MUGGES

D2.1: Trial Specification and Requirements

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1. EXECUTIVE SUMMARY

The main objectives of the present document are:

- Identification of “University” communities and analysis of MUGGES service support potentials
- Description of the top level strategy and architecture for the trial of MUGGES in the proposed “University” scenario.
- Generation of preliminary information for trial activities according to local constraints and agreed with the supporting user groups that may provide the physical context for tests. In particular: scope of the trial, trial scenario, deployment issues and aspects of the evaluation method.
- Specification of the different phases of the trial process itself, including organizational issues, pretesting of the trial and accompanying questionnaires, and trial execution aspects.

Currently we have identified three University of Deusto communities: the international students, social web group and the campus community. As (especially foreign) students in new environments have a high need for social integration and as they are also generally open-minded towards modern communication technology they are well suited for the trial tests. MUGGES “Track and share routes” and the “GeoTwitter” service have the potential to support all three communities significantly by improving student’s geographic orientation and self-coordination capabilities.

Three potential target communities were identified for trialling in the second trial site: Oulu Campus Area. These communities include exchange students, course group and working postgraduate students. MUGGES’s "On-the-spot journalism" and "Who beats me on my route?" services enable the users to post news or challenges also to strangers. These services involve location based information like news or competitive routes which can add consciousness about the surroundigs.

Subsequently we defined specific trial requirements as input for the trial planning task. To achieve realistic test scenarios it is important to choose the sample following the characteristics of potential MUGGES target groups and with a preference for people who are experienced with latest phone and Web 2.0 technologies. To achieve a sufficient number of shared routes or matching tweets, it is important to limit the geographic reach of the trial site. Furthermore we give test persons tasks which require the usage of MUGGES services. Hereby it is important to avoid the falsification of results by ignoring effects caused through environment familiarity or repeated process executions.

Potential trial executions are scheduled for the winter semester during September and November in compliance with the planned first and second trial period. We plan to use 20 mobile terminals for the trial with large screens (e.g. equivalent to Nokia N97), built-in cameras and location technology. These are minimum requirements for the proper execution of MUGGES services.

MUGGES acceptance is evaluated with quantitative and qualitative research approaches. During the trial usage data from the devices is captured and stored in log files for later evaluation. We hereby obtain not only usage frequency and error statistics but more complicated data revealing the when, what and how service usage patterns. After the experiment test persons are interviewed. Questionnaire will focus on the user background and the perceived service usage following the Compass Acceptance model for the evaluation of mobile services.

To avoid privacy issues we require signed agreements with the test person to analyze their contents. As students may not be at all fluent in English we will offer the questionnaires in Spanish. The same is not required for the MUGGES applications as students are instructed before the trial and as the user interfaces are more or less self explanatory.

2. INTRODUCTION

The Work Package 2 (WP2) "Trial Design" specifies in detail the trial, its components and architecture. It also serves to specify the test components. The results coming from WP1 "User Needs Analysis" deliver the functional requirements needed to identify trial scenarios and technological, functional and operational requirements for the trial needed to run the MUGGES platform within trial sites. The trial operational phase will go ahead with the WP4 "Mugges Trial" and instantiate the methodological principles and test requirements defined in this document for the specific trials to be executed.

The specific task T2.1 is dedicated to the "Trial specification and requirements", that is:

- Identification of "University" communities and analysis of MUGGES service support potentials
- Description of the top level strategy and architecture for the trial of MUGGES in the proposed "University" scenario.
- Generation of preliminary information for trial activities according to local constraints and agreed with the supporting user groups that may provide the physical context for tests.
- Specification of the different phases of the trial process itself.

Although lab experiments are well controllable and data are easy to collect, field trials offer certain advantages. User interaction with mobile systems and services is very complex as it depends on the environment and context in which it occurs. The advantages of field experiments are that they will incorporate this natural context and environment of the user of the given service.

The trial will explore the feasibility and applicability of emerging technologies, targeting unanswered research questions such as: How will GNSS impact in mobile social and user-generated services? Or, how will consumers behave with this type of new, innovative services? Therefore besides obtaining relatively simple usage statistics such as frequency of use and counting errors, the goal is to find out what, where, when, how and ultimately why the service is used.

MUGGES builds on the idea that mobile terminals evolve to become also a server, where a mobile user will provide constantly updated information, relevant to other user's instantaneous interests and current context, in particular with location tagging. Location is used in the scope of this project for the tagging of contents and services to make them discoverable, reachable and accessible in the mobile platform. MUGGES templates are stored as server side objects in the MUGGES Application Warehouse that can be directly downloaded by mobile users. Once downloaded, users can start their execution. MUGGES applications are small and independent location aware mobile sample applications. They can be executed on mobile phones to create or fetch contents from other mobile devices, owned by users willing to share their content. Both functional benefits and the characteristics of the MUGGES infrastructure are taken into account when defining major requirements of the field trials.

The structure of the document follows the list of objectives above mentioned: Section 3 focuses on the identification of suitable university communities and the matchmaking of MUGGES services, Section 4, 5 and 6 describe requirements for the organization and deployment of the trial, while Section 7 defines the evaluation methodology and applied measurements. Requirements for the trial execution are given in Section 8. All the requirements identified in Sections 5 to 8 are assigned a code in the context where they are described (e.g., "RA1.1"). Finally, Section 9 summarizes all the requirements in tables for future reference. This document will serve as the basis for designing the trial plan to be developed in T4.1.

3. DESCRIPTION OF TARGET COMMUNITIES

In order to target the research questions, it is not required to support community building, but to support already existing communities. So the first step of the trial is to identify existing communities in our scenario e.g. sport and cultural communities and evaluate their potential for running MUGGES services. Regarding the empirical evaluation of this MUGGES trial, it is however important to carefully select the communities. So the following critical assumptions will guide the selection:

- Access to the selected community: in order to do the empirical evaluation of specific MUGGES services the research team should have direct access to the community. This facilitates the organization of experiments and the procedure of regular feedback loops.
- The members of the selected community should be open-minded towards new technologies.
- The opportunities of the MUGGES platform should significantly enrich the forms of communication and interaction within the community.
- Ideally, the selected communities should already have experience with Web 2.0 applications for their community conversations. This aspect can ease the introduction of MUGGES services to the test persons.

3.1. POTENTIAL COMMUNITIES AT THE UNIVERSITY OF DEUSTO

The University of Deusto has two campuses: Bilbao and San Sebastian, both in the Basque Country, Spain. The Bilbao campus will host the first site for field trial experimentation of MUGGES. Bilbao is the centre of a metropolitan area with more than one million inhabitants, a city traditionally open to Europe. It is, in addition, an important harbour, a commercial and financial centre of the Basque Country and the north of Spain. In September of 1997, the city has undergone a significant transformation under a symbol, an emblematic building, the Bilbao Guggenheim Museum. The central headquarters of the University of Deusto are situated on the opposite side of the estuary, facing the Guggenheim Museum.

The University of Deusto has about 9.500 students, with a mobility of approximately 1.300 students and 50 professors. The faculties, institutes and schools are also implicated in intensive programmes, European modules and joint curricular designs at various levels, at the same time as they participate in cross-border activities, integrated languages, ODL and Leonardo programme

Consideration of the issues presented in the previous section led to selecting student communities at the University of Deusto for the field trial experiment. These student groups were established to support their activities in the university and especially outside university. Moreover, lecturers at the University of Deusto have easy access to the students within their classes. It is generally assumed that students are open-minded towards technology as computers and Web 2.0 applications are basic part of student life.

We consider student groups like the international students group [1], the ESIDE student group and the social web group [2] as adequate target communities for the experiment. All these mentioned groups have in common, that they do not only study together, but also have their own blog community (blogs.deusto.es) and undertake shared activities together in the environment of the university and in some cases outside of the university. In the following section we describe their community characteristics in more detail.

3.1.1. International Students Group

At the University of Deusto foreign exchange students can participate in courses during the summer or winter semesters. Their program lasts for one month during the summer period and 4 months during the winter semester. The University of Deusto offers up-to 120 places for foreign students; a great majority comes from America and the EU countries (ERASMUS programs).

Foreign students have a high need for social support and community integration as they are not familiar with the environment and in most cases arrive alone. To arrange their living, students in their first months require information about accommodations, transport systems, places for shopping, attractions of Bilbao and cultural events. A special web blog was created to distribute information among exchange students; however it is mainly targeted on outgoing students. Tourist guides, paper maps and local information brochures are helpful but without additional recommendations from other students taking the first steps is difficult. Also, paper based information is often outdated and does not fit the individual situation of the students.

