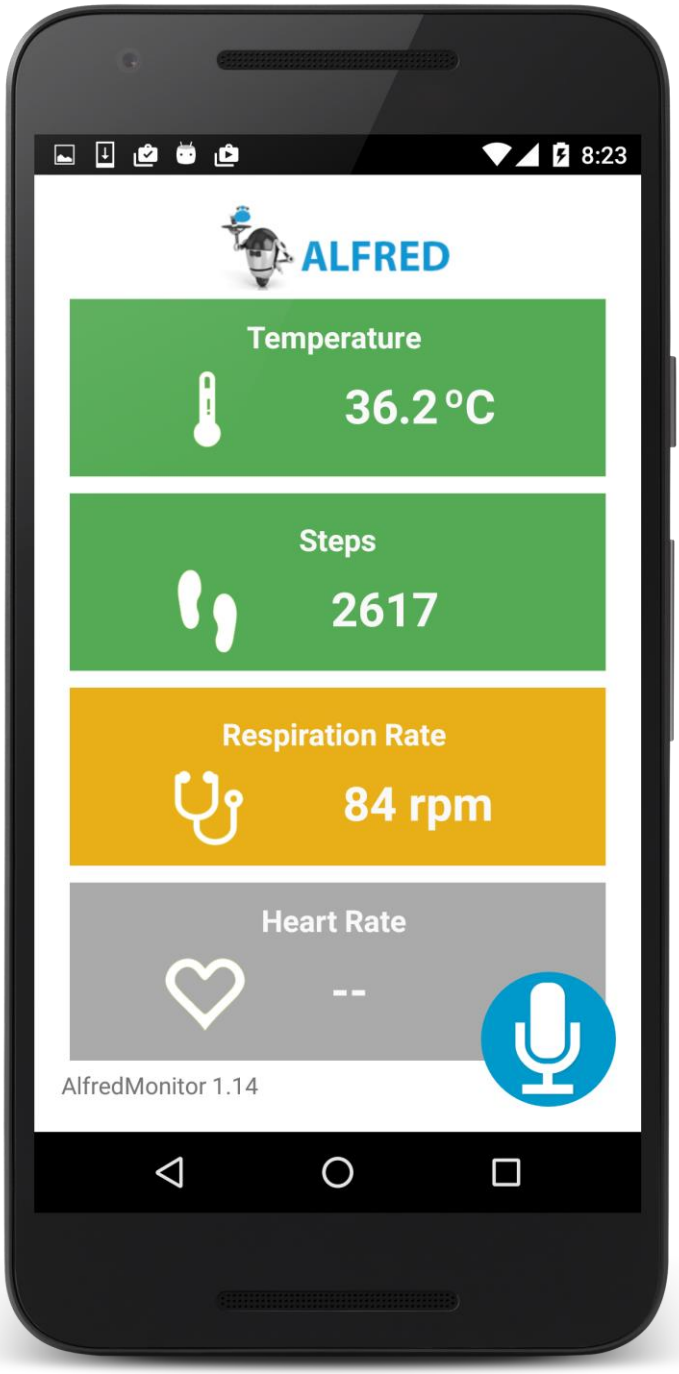

Figure 1: Screenshot of the Health Monitor Application

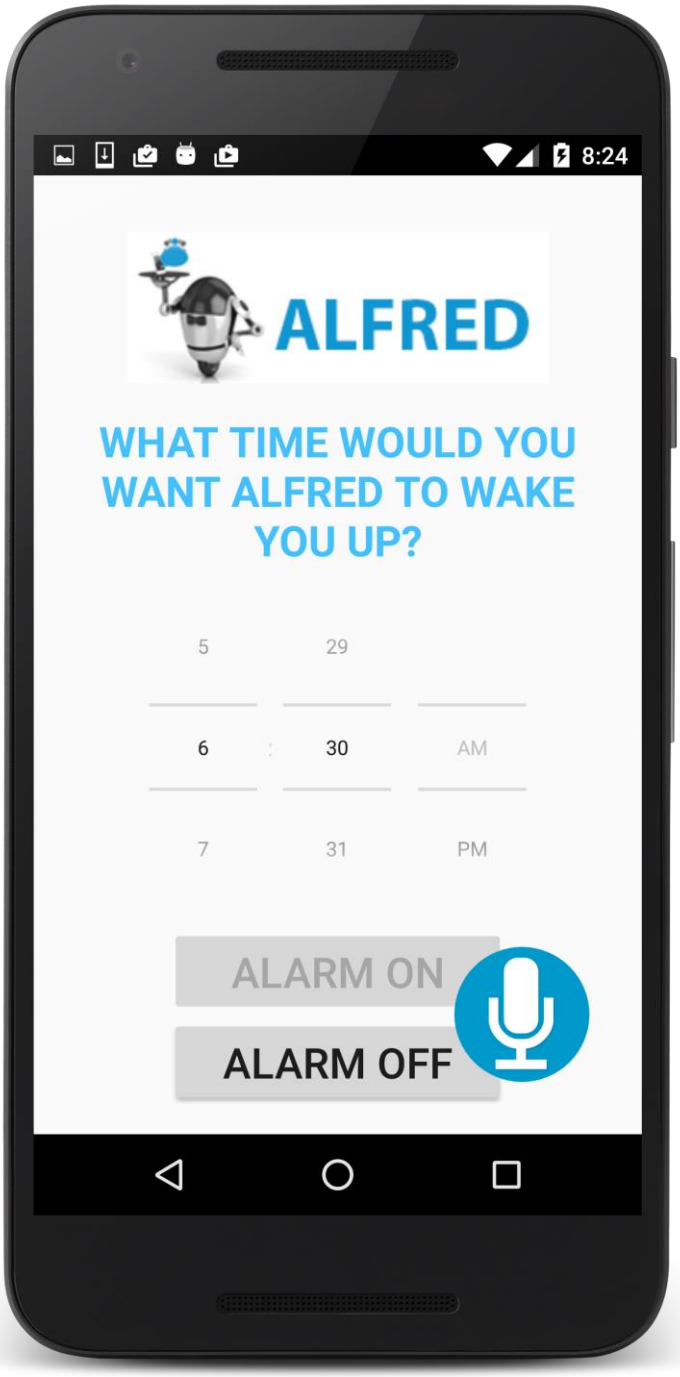

Figure 2: Screenshot of the Alarm Clock Application

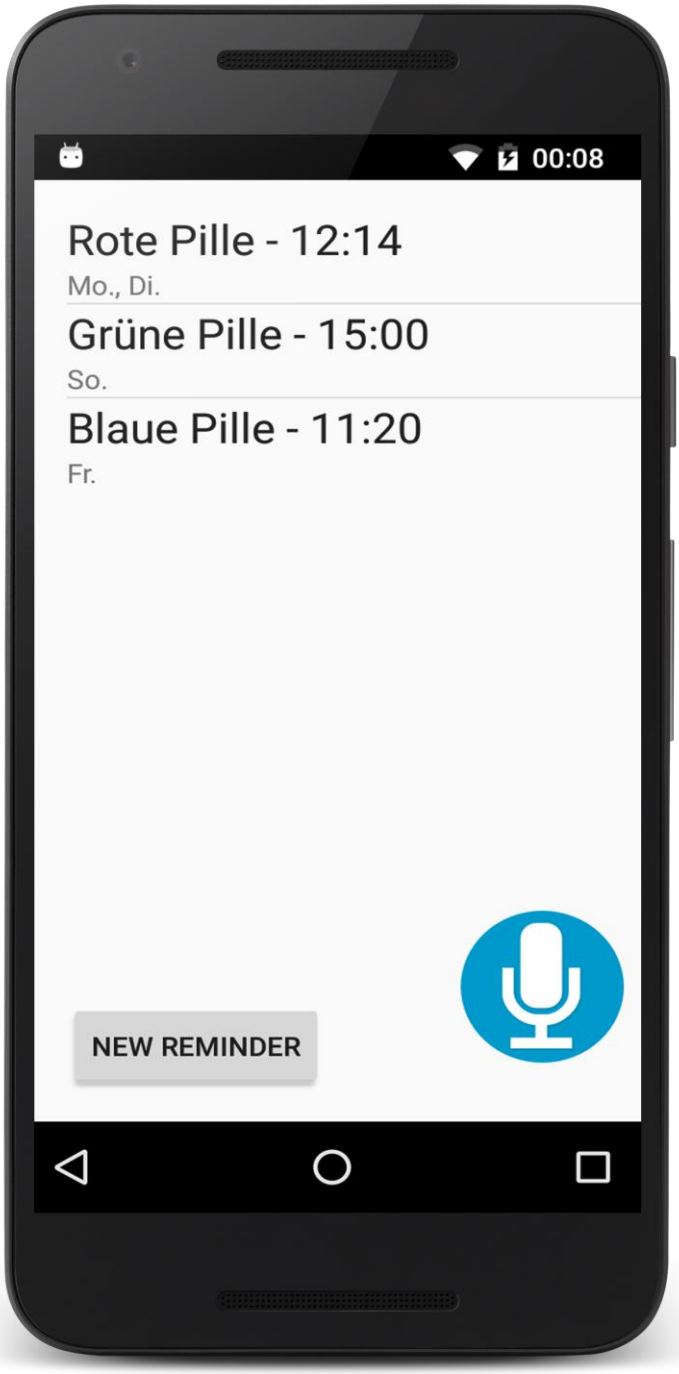

Figure 3: Screenshot of the Medical Reminder Application

4 Requirements and Preparations

This chapter explains the requirements that need to be met prior to installing and running the aforementioned ALFRED extensions. The next two chapters will then explain how to install and run these applications. **NOTE: the integrated version of the ALFRED system does automate most of these steps for the user, as the ALFRED extensions can simply be downloaded from the ALFREDO marketplace.**

