Deliverable 2.5

Title of the Deliverable: Refinement Recommendations

Lead Partner	Proges
Authors:	Alessandro Riccomini (Aicod) Dominic Krystali (VSRO) Lorenzo Lasagna (Proges)
Contributors:	
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Intestazione dati azienda
che redatto il documento

Summary

Introduction 3

Usability tests 4

Cloud updates 6

Security issues 9

Conclusions 10

Intestazione dati azienda
che redatto il documento

Introduction

During the pilot stage, Noah interfaces and general architecture have been checked in order to assess its usability, security and reliability.
The assessment has been carried out at three different levels:

1) usability and organisational impact;
2) cloud updates;
3) security (with a special regard to privacy issues).

Usability has been measured by an online test conceived to spot out any difficulty of usage by a non-expert operator.

The cloud system have been updated to grant the best level of flexibility and scalability without lacks of security or data-protection, even in a large scale usage scenario.

Security measures has been tested to ensure a restricted access to data, to track user's identity, to match the caregiver and the end-user, and to manage a full-anonymized data storage.

Outcomes – at each level – have been analysed at the end of the trial process, with the aim of gathering final remarks and refinement recommendations.

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Usability tests

Introduction

Usability tests have been designed to help in understanding the real comprehensibility of the app interface to secondary end-users (caregivers).

The tests were carried out to identify above all the comprehensibility of:

- functional buttons
- navigation system
- options and preferences
- messages and reports

Target groups

Target groups were identified in caregiver figures from the different countries involved in the project. This was to understand the comprehensibility of the interface in the various countries and to check the translations entered in the user interface for the various functions. 38 people joined the test: 13 from Belgium, 13 from Italy and 12 from Romania.

Test methodology

Test execution followed the subsequent path:

- construction of an online *functional mock-up*, usable by smartphone and perfectly congruent to the designed mobile interface;
- implementation of the UX mock-up on *usability hub* platform;
- invitation of the users. Users were not in any way prepared to fulfil the test or to use the interface;
- test execution. Users followed a path leading to further steps, where interface functions were shown, with some specific questions. Users had to answer the questions by performing proper actions on the interface.

Results

Tests results are shown in the annex.

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Cloud updates

The architecture of the NOAH system is based on the client-server concept. An overview of system is presented in the figure 1.

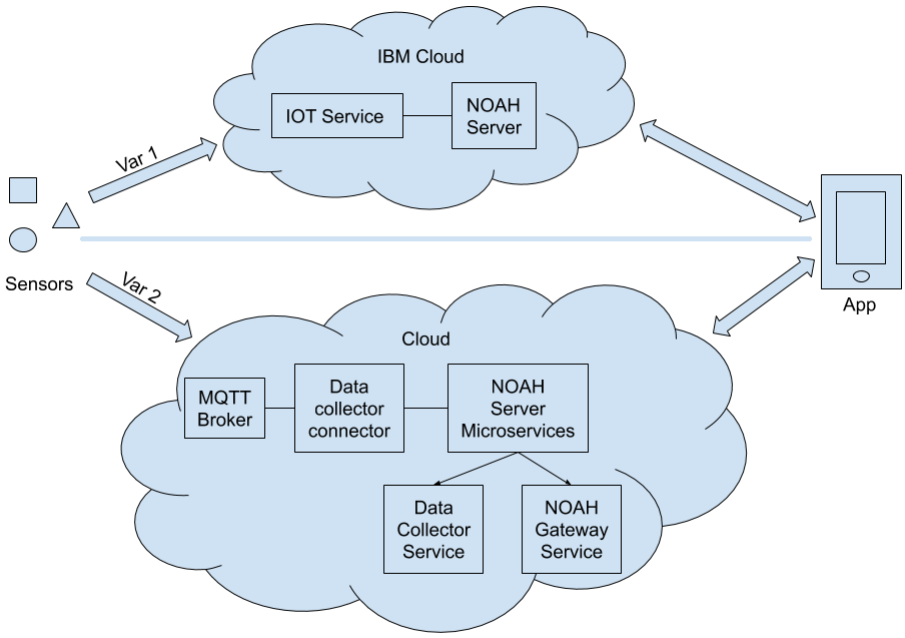

Figure 1 - Overview of NOAH system

In a first development iteration, the server side is developed and hosted by the IMB Cloud (Bluemix) platform. The second variant of the NOAH system uses a microservices-based architecture, which contains three such components, also running on Cloud.

The Node-RED version of the application, developed using the IMB Cloud services represents a prototype system. The microservices version represent the modularization of the application and at the same time its optimization, allowing it to run in a diversity of cloud environments.

The architecture implemented in this regard (Figure 1) involves a server application built by interconnecting three microservices that fulfil different functionalities. Thus, there is a service that facilitates communication with the connected and sends the information to a microservice that collects this information and stores it. The third microservice represents the interface between the server and the client.

Being a modular application, the server component of the NOAH system presents the advantage of diversity, so microservices are developed using different technologies, reaching the same result. In this way the communication part with the connected devices is developed in the Python language, and the collection, processing of the data and their service to the clients have been developed using the Spring Boot framework.

The microservice for the server application of the NOAH system is the central component that serves to collect the data from the sensors. This application receives the data sent by the module that communicate with the sensors and process and store it into the database.

The Gateway application has the role to provide all the information that is needed in the Android client application, querying the database and formatting the information for the users

AdminCenter is part of the system, where an administrator user has the possibility to manage sensors by registering and grouping them into kits. Also, there is an overview of kits and the last received states of the sensors.

The NOAH system uses cloud technologies and IoT principles to provide quality services, in a flexible and scalable product. The two equivalent deployments as facilities (the first, using services provided by IBM Cloud, the second representing a more flexible solution from the point of view of the cloud service provider), give a clear advantage to the system, being widely scalable, depending on by the number of users and budget.

Security issues

The security of the system is ensured by multiple methods depending on the characteristics of each working flow.

Users' access to the application is controlled based on the username-password pair authentication mechanism, based on roles which restrict the features of the application that can be used.

Mobile applications can be accessed by two types of users: caregivers and end-users, roles that provide access to specific features. These applications provide an auto-login feature secured by a token which is generated when user logs in and is deleted when user logs out. A link between the users is required and it is done by a 4 digit private code which is known only by the end-user and their assigned caregiver.

The sensors used by the system are directly connected to the Internet and communication with the server is secured by using the SSL / TLS protocol (PKI Infrastructure).

Measures were taken for guarding users' identities. Data is kept in anonymized database tables, not directly linked to the users. All communication interfaces with the database are secured using the internal mechanism of the database management systems.

Conclusions

Final tests have not shown any major issue, fault or concern.

Usability test has demonstrated that Noah interface can be easily handled (even without a specific training) by any non-expert operator, and without any significant impact on the caregiving routine.

Cloud architecture revealed full reliability, flexibility and scalability. Nevertheless, in case of large scale adoption and full capacity operation, commercial cloud services seem to provide better guarantees and should be preferred.

Finally, system's security has been testified and all the privacy constraints have been fulfilled.