Exchange students - especially from America - are often well experienced with Web 2.0 applications like facebook and Twitter. This fact makes them good candidates for the MUGGES trial. We expect that location aware social mobile services can help them to share experience more effectively, get to know other students and moreover offer them enormous support for their active, spontaneous and mobile life.

3.1.2. Web 2.0 ESIDE Student Group

This group includes all students participating in programs offered by the Faculty of Engineering (ESIDE). As students share most of the classes, they develop strong friend relationships. Students meet regularly during their classes and often continue to share their spare time together.

During the exam period students have an extensive work plan to master and therefore have fewer opportunities to meet. Many students study at home or meet occasionally in small student groups at the library or in computer rooms. Students may be afraid of missing specific events and have a high need to stay up-to-date about ongoing activities. News spread often through a rumour spreading process in which students forward information to other students randomly or more intentionally with their mobile phones or email.

It is clear that students may profit from new mobile, location based group-oriented communications services by providing them with study relevant information. Location aware social mobile services have the potential to streamline the news spreading process around the campus and help students to find learn material more quickly and arrange meetings more spontaneously. Students affinities towards the technological domain makes them an interesting target group for trail testing as it can be assumed that new technologies are easily adapted by them. Access to the community is given through the professor.

3.1.3. Social Web Group

The Faculty of Engineering of Deusto offers a subject focusing on social network theories and their applications. The size of the class is varying around 60 students however not all students may be willing to participate at the trial. Students meet twice a week at the class room, but usually they meet more often outside the class e.g. in the computer rooms. Accompanying the class a social web blog was founded, in

which students can publish questions or post articles related to the topic. The number of registered users may include current and former class members; however the number of active members is much less and may depend on ongoing class activities.

As part of their class students have to survey on social network aspects and may do this through excursions outside the university campus. Research projects on mobile communication are especially interesting, as mobile communication has dramatically changed the way how people coordinate social life. Permanent accessibility has lead to a flexibilization of daily schedules but came to the price of more coordination effort. Location aware social mobile software has the potential to support spontaneous group formations more sustainable and thus represents an obvious research topic for the class. Students use mobile phones and Spanish facebook like variant called Tuenti.com to keep in contact. However as the majority of student's lives in Bilbao, they are well integrated and are less interested in Web 2.0 applications.

3.2. POTENTIAL COMMUNITIES AT OULU CAMPUS AREA

Second trial site will be constructed in Oulu, Finland. In the following, we briefly give some background information of reasons why choosing the target communities. Oulu is the largest city in Northern Finland. In terms of population, Oulu is the sixth largest city in Finland with over 137 000 inhabitants (1.1.2009) [3]. The city has two campuses: University of Applied Science and University of Oulu which is situated nearby VTT Technical Research Centre of Finland. The University of Oulu had about 15 775 students in the end of year 2008 and the personnel is about 3000 people. In 2008 the University of Oulu had 502 exchange students coming from 40 countries. Postgraduate students group consist about 3000 people.

We consider three kinds of general student groups as potential target communities for trialling. The groups are: exchange students group, course group and working postgraduate students group.

3.2.1. Exchange Students

The group in question consists of international students with different backgrounds, cultures, nationalities and mother tongues. The incoming students must have sufficient knowledge in English in order to manage every day situations. The language which is mostly spoken among international students is also English. From exchange students it can be expected that they probably do not know each other when arriving to exchange. Creating a social network and exploring different places in the beginning of the exchange is important.

Students participate in various study programmes, follow different schedules and stay for diverse study periods. Therefore, simultaneous use of mobile services between participants can be possible but it can be improbable.

3.2.2. Course Group

In University, there are different curricula in courses. Some courses consist of lectures and practices while others combine different means of multimedia. Some courses can be held virtually in network learning environment. From a course group it can be assumed that most of the students may know each other (based on same interest subject or same study programme). Virtual networks give the possibility of real-time information exchange.

As a course tasks could be considered the following: commenting, producing content and giving response to other multimedia. Based on course schedule simultaneous time of using mobile services would be possible.

3.2.3. Working Postgraduate Students

Every postgraduate student has their own curriculum. Therefore, students doing the PhD may not necessarily meet even though they study in same department. Postgraduate students can be employed by the University or by companies. From postgraduate students group can be assumed that people do not know each other unless they work in same company with similar interests and projects. The group of postgraduate students can be heterogeneous in terms of age, gender, job, family, interests, hobbies etc.

The time spend doing PhD depends if the postgraduate student is full-time, part-time or studying only in spare time. Therefore, simultaneous use of mobile services between participants could be impossible.

3.3. POTENTIAL ENHANCEMENTS WITH MUGGES

To emphasize the potentials, which MUGGES offers to the student communities, we will first classify MUGGES services and match them with specific student group characterisitics in Section 3.3.1. In the following Sections we will complement the picture by describing typical interaction scenarios in which MUGGES can be applied. Trial scenarios can later ease the planning of trial by e.g. allowing the trial planners to limit trials to certain areas and to foresee potential problems.

3.3.1. Benefit Analysis of MUGGES Services

To visualize the benefit of individual MUGGES services we classified them after adequate usage situation. Situation determing factors include usage spontaneity and required environment familiarity:

	Spontaneous Activities (Self coordination)	Repetitive Activities
Familiar Environment	GeoTwitter, GeoAuctions, On-the-spot Journalism, On-the-spot Dating	Event Monitor, Scavenger Hunt
Unfamiliar Environment (Exploration)		Track and share routes, Who beats me on my route?

Table 3.1 - Classification of MUGGES Services based on usage situation.

To identify appropriate MUGGES services for individual university communities, we considered, besides the service benefit for the community, organizational and deployment related factors. For instance, to reduce deployment costs the same MUGGES services could be applied in different university groups. After interviewing the responsible contact persons, following suitable MUGGES services were identified:

University of Deusto Communities	Characteristics	MUGGES Service
International Students	Foreign Students, Missing Integration	Track and share routes, GeoTwitter
Social Web	Application expertise in Social Networking Principles	GeoTwitter, On-the-spot Dating
University Campus	Need to track states e.g. cafeteria, Computer room etc. Description of Campus Activities	Event Monitor, GeoTwitter

Table 3.2 - Mapping of MUGGES services to existing user communities in Deusto campus.

For the field trials in Deusto we decided to deploy the GeoTwitter and Track and Share routes mugglets as they enhance the orientation for students in unfamiliar environments and on the same time have the potential to support student integration by offering on-the-spot community services. In the following sections we describe their benefits for the university community in more detail based on typical university scenarios.

In the following table, we identify the main characteristics of the earlier described potential communities in Oulu Campus area. These results give more precise answer to which MUGGES Service is suited to different groups based on the community description. We identified three different groups with special characteristics and mapped possible services suitable for exploitation in the trial.

Oulu Campus Communities	Characteristics	MUGGES Service
Exchange students	Open minded for: travelling, meeting new people, starting new hobbies	GeoTwitter, Track and share routes, Who beats me on my route?
Course Group	Similar professional interests, about same age group, same physical building	On-the-spot journalism, Track and Share Routes
Working postgraduate students	Decentralised group, various professional interests	On-the-spot journalism, Who beats me on my route?

Table 3.3 - Mapping of MUGGES services to existing user communities in Oulu campus.

The outcome can differ between various groups. By asking similar questions to different communities we can find if there are some repetitive criteria that are based on a specific group. The services envisioned to different groups thus can have a variety of requirements. Some of these factors can influence to design of the trial situation. Based on this beneficial analysis we plan to include “Who beats me on my route?” and “On-the-spot journalism” mugglets for trialling in the Oulu Campus Area.

The measurements which will be taken into account in trial are defined in more detail in the Section 7.2. The techniques for requirements gathering are presented in D1.4 “MUGGES Trial Requirements”.

3.3.2. Track and Share Routes

John is an exchange student from America and visits for the first time Bilbao. As he is new to the university, he does not have friends. He needs to find suitable housing, to do some initial shopping and later wants to explore the city nightlife of Bilbao.

At the university, he has heard about the MUGGES platform in the welcome lecture and now curiously obtains an account to use the Route Tracker/Share Routes application. It is clear that guided routes can dramatically improve the orientation within the city. And with the increasing number of routes one can assume that routes even for the most specific aspects can be found within MUGGES.