- The most basic requirement is a mobile Android device at your disposal, most preferably an LG Nexus 5 or its successor, the LG Nexus 5x. Although the applications introduced may also run on other Android smartphones and tablet computers, they have only been tested on these two devices.

Figure 4: LG Nexus 5 on the left; on the right the slightly larger LG Nexus 5x

- Ensure that the Android operation system running on the device is up-to-date. We recommend using Android 6.0.1. To check the Android version of your smartphone, go to [Settings], scroll down for [About Phone] and look for the item [Android version]. **NOTE: the preparation and installation instructions in chapters 4, 5 and 6 are written for Android version 6.0. The steps may be different for older and newer versions.**

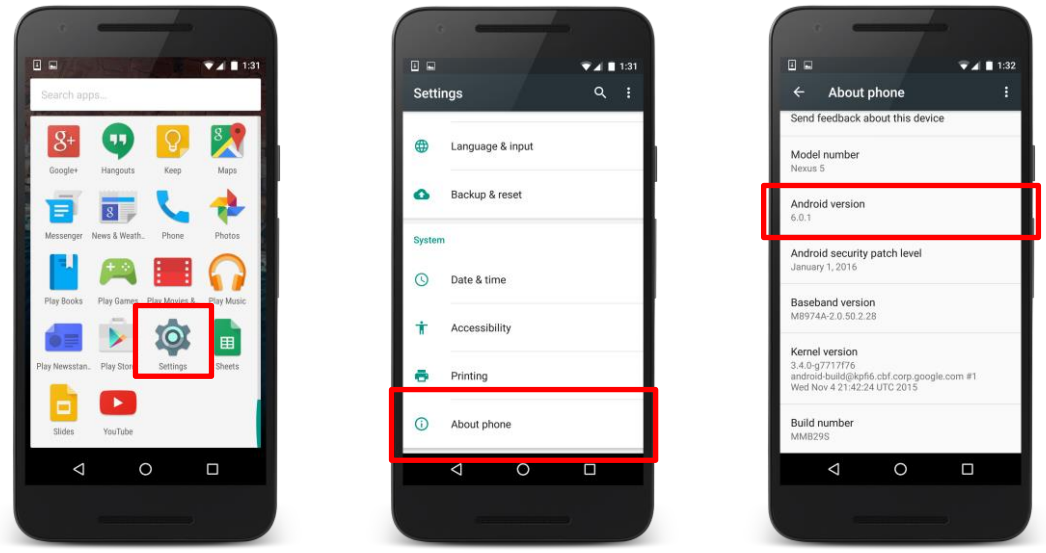

Figure 5: Steps for checking the Android version of your device

- Before you can install the ALFRED applications on your Android device, you need to enable it to run unpublished software that has not been obtained via the official Google Play Store. The first step is to enable the “developer mode” of the phone. In order to do this, go to the [About Phone] screen as shown above, but this time scroll down until you see the entry [Build number]. Now tap this entry multiple times in a row, until you receive the notification “You are now a developer!”.