He first selects routes which lead him to appropriate student housing. He follows their track and visits several student residences till he has found a cheap accommodation for his semester. After unpacking his suitcase, he decides to go for shopping as he wants to cook something in the kitchen. Again he opens up the MUGGES Track and Share Routes service and quickly finds the main shopping paths right from his flat, as many other students had the same problem before. He feels lucky about the location based capability of this service as he is able to quickly find the even most hidden places. As he is already used to the track and share routes service, he also uses this MUGGES service to look for pubs frequently visited by students.

After a long day, John resumes that he has achieved a lot and that he has found exactly those type of places he was interested in; thanks to the MUGGES Track and Share Route service.

3.3.3. GeoTwitter

John is a student and after few months in the winter semester the exams period arrives. Most of the time he studies at home but a few times he decides to go to the campus to meet some friends and discuss some difficult aspects. He knows that some other friends are at the campus but he has not made fix appointments.

John has heard about the GeoTwitter service and decides to test it. The service allows him to drop tweets, in which he shortly describes his availability, his current activities or comments on exams related issues.

He pulls out his mobile phone and searches with GeoTwitter for advices from other students of his class. He retrieves several messages from class mates and finally discovers a message from his best friend stating that he currently sits with others in the cafeteria to have a short break from studying. John decides to visit him, as the cafeteria is only a couple of meters away. But before he reaches the cafeteria he passes the ESIDE department and discovers a message from another friend that he has just heard from the professor that certain supplemental articles are recommended for reading as these represent an important exam focus. Unfortunately, John has no idea where he can find those, but this problem is immediately solved when he passes the university library on the way to the cafeteria, where Isabel, another student, has dropped a Tweet that she found exactly these articles within the new library on the second floor. He decides to enter the library and checks if the book is still available for later studying and thinks that this has really saved him a lot of time. Later, John meets his best friend with other students at the cafeteria and, after having a coffee, the entire group decides to share work on this to save some time in the evening.

All of them agree to use the GeoTwitter service more often as it encourages opportunistic behavior and to the same time enhances information spreading within the class even if they don't have the chance to meet in person.

3.3.4. On-the-spot journalism

John is keen on following the news in the Medias such as Internet, television and newspapers. The two latter are broadcast-driven, that is one-way interaction without the possibility to impact real-time to the content. Since local news are broadcasted in television only once a day and they do not cover all the small news – such as broken glass on the road, sudden traffic accidents/jams or lost/found objects (keys, wallets etc.) – John seeks an additional way of prosuming (producing and consuming) the news. John's friend recommends a MUGGES service called "on-the-spot journalism" which he decides to download to his mobile.

John rides a bicycle every day to work. One day after work he is riding his bike as usual. John's phone start to ring and he stops for answering. Then, John bicycles home. When John arrives to his doorstep he notices that his keys are missing from the pocket – same pocket which has his mobile phone. He first goes the route back to find the keys but they are not on the ground. John contacts lost property of the city but nobody has returned his keys. To boost the seeking John makes news of the missing keys with "on-the-spot journalism" service and promises small reward for the finder.

Pete is jogging with his dog. He is following "on-the-spot" journalism service since he is worried about broken glass or other dangerous objects on the ground that might hurt his dog. His mobile service pushes a message of announcing missing keys in the neighbourhood. The dog stops for exploring something on the grass near the road – Pete sees that it is something metal – the keys. Just to be sure that these are the right keys; Pete takes a picture of the keys and sends it to John who verifies the keys belong to him. They agree to meet on the place Pete is currently in and the keys and reward is exchanged.

The MUGGES service enables real-time exchanging mugglets – both following and providing them – of important local news with mobile phone.

3.3.5. Who beats me on my route?

John and Pete are active joggers. They aim to participate in marathon but unfortunately they do not have spare time in simultaneously for practising since Pete has shift work. The friends are determined to challenge each other in order to keep the running interesting and to see the results afterwards. Who beats me on my route? is a new kind of service which enables to firstly to track the route based on user's changing location as well as publishing the route taken with parameters (such as route length, high speed, average speed, time) in order the results to be comparable to other runners. John and Pete use the MUGGES platform for exchanging private running challenges between each other – that enables kind of virtually practising together.

Who beats me on my route is not limited to jogging: it can be used for roller-skating, Nordic walking (fitness walking) or bicycling. John's girlfriend Tina is into Nordic walking. She has joined to group of Nordic walking which gathers once a week to practise different routes. The Nordic walking group is lead by a personal trainer who gives also trainings to groups. Tina is sick on Monday so she cannot participate in the weekly group walking. However, the trainer uses "Who beats me on my route?" service to record the route for Tina to later use as comparison. Tina gots better on Thursday and she is eager to check how well her performance is compared to the group's performance. Since the route is published as a public challenge – all the other group members can return to the route to outperform.

Playful competition can motivate people to outperform in sports. This MUGGES service gives the user a possibility to share own route records privately with a friend or universally with general public.

4. SCOPE OF FIELD TRIALS

4.1. PARTICULAR MUGGES MODULES

Information collected by different modules in the general architecture is envisioned to be used for analysis and evaluation of MUGGES. Within this section, the role of different general architecture modules, as presented in D1.3 “MUGGES Architecture” is pointed regarding the evaluation of field trials. Moreover, additional modules are also addressed, so that analysis of field trials can be conducted easily.

To support field trials, MUGGES Accounting module can be used to track mugglets. This allows validation of mugglets and evaluation of their importance to users. Although, MUGGES Accounting is intended to be a simple database, information collected can easily be used to infer results on MUGGES usage.

MUGGES Location Server can also be of importance, as location and context of usage regarding each mugglets can better describe the effectiveness of different mugglets, and in diverse contexts. Moreover, improvements can be suggested to current use case scenarios in order to improve them and supply value-added to related mugglets as well as better user experience.

MUGGES Service Warehouse can also play an important role, since data regarding customization of templates can be used to detail aspects of customization more employed by MUGGES community of users.

Specifically, we want to find out what mugglet templates are used (accesed) more often, what mugglet templates are personalized and provided more often, and which are the searches and subscriptions that user are more interested in. For these searches and subscriptions, and If some kind of automatic recommendation is implemented, the ratio of accesed services versus recommended services can be measured to see how useful the recommendation was for the service.

The User Management Module contains Profile and Context Information about the user. We want to measure how much information the user includes here and how useful it is for the search and recommendation systems.

An additional module can also be added to the general architecture to automatically collect and analise the information gathered within it. Namelly, this module could be responsible to collect data mentioned in previous paragraphs and present analysed information to stakeholders within scope of field trials. Nevertheless, this module may relate to a lower priority with focus on the general architecture, described in D1.3 “MUGGES Architecture”.

Further information about the particular implementation of the general MUGGES architecture for the trials can be found in D2.2 “Trial architecture”.

4.2. INTEGRATION OF 3RD PARTY SERVICES, MASH-UPS

To offer this service intelligence the MUGGES platform integrates dependent services from third parties. In other words, MUGGES acts as abstraction interface for third party providers. Since Mugges does not provide these services and only manages them we still need to deploy these third party components. In the following we will give an short overview of potential add-on services:

To achieve realistic user experiences MUGGES create service mash-ups with third party map and event information. With major focus in location-based information, in field trials maps from Google Maps [4] can

be used to supply visual cues to users. The type of maps and their effectiveness can also be evaluated, namely including graphical information, satellite imagery or a hybrid. Included information within Google Maps may in some cases be too extensive and further studies can be performed whether to use other types of maps, and in which scenarios. Geocoding and inverse geocoding features will also be obtained from 3rd parties (Google Maps API [4]).

In specific scenarios, namely in a subway map, content within maps can be adjusted to create a suitable and useful map that conveys geospatial information within a specific representation of the world. Methods used relate to cartography generalization and meant to ajust maps to context specific scenarios.

Moreover, MUGGES may require connection with additional 3rd party services, namely regarding social networking. Services such as Twitter can be used within MUGGES to further improve user experience. Additionally, with an already established community of users, Starting from a previous and established community of users can enhance MUGGES platform and contributions from a bigger array of users. Again, integration of MUGGES with additional 3rd party services should relate with priorities attributed to mugglets and associated functionalities. Implementation should follow the priority scheme established in D1.1 “Use Cases and Scenarios”.

4.3. OTHER RESTRICTIONS

Regarding mobile terminals, many restrictions can be addressed. In the scope of the field trials, restrictions can be the number of available devices (limited to twenty), battery consumption, means of interaction with mugglets; or responsiveness of a mugglet. All these factores can be real barriers regarding MUGGES receptiveness.

Battery comsumption is a clear technical challenge for the project due to the constant use of GPS and the frequent connections with the server in order to update position and context. The perception of users about this fact must be measured in ordet to know whether they consider it a serious handicap which would stop them to usind and providing mugglets.

Besides, we have to make sure that this constant data update is not seen as a privacy issue.

5. REQUIREMENTS FOR TRIAL ACTIVITY PLANNING

When deciding on the procedure for the field trial on MUGGES the following field activity planning requirements (RA) have to be considered:

5.1. CONTROL SAMPLE

The study should be large enough to have a high probability of detecting statistically significant or for the operator important differences of a certain parameter if such a difference exists. In general, the size of an effect is inverse related to the sample size, that is large samples are necessary to detect small differences. Budget restrictions, however, limit the number of available terminals which limit the sample size. The sequencing of experiments with different members of the same control group is an appropriate means to stretch the sample size. To determine the exact sample size (RA1.1) four factors have to be considered including expected effective size (group differences), the desired probability of the experiment to detect the postulated effect, the significance level and the population standard deviation (continuous data).

To achieve adequate test results, it is important to keep in mind, that all persons should belong to the specified target audience of the MUGGES service.

5.2. EXPERIMENT TASKS

To assure trial effectiveness and comparability between trials, specific tasks e.g. the exploration of urban areas can be assigned to trial participants. As the results heavily depend on the background knowledge of the user, it is crucial to avoid learning and familiarity effects during task execution:

- Eliminate learning effects (RA2.1): Special care should be taken when assigning tasks to groups to ensure that an individual does not do the same task for multiple methods because location-based tasks are particularly sensitive to repetition. If the test person has the opportunity to learn from errors in previous experiments, he will certainly take different decisions and falsify test outcomes.
- Eliminate familiarity effects (RA2.2): The tasks may also need to be set in different locations, as familiarity with an area may affect performance. As the benefit of location based services increases with the unfamiliarity of the environment, user familiar with the environment may use it in a different way or perceive the value of these service less important. To avoid this, the experiment for the Track and Share Routes service can be repeated with distinct (but similar) routes.

5.3. EXPERIMENT SITES

As MUGGES is based on location based services, it is necessary to restrict the trial space to specific areas to achieve critical mass:

- Assuring sufficient number of routes (RA3.1): The road networks constitute a far too wide area for a low number of users (see sample size in Section 5.1) to roam freely in order to create available routes with the Track and Share Routes service at an interesting rate. Given an amount of users willing to undergo the trial, we will restrict the area accordingly and even choreograph their movements so that we can guarantee acceptable accumulation of route offers within a certain area.

- Assuring a sufficient number of tweets (RA3.2): The GeoTwitter application is developed to automate spontaneous interaction among unacquainted users. More so, there is an important element of surprise in a MUGGES experience. Having too few tweets in the trial will take away this i.e. they will quickly recognize and learn which the other users are.
- Assuring sufficient number of news (RA3.3): in order piece of information to become news it requires that someone creates it and at least one person reads it with On-the-spot journalism service. Participants should be encouraged to create and follow news. Recommendations of news may be left out from the first trial version.
- Assuring sufficient number of competitive routes (RA3.4): same practising surroundings among participants are needed for "Who beats me on my route?" service. Participants should be interested in running and they should be in good physical condition.

6. REQUIREMENTS FOR TRIAL DEPLOYMENT

6.1. ORGANIZATIONAL REQUIREMENTS

This section describes trial deployment requirements (RD) including required trial agreements, potential time frames, language requirements and pretest requirements to assure trial quality.

6.1.1. Trial Agreements

User agreements (RD1.1) are used to assure the legal situation of the trial. This agreement should generally encompass aspects of correct service usage, limitations of the service scenario, data backups, support services, test person privacy, usage of test data and software and document licenses.

In particular following aspects have to be considered:

- To assure content and behavior evaluations, explicit permissions have to be obtained to evaluate user generated contents and personal behavior of trial users
- To allow publication of test results, test users have to agree on data anonymization issues prior publishing of test results
- Since knowledge sharing is a key issue of MUGGES and the engagement of unacquainted users may be intimidating, a special mention informing users about the MUGGES service philosophy should be introduced.
- To limit communication costs, the calling functionality of the phones, which is not needed for the trial should be disabled. Another benefit of this measurement is, that people have to use MUGGES to solve their problems instead of calling their friends for help.

6.1.2. Time frame

The current project schedule envisions for

- Trial Phase 1 from June 2010 to November 2010
- Trial Phase 2 from September 2010 to November 2010.

The international student group and social web group will be available (RD1.2) from February to June. Moreover the international student group and the ESIDE student group are also available during July. As the technical infrastructure is not available before February/March 2010, the months between February and June are planned for the execution of the trial.

6.1.3. Language Requirements

In order to comply with project administrative requirements the user interface language (RD1.3) of the first version of MUGGES services will be in English. Future releases of MUGGES will also include variable language settings for the user interfaces.

As some communities in Deusto are however Spanish speaking and language difficulties can influence the test results, we will offer questionnaires (RD1.4) in English and Spanish versions. We have to keep in mind that users would like to write entries in their own language even though the interface is provided only in English.

6.1.4. Pretests

The questionnaire (RD1.5) used in this study should be tested with the intended audiences to assure understandability. For this purpose a pretest followed by a discussion with the test persons will be conducted.

The experimenters will evaluate the prototypes (RD1.6) before the field trial is started. Therefore they will simulate the trial scenarios and identify operation problems and resolve them. During this period videos can be shot as a manual for the introduction of the MUGGES platform.

6.2. REQUIRED HARDWARE, SOFTWARE AND INFRASTRUCTURE

Although, MUGGES focus in a mobile to mobile view of an array of services additional server-side infrastructure (RD2.1) is required as well as improved mobile terminal. In trial scenario, focus is to be put in Nokia N97 devices. This device allows MUGGES to explore features that will be seen in the future mobile terminals and can be explored in this field trial with Nokia N97.

Therefore for the server-side infrastructure, a reference hardware infrastructure can be:

- 1+ x 3.4GHz or greater Intel "Xeon" class processors
- 4096+ MB RAM
- 160+ GB usable disk space
- 1+ x 100/1000 Ethernet ports

Regarding connectivity, server-side architecture should have a high speed connection (RD2.2) with a public address, so that accessibility to the machine is allowed from the exterior of MUGGES platform. Additional software for the server, would require, an operational system, a database and a additional software to support mugglets.

In the mobile terminal (RD2.3) and for acceptable MUGGES service usability and performance, parameters such as operating options, operating system, display resolution, performance, storage capacity and extensibility of the system were crucial. Without large screens, adequate storage capacities and the availability of different location technologies MUGGES applications cannot function properly.

MUGGES requires at least the following hardware capabilities (based on Nokia N97 hardware):

- Processor capacity (ARM 11, 434 MHz processor or equivalent)
- Large Screen Display resolution (360x640 pixels,16M colors, 3.5 inches)
- Storage capacity (up to 16 GB storage and 128 MB RAM)
- Ad-hoc Networks (Bluetooth, WiFi, IR)
- Integrated interfaces (serial Com-Port; USB;Card Slots)

- Following integrated or extern devices:
    - Camera (5MP, 2592x1944 pixels) preferable with Geo-tagging
    - Diverse location technologies (GPS, WLAN, RFID)
    - Touch Screen and keypad
- CSD, Dual Transfer Mode (MSC 11), EGPRS, GPRS, HSCSD, HSDPA, and WCDMA Support

Apart from client and server, some simple equipment for indoor location (RD2.4) may bee needed, such as RFID tags, Bluetooth beacons, or simply printed 2D barcodes which can render its position by means of a camera phone and the necessary software. These items should be distributed in several places of the trial location, especially indoors, to allow a proper behaviour of the mugglets.

6.3. DEVICE CONFIGURATIONS

One goal in MUGGES is creating a technology-independent layer for positioning that may be used by location based service providers in an agnostic manner. The MUGGES execution environment will make use of these location technologies based on 1) which are available on the mobile terminal, and 2) which is the most suitable for the invoked MUGGES service. Even complementary location data provided by different technologies would generate a more accurate user position.