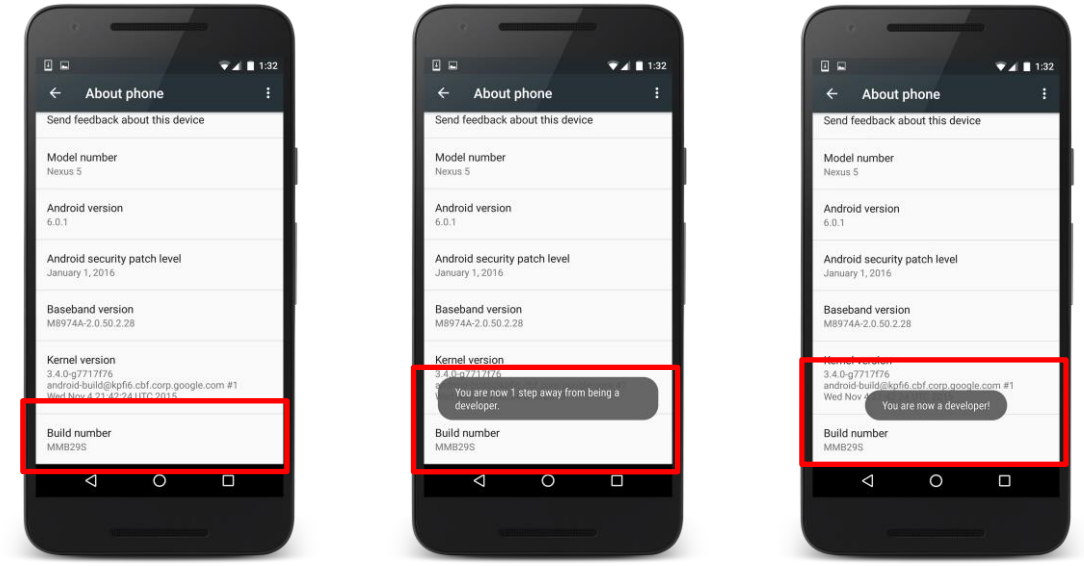

Figure 6: Activating the developer mode

- After you have become a “developer”, a new entry in the Settings menu appeared. Tap [Developer options], scroll down and activate [USB debugging].

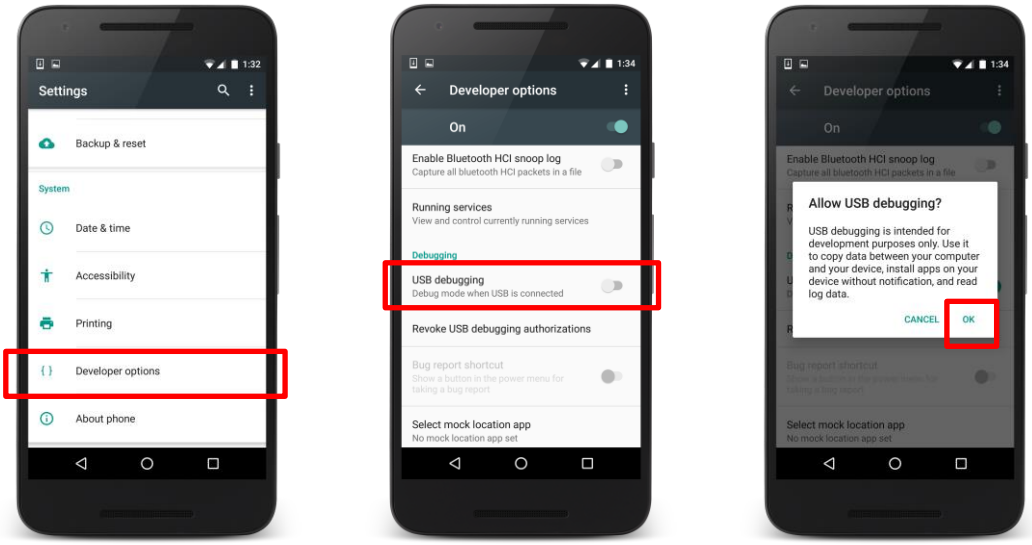

Figure 7: Activation of “USB debugging” mode

- One more step: you also need to allow “Unknown sources”. To do this, go to [Security] on the main settings page and activate the [Unknown sources] item.