To assure sufficient execution of MUGGES services on the mobile phone, we here summarize minimal requirements in dependence of the applied MUGGES template:

- GeoTwitter: This service is intended to be used in in- and outdoor scenarios. To reference tweets with locations, an accuracy of at least 50-200 meter precision is required. High location accuracies are needed to identify specific buildings (RD3.1) on the campus whereas lower precisions are acceptable for the tweet assignments to places (RD3.2) within Bilbao.

  Within urban areas, network based location approaches based on the cell-id of telecom networks are probably sufficient. This approach may obtain accuracies up to 100 meters; network triangulation may again improve this value. If higher precisions are required location technologies based on Bluetooth, RFID or infrared beacons are more reasonable, however they require an additional infrastructure setup.

- Track and share routes: This service is applied only outdoors and has to be globally available (RD3.3) e.g. to make it work in mountain areas close to Bilbao. Locations are mapped to routes through geocoding services. Geocoding services require location accuracy (RD3.4) in urban environments of 10 to 20 meters.

  GPS systems are well proved for navigation services. A standard GPS receiver for civil use offers accuracy down to a few meters. The number and geometry of the received satellites influences the accuracy considerably, and in daily use, accuracies of about 20 m can be expected. However in cities with large buildings, creating urban canyons, the GPS may not perform well as the line of sight to the satellites may be interrupted. As the number of stories in buildings of Bilbao is seldom more than 6 floors, we can neglect this problem for the trial case.

- On the spot journalism: This service is targeted both indoors and outdoors use. Since news concern usually people, objects and named places (RD3.5) (symbolic locations instead of accurate physical positions) high resolution positioning isn't necessarily mandatory. Better precision is

probably preferable inside buildings (RD3.6) (like room or lecture hall level accuracy) compared to the outdoors where a district level accuracy might be sufficient enough. Geocoding (binding symbolic locations to physical ones and vice versa) might also be required.

For this trial case outdoor positioning can be provided by using either a cellular network (GSM) cell-ids or GPS. In populous areas cells tend to be small enough and a district level accuracy might be obtained even by using solely GSM base station cell-ids. If needs for higher precision will emerge, nothing prevents to consider either network based triangularization offered by teleoperators (if available as a service on a trial site) or use of GPS (when terminal capabilities allow it). As stated above urban environments might be harsh for GPS but GSM cell-id based positioning can always be used as a back-up service when loss of GPS signals emerge.

Inside buildings WLAN infrastructure is pretty much a commodity nowadays and WLAN base station ids could be used as a mean of positioning in a similar way as GSM cell-ids do. The accuracy of this approach highly depends on a layout of a local Wi-Fi network (the same fact applies to GSM networks as well). More precise WLAN positioning systems with triangularization like Ekahau RLTS [5] exist but are not recommended choices since need of additional investments and set-up time and due to the poor performance in open spaces. If WLAN infrastructure is not available, alternate and less precise positioning could be achieved by using GSM cell-ids. If very high accuracy demands emerge during a trial, use of visual markers might be considered.

It also should be noted that Wi-Fi signals usually "leak" outside buildings in urban areas and this phenomena can be used to sharpen location accuracy outdoors as well - especially when GPS signaling is poorly available. Since WLAN are operated by individuals or corporate, this "best effort service" is not very reliable though, some base stations might come and go. Another remark should also be stated: if geocoding needs pop up, ready made mapping (cell-ids to physical/symbolic places and vise versa) services are seldom available for WLAN or GSM networks. This mapping task (RD3.7) might require some additional efforts for a trial set-up. GPS ready-made geocoding services are provided by 3rd parties, like Google Maps [4] and local service providers like Eniro in Finland.

- Who beats me on my route: This service is intended mainly to outdoor use, but indoor utilization cannot be excluded though. The accuracy needed to describe a route (RD3.8) is usually high. Essentially a route is a set of waypoints; density and ordering of these points define how precisely users should follow up it. For example orienteering or pub crawling track describe only few points and users might fairly freely select suitable (fastest /most convenient) paths between them (visiting order usually is needed to preserve). On the other hand, race routes are tightly defined and users should strictly keep on paths to prevent disqualification. In both cases a precise description of waypoints is mandatory to avoid getting lost. If some kind of competition is concerned, usually a proof of visits at a set of certain points is also an essential requirement.

  Route descriptions can be published either by using symbolic (addresses, landmarks etc.) or physical places (coordinate pairs). The marking of these places can be done "virtually" by defining well known place names on a map or a set of GPS coordinates. Another method to mark a route is to use physical signposts on environment – for private use these signposts should be pretty unobtrusive, perhaps some sticker like 2D visual markers on certain easily recognizable places could be utilized.

  Both GPS coordinates and digitally readable markers/signposts (barcodes, 2D semacodes, RFID tags that can associate information to a tag) provide accurate way to mark-up "who beats me on

my route? " - paths for outdoor environments. The selection of required positioning between these alternative methods is more a matter of taste - a marker based approach is a bit more tedious by requiring physical "on-site" visits. For indoor use, the marker approach is the most preferable high accurate choice, but also WLAN cell-id waypoint marking might be applicable for less demanding route applications as well.

7. REQUIREMENTS FOR RESULT MEASURING

7.1. MEASUREMENT METHODOLOGY

In order to measure the outcomes of the field trials quantitative and qualitative approaches are required. In this Section we give an overview for both approaches and summarize most important requirements for measuring (RM).

For the quantitative evaluation of the trial, it is important to obtain not only process development and the process outcome as an indication for the service usability but also information about the service usage to identify significant usage patterns.

Quantitative measurements can be obtained by logging of events in the user interface and MUGGES related events and store them as a time-dependent structure temporarily on the phone. These events include pressed buttons, screen transitions, error messages, starting and stopping of services, context data and changes in settings. The logging process itself should have no influence on the performance (RM1.1) of the application. Moreover, it is important to predefine validity ranges of applied measurements, to detect and exclude measurement faults. Collected data could be transferred to a server wireless over GPRS periodically or during shutdown of the service. It is important to take a range of different quantitative measures, as participants may make tradeoffs which can otherwise not be detected. To give a sample, people may still successfully use a service, but it may take them to rest or lower the speed to deal with it properly.

Qualitative approaches include user comments during the execution of MUGGES services, experimenter observations during the trial and questionnaires after the trial.

In selected cases, it is useful for the experimenter to note down observations during the experiment on particular uses of the device and routes taken, as mentioned above. Taking photographs and videos may also help, if the effort is reasonable. To avoid influencing the behavior of test persons, experimenter should always follow them with certain distance (RM1.2). After the experiment participants are questioned after trying out each method about their experience of that method, using a questionnaire or interview. At the end of the experiment, they are also asked to compare the different methods.

Well designed questionnaires are highly structured to allow the same types of information to be collected from a large number of people in the same way and for data to be analyzed quantitatively and systematically. The following format requirements have to be met to assure proper qualitative execution of the study:

- Question Ordering (RM1.3): Questionnaire should not start with demographic and personal questions. To achieve the best response rates, questions should follow a logical order: from general to particular, from easy to difficult, from the least sensitive to the most sensitive, from the factual to abstract, and from the more general to the more specific.
- Question Phrasing (RM1.4): The way questions are phrased is important and there are some general rules for constructing good questions in a questionnaire:
    - Usage of short and simple sentences
    - Asking for only one piece of information at a time
    - Avoidance of negatives if possible

- Asking precise questions
- Affirmation that those asked have the necessary knowledge
- Consideration of sensitive issues

7.1.1. Comparison of Results

To obtain a quantitative evaluation, it is necessary to compare the results from one method with those from another.

The benefit of any MUGGES services can easily be identified by comparing those with standard process practices (RM1.5) like using mobile phones for on-the-spot communication or tourist guides and paper maps to search for routes in the city.

Furthermore, it is important to identify MUGGES service benefits and user acceptance for different user communities (RM1.6).

As some people are more familiar with mobile technology than others, it is important to cluster people after their technological experience (RM1.7). The clusters hereby shall follow the categories defined by Rogers [6] in his theory about the diffusion of innovation, where he explicitly divided humans in

- Innovators (first individuals to adopt an innovation)
- Early Adopters: (typically opinion leaders with interest in new technologies)
- Early Majority (individuals adopting an innovation after a varying degree of time)
- Late Majority (individuals adopting an innovation after the average member of the society)
- Laggards (the last group of individuals adopting an innovation)

7.2. MEASUREMENTS

The goal of our field trial is to find answers to the following research leading questions: How will the consumer behave with this type of new innovative service? Or, how will GNSS impact in mobile social and user generated services?