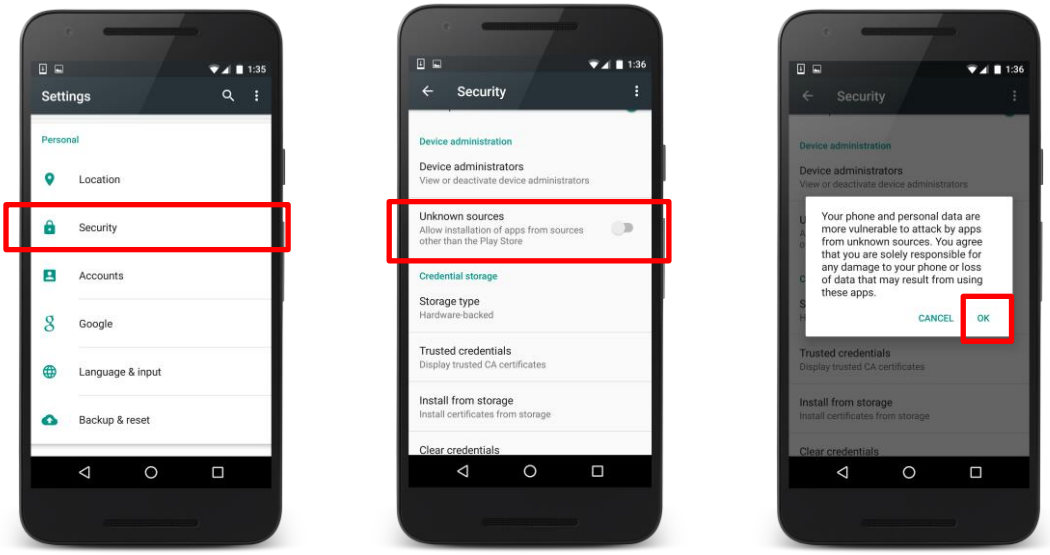

Figure 8: Allowing “Unknown sources”

- There is one more thing you need to do before we can proceed to the next chapter. Since Android devices do not come with a built-in file explorer (such as the Windows Explorer on Windows computers), we need to download such a software from the Google Play Store. Luckily, there is a number of such applications available for free. We recommend getting the application “File Manager” by ZenUI. Simply look for “file manager” on the Google Play Store, download and install the application. Make sure to give the application access to your local data once downloaded and started for the first time.

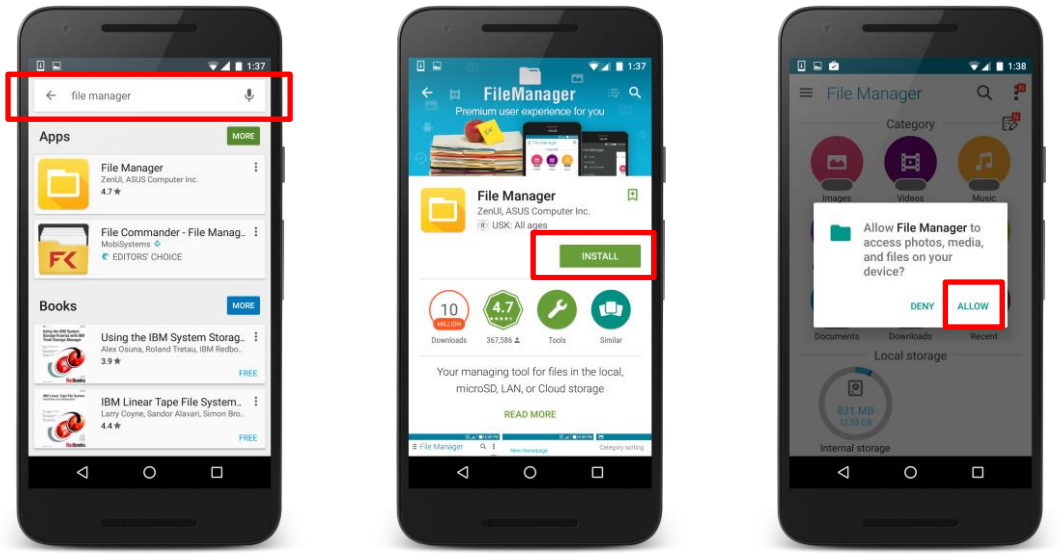

Figure 9: Installing a file manager on your device

5 Deployment (Installation)

NOTE: If you are using the integrated version of the ALFRED system, simply download the applications from the ALFREDO marketplace, they will be installed automatically. The following instructions are meant for manually installing the stand-alone APKs of the apps.

If you have taken all the steps as described in chapter 4, your device is now prepared for installing the ALFRED extension apps of WP6. For the following installation guide, we will focus on installing the application “Alarm Clock” (see chapter 3 for details). The installation process for all other apps as described in chapter 3 works in a similar fashion, you just need to substitute the corresponding file names (see the table below). Please note that both the applications “Health Monitor” and “Weight Control” require you to take an extra step and to install the application “Personal Assistant” first. Note that for the sake of simplicity, we furthermore assume that you are using a Windows PC. If not, please adapt the instructions accordingly to fit your specific configuration.

- Start with connecting your Android device to your PC. You should have the application APKs ready in a folder somewhere on that PC. Use the USB cable that came with your smartphone for the connection.
- You may need to install the corresponding drivers on your PC if this is the first time that you connect your smartphone. If nothing happens, go to http://developer.android.com/sdk/win-usb.html and follow the instructions there.
- If everything works as intended, you should see two notifications on your smartphone screen saying “USB debugging connected” and “USB for charging”. Tap the later one and select the second option from the list [File transfers].

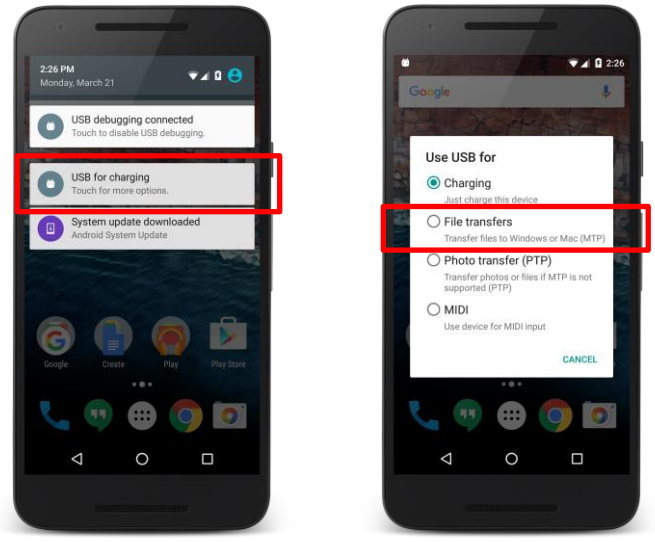

Figure 10: Transferring files to your smartphone

- You can now move files to and from your smartphone, just as if it was an USB stick. Go to your Windows explorer, select the APKs of the applications you want to install (see table below), and move them to the folder “Download” on your smartphone.
- After all files have been copied, disconnect your smartphone from your PC.
- Open the file manager application on your smartphone to access the files. If you have installed “File Manager”, as recommended in chapter 4, tap the [Downloads] icon. You should see all the APKs you have just copied to your smartphone (and possibly other files). Simply tap them to open the corresponding installation screen.