In order to answer our first research question we need to identify preferred usage situations (time, location and activity) and analyze usage statistics for given MUGGES templates and services.

In order to answer the second research question we need to quantify the user benefit created through the MUGGES platform. One way to measure this are performance parameters or more general acceptance parameters.

In the following subsection we describe the measurements in more detail.

7.2.1. General Data about Test Persons

Before starting the survey, it is important to record demographic information about the test persons relevant to the project (RM2.1). These include

- Contact information

- Education/occupation
- Primary language and English proficiency
- Experience with Web 2.0 applications
- Mobile phone usage patterns.

7.2.2. Quantitative Measurements

To obtain objective information about MUGGES usage, we obtain quantitative usage information (numerical values). These measurements are typically collected with the MUGGES accounting module as mentioned already in Section 4.1 "Particular MUGGES Modules". Quantitative values allow for direct comparison between observations made by different people or at different times, and thus are very important for scientific evaluation. We classify them roughly in general and service specific measurements e.g. the "GeoTwitter", "Track and Share Routes", "On-the-spot journalism", "Who beats me on my Route?" related measurements. To account for the community character of MUGGES we further distinguish between provider and consumer oriented measurements. In the following we describe the quantitative measurements applied for the trial in more detail.

7.2.2.1. General MUGGES Measurements

A new Twitter survey has proven that only a small proportion of the communities are really active and the majority behaves rather passive. In the literature, this phenomenon is often referred to as the lurker or free riding problem. To encourage community activities, MUGGES providers may use incentives to stimulate service creation by the community. Community participation is generally topic dependent and may also vary between different MUGGES services. Following facts reveal important information about community activities:

- Template usage: The number of applied MUGGES templates reveals information about the suitability of MUGGES applications for specific user communities.

  Measure (RM2.2): Number of utilized templates per community

- Service usage: The number of created MUGGES services provides information about the overall community activity.

  Measure (RM2.3): Number of created services per template and community

- Service subscriptions: The proportion between providers and followers at a given time describes the temporary service consumption behaviour.

  Measure (RM2.4): Number of service creators and subscribers (followers) per service and community

- Usage problems: Test persons may have problems using the service for different reasons. Problem logging is important as problems may indicate situations where the application of MUGGES service may be unsuitable. Also, to make sure that these problems do not influence MUGGES usage we track potential problems with the user interface.

  Measure (RM2.5): Frequency, number of cancel buttons pressed per day per user, errorness data entries, and system exceptions

7.2.2.2. Performance Measurements for Track and Share Routes

This section describes some of the most relevant measures that can be used when evaluating mobile guides and other location sensitive applications. With regard to the evaluation of these factors, this study differentiates between consumer- and provider-oriented measurement factors.

Consumer Perspective:

- Commenting of Progress State: During the recording of the route, test users may want to interrupt the recording or stop it without reason. To ease user handling, the user should be able to take "unplanned" actions and comment them accordingly to avoid false interpretations.

  Measure (RM2.6): Progress states including Started, Interrupted, Resumed, and Finished

Provider Perspective:

- Timings: These include the starting and stopping of track services, usage frequency and the durations spend with the service. We assume that time characteristics of shared routes may reveal important usage patterns. Timings can be obtained by the device itself or in exceptional cases taken by an observer with stop watches.

  Measure (RM2.7): Starting time of the route, stopping time of the route, duration of the route (hours, minutes, seconds)

- Distance travelled and route taken: The distance travelled and route taken by participants can help to identify location-based errors and to determine particular points at which difficulty arose. With location technology part of MUGGES platforms mobility traces can be logged and verified with map based applications.

  Measure (RM2.8): Starting point coordinates, ending point coordinates; recording route coordinates (in specified time intervals)

7.2.2.3. Usage/Content Measurements for GeoTwitter

To get the better picture for which situations the service is best suited, we need to analyze the usage patterns of GeoTwitter. This includes primary an evaluation of the context data referenced with published twitters to detect popular situations for publishing and querying tweets. With regard to the evaluation of these factors, this study differentiates between consumer- and provider-oriented measurement factors.

Consumer Perspective:

- Reference activity: It is generally agreed that the current activity is an import criteria to determine the motivation of the Tweet. The test person may specify his state from a set of predefined options. Buddy state changes can then be logged together with the update time.

  Measure (RM2.9): Choosing category from predefined options

- Content domain of tweet: The tweet content itself most likely reveals a lot of information about popular tweet scenarios. Analysis software can be used to scan tweets for descriptors disclosing context specific information. A Twitter survey [7] reveals that several signs have been used by early adaptors to specify Tweet addresses related Tweet contexts:

  - Tweeters use "@" signs to address specific persons/services, indicate locations and purposes or define valid time frames.

- Hash tags "#" are a simple way of grouping messages based on specific topics or groups and based on short term or long term naming conventions. Hast tags are used to generate a resource based on that specific thematic or to bridge knowledge across networks of interest.

Measure (RM2.10): Choosing category from predefined options

- Consuming location of tweet: Identifies characteristic user locations where people see a benefit using GeoTwitter. By comparing the consumer location with the tweet reference location one draw conclusions how well user interests are met by the tweet.

  Measure (RM2.11): Coordinates when downloading the tweet

- Consuming time of tweet: Reveals information about preferred usage times. It may further reveal information about the lifecycle of tweets, if this information is compared with the creation time of the tweet.

  Measure (RM2.12): Time of downloading the tweet

Provider Perspective:

- Reference location of tweet: Important to detect geographical hotspots for tagging. The assumption is that some locations may proof better for tagging e.g. city centres, pedestrian areas because people have more time for creating tweets.

  Measure (RM2.13): Coordinates when publishing tweets

- Publishing time of tweet: Reveals information when people spend most of their time with tagging. Since tagging takes a lot of time, people may use specific niche situations for writing tweets.

  Measure (RM2.14): Publishing time of tweets

  Remark (RM2.15): To assure validity of tweets, it may be required to filter out tweets which are outside of the experiment sites or the experiment time frame.

7.2.2.4. Performance Measurements for Who beats me on my Route?

This section represents some of the most relevant measurements for competing routes. With regard to the evaluation of these factors, this study differentiates between consumer- and provider-oriented measurement factors.

Consumer perspective

- Private challenge: This gives a user possibility to challenge a specified user for competition in same route.

  Remarks: In case the trial community is only small and limited number of participants simultaneously this option may be left out.

  Measure (RM2.16): Frequency, number private of private challenges posted per user per day

- Public challenge: When a challenge is set public it gives a change to compete with all the participants.

  Measure (RM2.17): Frequency, number of public challenges posted per user per day

Provider perspective

- Timings: The information is gathered about the starting and stopping the service, also duration spent on using the service.

  Measure (RM2.18): Starting time of the route, stopping time of the route, duration of the route (hours, minutes, seconds)

- Distance travelled and route taken: This can be visualized for example based on a map. Ending and starting point should be clearly marked.

  Measure (RM2.19): Starting point coordinates, ending point coordinates; recording route coordinates (in specified time intervals)

- Comparison: This factor reveals if the consumer followed the same route as provider. If the consumer did the new result can be published as a better score i.e. a new mugglet.

  Remarks: The location based method should fit for comparing results in a reasonable accuracy.

  Measure (RM2.20): Comparison Boolean variable,

  if (publisher route – tolerated deviation) <consumer route < (publisher route + tolerated deviation) is true

- Errors: If the system has malfunction for any kind of reason an error handling procedure should be provided, for example with a cancel button. The interface should enable users to comment possible problems occurred during the use of the service. This could help analyzing possible patterns of error occurrence.

  Measure (RM2.21): Frequency, number of cancel buttons pressed per day per user

7.2.2.5. Usage/Content Measurements for On-the-spot journalism

In order to find usage patterns of On-the-spot journalism mugglet we need to analyze some important factors from items of news. With regard to the evaluation of these factors, this study differentiates between consumer- and provider-oriented measurement factors.

Consumer perspective:

- Content domain of news: The topic has to be set clearly when publishing or consuming news. This includes the textual information but it could be accompanied with a picture.

  Measure (RM2.22): Choosing category from predefined options

- Recommendations for news: Other people can recommend the news by voting. This option can influence the listing (order) of news.

  Measure (RM2.23): Number of recommends per news

- Consuming location of news: It is important to detect if there are hotspots for news downloading.

  Measure (RM2.24): Coordinates when downloading news

- Consuming time of news: This reveals the opposite information: when people are consuming news.