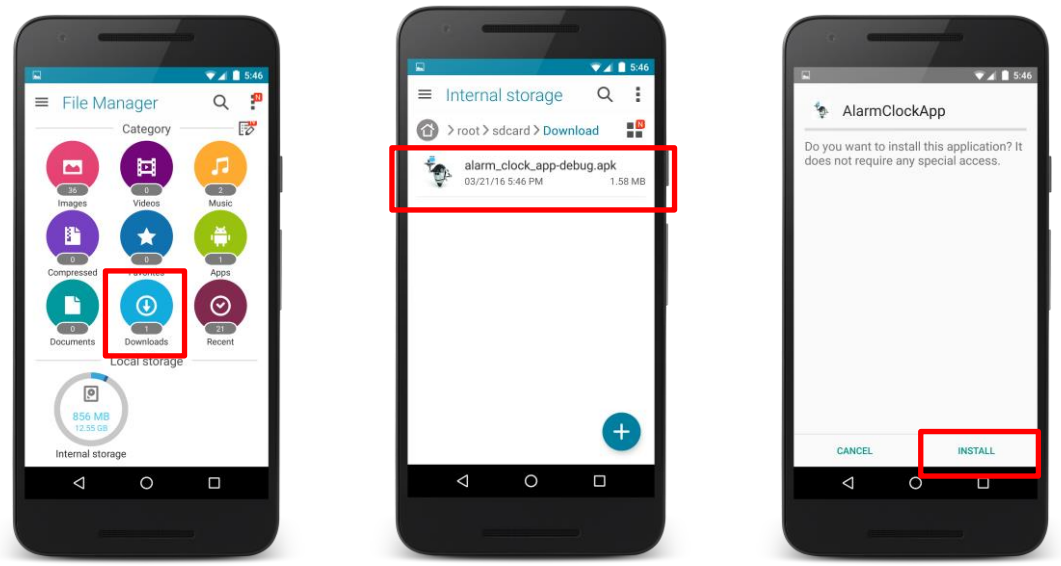

Figure 11: Installing an APK using the File Manager application

- Depending on which of the applications described in chapter 3 you want to install, you have to copy the correct APK files to your smartphone. The following table states the file names of these applications. As mentioned before, please note that for applications 4 and 5 – the “Health Monitor” and the “Weight Control” app – you need to install the “Personal Assistant” application, the last entry in the list, before you install any of these two applications.

#	Name of Application	File Name of Stand-alone Application
1	Alarm Clock	ALFRED-Alarm.apk
2	Medical Reminder	ALFRED-Medicalreminder.apk
3	Body Posture	ALFRED-Posture.apk
4	Health Monitor	ALFRED-Healthmonitor.apk
5	Weight Control	ALFRED-Weight.apk
*	Personal Assistant App	PA-Standalone.apk

Table 1: Application file names

6 Execution and Usage

Running the installed apps works just like running any other app obtained from the Google Play Store. Find the corresponding entry in the list of applications locally installed, and tap it once to start it. For usage instructions, please refer to chapter 3 of this document.

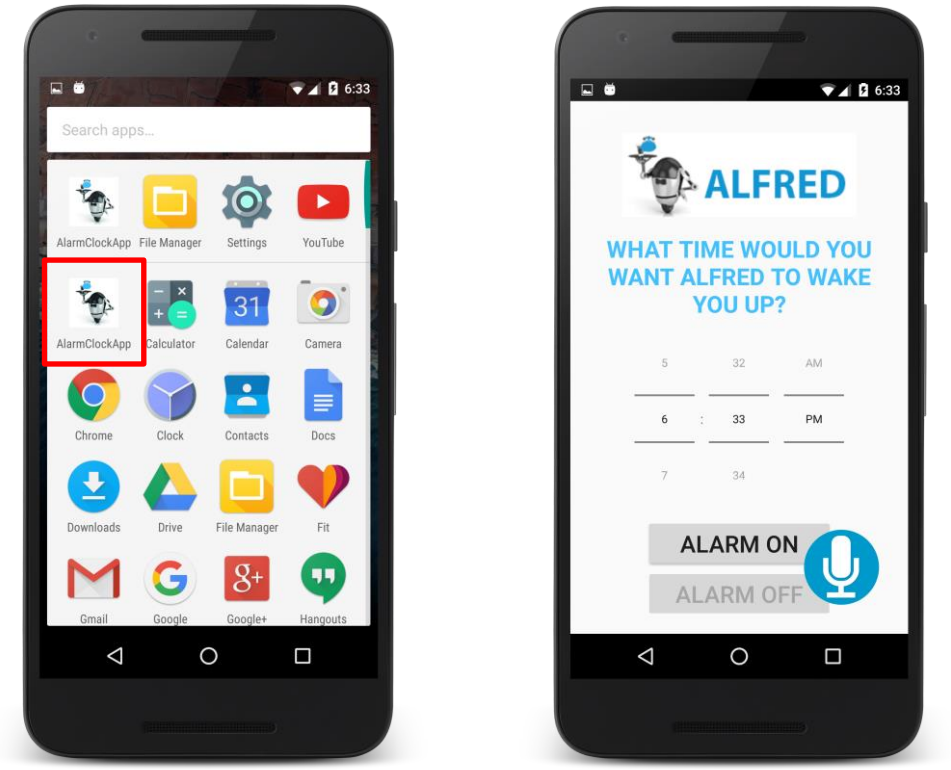

Figure 12: Running an installed application

7 Test Plan

On a technical level, all applications were tested multiple times during the initial development phase to ensure integration into the ALFRED system's Personal Assistant. Regarding usability tests, the ALFRED extensions will be tested with focus groups under the supervision of the project's end user partners during the final iterative testing in April 2016 (according to the planning as detailed in D8.2.1). In a second phase, the individual and autonomous testing of ALFRED is planned to start in May 2016 and will take place on the project's pilot sites in France and in The Netherlands. Feedback gathered during both evaluation stages will be used to improve the entirety of the ALFRED system, including all external applications described in this document, until their final release versions will be made available in September 2016. The following list details the further test and development steps. Read all dates as "end of".

- March 2016: Feature complete (= beta) applications ready and fully integrated
- April 2016: Feedback from focus group sessions
- June 2016: Evaluation results from pilot studies
- August 2016: Final versions of applications with integrated evaluation results
- September 2016: Deliverable D6.5.2 describes final release pf WP6 extensions

8 Target Performance

The following key performance indicators (KPIs) will be evaluated during the usability tests (see chapter 7). They will be assessed using both questionnaires handed to the end users, and by relying on logging files that automatically document certain types of behavior. The end users will be informed about the existence of this logging mechanism and will be able to disable it manually at any time.

Topic	Description	Target KPI
Ease of Use	It is important, that the intended end users of the ALFRED system find all extensions easy to use. This includes being able to start, run and handle the application without (or with limited) assistance by another person or detailed written instructions.	During the initial focus group sessions (in April 2016), the test users will be asked to start, run and handle the applications (that is, perform a specific task) first without an introduction and then again after an introduction has been provided by a supervisor. The target performance for this KPI is that 4 of 10 users are able to handle the respective applications on their own without having received an introduction, and that 8 of 10 users are able to handle the application on their own after having received an introduction.
Reliability	Applications that crash or do not function as intended in another way are prone to frustrate users, especially those without a technical background. To this end, applications should not terminate in an unexpected manner or show any other kind of unpleasant behaviour.	During the focus group sessions, the supervisors will be asked to document all bugs encountered by the end users. The target performance is to receive no reports in this regard. During the pilot tests (May 2016), the application behaviour will be logged and all crashes documented. The target performance is to receive no crash logs.
Utility	The ALFRED extensions are meant to enhance the system's usability to its end users. However, that this is actually the case can only be evaluated by long time evaluations.	During the focus group sessions, the participants will be asked to rate the perceived usefulness of all applications on a 5 point Likert scale (with 1 meaning "not useful at all" and 5 being "extremely useful"). The target performance is that the perceived usefulness of all extensions is rated 3 or above ("useful", "very useful" or "extremely useful"). During the pilot tests, the number of interactions with all applications will be logged. The target performance is that every application will be accessed at least once a week.

Table 2: KPIs for WP6 extensions

9 Summary

This document describes the current state of the ALFRED extensions associated with the project's pillar III ("Effective and Personalized Care"), and therefore developed within the project's work package 6, more specifically task 6.5. These applications enhance the core ALFRED system by providing additional functionalities to the end user, such as reminding her to improve her posture, or to keep track of her weight. The applications developed within WP6 and introduced in this deliverable are "Medical Reminder", "Alarm Clock", "Health Monitor", "Body Posture", and "Weight Control". They have been developed by the project partners AITEX, ASC, and TUDA and will be tested by partners NFE, E-Seniors, and CHA and associated test users during the spring of 2016. The recommendations from these evaluations will then be used to improve the extensions. The final release versions will be described in the second version of this deliverable, D6.5.2.