Measure (RM2.25): Time of downloading the news

Provider perspective:

- Reference location of news: It is important to detect if there are hotspots for news exploitation.

  Measure (RM2.26): Coordinates when publishing news

- Publishing time of news: This reveals the information when people are providing news.

  Measure (RM2.27): Time of publishing news

7.2.3. Qualitative Measurements

User acceptance is increasingly regarded as critical success factor for mobile devices. Although several acceptance models exist and help to increase understanding of different influencing factors on user acceptance, they are not suitable to support the development of mobile services. A well known evaluation framework is the technical acceptance model based on perceived usefulness and perceived ease of use.

To stronger reflect the mobile characteristics of cellular phone based services Amberg [8] et al. extended the evaluation framework based on following key variables:

- Perceived Usefulness: This measurement describes the performance increase people gain, while using this mobile service. This measurement refers to the fact that people will adopt a new application to the extent that they believe it benefit them.

  Measure (RM3.1): Rating values for information quality and quantity or conformity of expectations

- Perceived Costs: An interface that reduces workload is likely to be more successful in a mobile setting, as people often may follow other real world tasks in parallel. As measurement scale for task load analysis scales developed by NASA [9] are commonly used. Some modifications more related to the mobile device and tasks are presented in the work by Fairclough [10].

  Measure (RM3.2): Rating values for content authoring and access effort

- Perceived Ease of Use: It is important to know if any system developed will be acceptable to users in practice. One important aspect of this is comfort, as complex services are difficult to learn. Knight [11] et al. have developed the Comfort Rating Scale (CRS) which assesses various aspects of the comfort of a device.

  Measure (RM3.3): Rating values for overall handling, menu navigation and personalisation

- Perceived Mobility: This measurement considers the mobile device (battery usage), the available mobile networks (reception quality) and, depending on the regarded service, also the degree of situation-dependency.

  Measure (RM3.4): Rating values for coverage quality, accessability and technical infrastructure

One benefit of the MUGGES platform is the support for user communities. The community value is created through information sharing and the stimulation of spontaneous user behavior. Two measurements are introduced to obtain the sense of community:

- Perceived Shared Knowledge: This measurement represents a rating of the information quality generated by the system. Hereby we assume that a broader user community creates larger knowledge repository and increases the probability to deliver situation relevant contents.

  Measure (RM3.5): Rating values for information quality and quantity

- Perceived Behavior Influence: It is assumed that MUGGES stimulates spontaneous behavior like further calling, messaging, starting of other mugglets and meeting other community members. This measurement describes a ratio to which test users believe MUGGES services have influenced their real world behavior.

  Measure (RM3.6): Rating values for the estimated amount of stimulated behavior

8. REQUIREMENTS FOR TRIAL EXECUTION

For a successful trial it is important to consider following requirements for execution (RE):

Before the evaluation is started, the users are briefly instructed (RE1) about how the system works. This is important as the familiarity with the device and its services influence the perception and may negatively impact the trial. All trial participants are assigned to deal with the applications before using them in the trial.

To motivate test persons and to stimulate MUGGES usage, several accompanying actions are planned. These include newsletters, support meetings, local supervisions (RE2) of the trial etc...

Unfortunately the prototype requires some delicate configuration and set-up in order to be functional. For instance, the wireless network interface and diverse location technologies have to be activated before launching the MUGGES platform and it must also be assigned unique IP address. A user also needs to download adequate MUGGLET templates. This requires solid support effort (RE3) and could take several hours a week.

9. SUMMARY OF REQUIREMENTS

9.1. REQUIREMENTS FOR TRIAL ACTIVITY PLANNING

Requirement	Description
Control Sample	
RA1.1	Determine adequate sample size
Specification of Experiment Tasks	
RA2.1	Assure non repetitive experiment tasks
RA2.2	Assure unfamiliar environments for test users
Specification of Experiment Sites	
RA3.1	Assure sufficient number of routes
RA3.2	Assure sufficient community activity
RA3.3	Assure sufficient number of news
RA3.4	Assure sufficient number of competitive routes

Table 9.1 – Requirements for trial activity planning.

9.2. REQUIREMENTS FOR TRIAL DEPLOYMENT

Requirement	Description
Trial Agreements	
RD1.1	Contents of user agreements
Experiment Design Issues	
RD1.2	Assure availability of test communities
RD1.3	Language requirements for the prototype
RD1.4	Language requirements for the questionnaire
RD1.5	Pre-testing of questionnaire
RD1.6	Pre-testing of MUGGES prototype
Trial Hardware	
RD2.1	Hardware requirements for server infrastructure
RD2.2	High-speed network requirements for server infrastructure
RD2.3	Hardware requirements for mobile terminals

RD2.4	Infrastructure requirements for positioning infrastructure
Device Specific Configurations/"GeoTwitter"	
RD3.1	Assure location precision for building identification
RD3.2	Assure location precision for place identification
Device Specific Configurations/ "Track and Share Routes"	
RD3.3	Global coverage of outdoor positing system
RD3.4	Assure location precision for route identification
Device Specific Configurations/ "On the spot journalism"	
RD3.5	Assure location precision for place identification
RD3.6	Assure location precision for building identification
Device Specific Configurations/"Who beats me on my route?"	
RD3.7	Additional third party service requirements for geomapping services
RD3.8	Assure location precision for route identification

Table 9.2 – Requirements for trial deployment.

9.3. REQUIREMENTS FOR RESULT MEASURING

Requirement	Description
Methodological Requirements	
RM1.1	Assure independence of user interaction logging process
RM1.2	Assure independence of user observation processes
RM1.3	Assure adequate questionnaire formatting/adequate ordering of questions
RM1.4	Assure adequate questionnaire formatting/adequate phrasing of questions
RM1.5	Performance comparison with reference systems
RM1.6	Performance comparison between communities
RM1.7	Performance comparison after technological experience
General Data about Test Persons	
RM2.1	Record demographic information about the test persons
General Quantitative Measurements	
RM2.2	Record the number of utilized templates per community
RM2.3	Record the of number of created services per template and community
RM2.4	Record the number of service creators and subscribers (followers) per service and

	community
RM2.5	Record the frequency, number of cancel buttons pressed per day per user, errorness data entries, and system exceptions
"Track and Share Routes" scenario	
RM2.6	Record the progress states including Started, Interrupted, Resumed, and Finished
RM2.7	Record the starting time of the route, stopping time of the route, duration of the route (hours, minutes, seconds)
RM2.8	Record the starting point coordinates, ending point coordinates and route coordinates (in specified time intervals)
"GeoTwitter" scenario	
RM2.9	Choose category of reference activity from predefined options
RM2.10	Choose category of content domain from predefined options
RM2.11	Record the coordinates when downloading the tweet
RM2.12	Record the time of downloading the tweet
RM2.13	Record the coordinates when publishing tweets
RM2.14	Record the publishing time of tweets
RM2.15	Filter out tweets which are outside of the experiment sites or the experiment time frame
"Who beats me on my Route?" scenario	
RM2.16	Record the frequency, number private of private challenges posted per user per day
RM2.17	Record the frequency, number of public challenges posted per user per day
RM2.18	Record the starting time of the route, stopping time of the route, duration of the route (hours, minutes, seconds)
RM2.19	Record the starting point coordinates, ending point coordinates; recording route coordinates (in specified time intervals)
RM2.20	Check if the consumer followed the same route as the provider
RM2.21	Record the frequency, number of cancel buttons pressed per day per user
"On-the-spot journalism" scenario	
RM2.22	Choose category of content domain for news from predefined options
RM2.23	Record the number of recommends per news
RM2.24	Record the coordinates when downloading news
RM2.25	Record the time of downloading the news
RM2.26	Record the coordinates when publishing news
RM2.27	Record the time of publishing news

Qualitative Measurements	
RM3.1	Perceived uselfulness: record rating values for information quality and quantity or conformity of expectations
RM3.2	Perceived Costs: record rating values for content authoring and access effort
RM3.3	Perceived Ease of Use: record rating values for overall handling, menu navigation and personalisation
RM3.4	Perceived Mobility: record rating values for coverage quality, accessability and technical infrastructure
RM3.5	Perceived Shared Knowledge: record rating values for information quality and quantity
RM3.6	Perceived Behavior Influence : record rating values for the estimated amount of stimulated behavior

Table 9.3 – Requirements for result measuring.

9.4. REQUIREMENTS FOR TRIAL EXECUTION

Requirement	Description
Trial Execution Aspects	
RE1	Preparation of trial instructions
RE2	Assuring adequate trial supervision
RE3	Assuring adequate technical support

Table 9.4 – Requirements for trial execution.

10. CONCLUSIONS

The results from the trial phase are one of the most important outcomes of MUGGES. Therefore, special care must be taken in identifying and analyzing the requirements that will lead to the trial design and execution.

Throughout this document, different communities at the two trial sites have been identified as possible beneficiaries of the improvements to be generated in MUGGES. Their current processes have been analyzed in order to determine in which ways their current performance and experience can be leveraged through the exploitation of mobile user-provided location-aware services.

A selection has been made from the initial scenarios developed in T1.1 in order to match them to the real challenges and situations the communities face in their everyday activities. After meetings and interviews with representatives of the communities a list of requirements on different areas have been gathered and structured, so that they will constitute the basis for the trial design process to be carried out in T4.1.

Particular attention has been given to the requirements for the result measurement, since they will provide a guide for validating the results of the trial. In this case, each scenario has been analyzed and both quantitative and qualitative measures have been identified and described. Additionally, it was found that there are several measurements which are shared among all the scenarios and possible applications of MUGGES, related to the platform itself.

The importance of community / user involvement during the trial has been continuously stressed through this document. As the trial process progresses, their role will become more and more significant for its success.

All the information collected in this document will shape the trial plan to be developed in T4.1, where particular decisions will be taken and documented in order to meet the above described requirements to carry out the trial process.

11. COMMENTS FROM EXTERNAL REVIEWERS

11.1. REVIEWER 2 – YDREAMS

Date: 14th September, 2009

The document is well written, allowing a pleasant read throughout it. Some suggestions relate to:

- Considering introducing abbreviations before using them. Such as, introduce "RA". Sometimes, it is hard to follow the context of requirements.

  → The meaning of the acronym has been introduced in the initial paragraph of every requirement section.

- Consider a section in the end of the document describing the achievements of the document.

  → Added, see Section 10 "Conclusion"

Section 1:

- Consider inserting a reference to the Compass Acceptance model. → See literature reference [8]

Section 2:

- "MUGGES templates are stored as server side module " consider using a different term other than module as it may be confusing with architectural modules. For example, "elements".

  → Rephrased them with term "objects".

- "MUGGES applications are small and independent location aware mobile sample applications running at the terminal side that can be filled with contents directly by users and put into exploitation from the user's mobile device, this is, provided in one mobile and reachable from others." Consider smaller sentences, since big sentences difficults reading.

  → Rephrased sentence

Section 3.2.1:

- "schedules and they stay exchange for diverse periods." This sente is confusing, consider revising.

  → Rephrased sentence

Section 3.3.1:

- "The techniques for requirements gathering are presented in D1.4." Consider adding a reference to the document.

  → Reference added.

Section 4.1,

- Consider adding a reference to the MUGGES architecture. Therefore, a reader can further understand the roles of each module.

  → Added reference for MUGGES Architecture.

Section 4.2:

- Consider adding the reference in the reference section.
- "Additionally, with an already established communinity of users, Starting from a previous and established community of users can enhance MUGGES platform and contributions from a bigger array of users." Consider ervisin, the sentence is confusing.

  → Sentence rephrased.
- "established in D1.1" consider adding a reference to the document.

Section 5.1:

- "RA1.1" it is not clear on what reference this links to. Consider to briefly explain the reference to the approapriate section.

  → Abbreviation "RA" introduced at the beginning of the section.

Section 5.3:

- "see sample size". Consider adding a reference to the approapriate section for better readability.

  → Reference added.

Section 6.3:

- "More precise WLAN positioning systems with triangularization like Ekahau RLTS exist but are not recommended choices, since need of additional investments, and set-up time and due to the poor performance in open spaces." Confusing sentence. Does it states that WLAN has poor performance in open spaces? Consider revising.
- "Eniro" Consider adding a reference to the project.

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YDREAMS

11.2. REVIEWER 1 – TELEFONICA I+D

Date: 10th September, 2009

This document is presenting, in a concise and clear way, the initial requirements for a trial with users. Most of the requirements are clearly justified and the final summary gathering all the requirements is a really good starting point for the design of the future trials. Additional comments and improvements suggested to the document are the following:

Section 1: (Page 4)

- Making tests in the street, in November, in Oulu maybe could be complicated due to weather conditions. Did you take in count this situation regarding issues like using touch-sensitive screens with gloves?

  → In our [VTT] point of view, it could be interesting to test these Mugglets in different weather conditions (either by using gloves or not).

- "We plan to use 20 mobile terminals for the trial with large screens," What is a large screen? The screen of a Nokia N95 was considered to be large until iPhone. Can you define the screen size?

  → Reference to exact mobile terminal specification added.

- "During and after the experiment test persons are interviewed". This means that while I am creating a route someone is going to follow me making questions? Is this possible and comfortable for the users?

  → Interviews during the trial are done in the pretest phase only. To avoid misunderstandings "During" was removed.

Section 3.3.2: (Page 11)

- Suddenly some user cases are written without any introduction explaining why they are presented. Should the students in the trial follow what it is explained? Won't be an "open" trial?

  → Added clarifying comments in Section 3.3

Section 4.1: (Page 14)

- Maybe a diagram identifying the modules could help understanding their role

  → Reference added to D2.2 "Trial architecture", which includes comprehensive technical information about the architecture.

- Is the stored information going to be processed automatically or will it be analysed manually?

  → For the purposes of the MUGGES Trials, it is not considered to implement automatic analysis tools. Of course, for commercial deployments this may be useful or even necessary.

- "To support field trials, MUGGES Accounting module can be used to track mugglets."
  To track a mugglet means to know where the provider is or who the provider is?

- I do not see the need of section 4.2. I understand that these 3rd party APIs are part of the Mugglets as capabilities.

  → Explained how MUGGES integrates third party services to improve service quality

- Why is Google Maps chosen instead of Yahoo Maps or Bing Maps?

  → The functionality required for MUGGES is covered by any of these options. Google Maps is chosen just for its greater popularity.

Section 4.3: (Page 15)

- title is "other restrictions"; it is not clear that the previous section is about restrictions.

Section 5: (Page 16)

- The requirements should be enumerated in a list before the explanation of each one, to improve the clarity.

  → Added a reference for requirements at the end of the document to avoid breaking the information flow of the text.

Section 6: (Page 18,19)

- "To limit costs and stimulate the usage of MUGGES services": It sounds like a contradiction , if you limit cost you cannot stimulate the use of an application connected to internet.

  → Rephrased sentence to clarify this contradiction..
- "Trial Phase 1 for June 2010 to November 2010 and ": Remove and

  → Removed “and”.

- Are questionnaires going to be online or in paper?

  → Internet solution requires server setup, installation of survey application and questionnaire configuration, budget available? Question delayed for Lissabon meeting.

Section 6.2: (Page 20)

- Do all the users have to use the same carrier?

  → This question is part of the Trial Planning Task. Question delayed for Lissabon meeting!

Section 6.3: (Page 20)

- Section 6.3 is justified in the location of Bilbao. What about the other location?

  → Section 6.3 should include remark that: "GeoTwitter" and "Track and Share Routes" Mugglets are trialled in Bilbao, whereas "On-the spot journalism" and "Who beats me on my route?" Mugglets will be included in Oulu trial.

- Have you considered the battery and the storage of data? What happens if the battery goes down during a trial, can you resume the test?

Section 7: (Page 25)

- The criteria for choosing the 7.2.2 measures are not clear enough. Can you develop a little bit more the introduction to justify the election?

  → Rephrased intrduction of quantitative measurements in Section 7.2.2

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12. ABBREVIATIONS

2D	2-dimensional
CDMA	Code Division Multiple Access
CSD	Circuit Switched Data
EGPRS	Enhanced General Packet Radio Service
GB	Gigabyte
GNSS	Global Navigation Satellite Systems
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communication
HSCSD	High Speed Circuit Switched Data
HSDPA	High Speed Downlink Packet Access
IP	Internet Protocol
IR	Infrared
KHz	Kilohertz
LBS	Location Based Services
MB	Megabyte
MHz	Megahertz
MP	Megapixel
RFID	Radio-frequency identification
RLTS	Real Time Location System
USB	Universal Serial Bus
WCDMA	Wideband Code Division Multiple Access
WLAN/WiFi	Wireless Local Area Network (commercially used Wi-Fi)

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