User Experience Design Guidelines for Telecare Services

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Abstract

Telecare can help health and social care agencies address the challenges they face from an ageing society and deliver services improving the clients' quality of life. The end users of telecare systems are unlikely to have a deep understanding of technology, therefore good human factors and ergonomics are important for the system's acceptance, usability and safety. This paper reports preliminary results from a project initiated by the European Telecommunications Standardization Institute (ETSI) to develop a set of guidelines for human factors in telecare systems, thereby maximizing user experience and promoting the usage of telecare, and directed towards all stakeholders in the telecare delivery chain. The guidelines are first structured along the dimension of human factors, consisting of: confidentiality and privacy; ethics; legal aspects; availability and reliability; integrity; safety; installation, setup and configuration; user interaction; localization and customization; service and system aspects; organizational aspects; user education; interoperability; development process and testing. For each of these, guidelines are enumerated and grouped as being either generic or pertaining to one of the different product lifecycles: research and development; design and manufacture; equipment delivery; and final service deployment. In all, a considerable number of generic and specific guidelines will be provided. The work is in progress (Sep. 2006), and the authors encourage input and comments. For more information, see
http://portal.etsi.org/stfs/STF_HomePages/STF299/STF299.asp also available through
http://stf299.org

Keywords

eHealth, eInclusion, Human Factors, Guidelines, Mobility support, Social and Health services, Telecare, User Experience

1. Introduction

Telecare is a strategic enabler of independent living for people with functional limitations. Maintaining traditional health and social care services to users with high expectations in terms of freedom of choice, mobility and personal attention on demand [1] will become increasingly expensive, with no perceived increase in quality. Changing demographics and new technologies mean that telecare is increasingly seen as a necessary and practical solution to the challenges faced by health and social care services. Telecare is also seen as supporting a paradigm shift within health and social service provision models, leading to an increase in community based care together with a reduction in the artificial barriers that exist between these models.

Technical developments are offering seamless and more continuous access to fixed and mobile broadband networks, the vision of a world where ICT resources around us will improve the quality of our lives is becoming realistic. These developments will lead to new applications and services capable of monitoring and helping clients and their carers perform necessary tasks and activities of daily living, see ETSI TR 102 415 [2].

According to that report, telecare is defined as the provision of health and social care services to individuals, inside and outside of their homes, with the support of systems enabled by ICT. The services that can be provided through telecare include: personal monitoring, security management, electronic assistive technologies and information services used to support personal health and well-being. Within the latter category, provision of information services to support mobility may notably improve the quality of life of older persons and people with disability.

Human factors constitutes the scientific knowledge about human abilities and limitations, with the aim of making products and services more efficient, secure, accessible and easy to use. In the telecare domain, it involves a large number of elements, including the establishment of human confidence, device setup, configuration, calibration and maintenance, data collection, user procedures, cultural issues such as the use of language and illustrations, the organization of the care provisioning process, and communication with diagnostic systems and carers, human communication and confirmation, and decision making, the presentation medium and accessibility issues.

The consideration of human factors in the creation and deployment of Telecare services and products will constitute a key factor in the success of their effective adoption as support elements for the independent living of people with functional limitations. In the framework of a user centred approach, human factors should be considered at every stage of the telecare service lifecycle, namely: research, development, manufacturing and service deployment. Furthermore, the integration of specific phases of methodological evaluation of human factors will be essential to detect and solve potential deficiencies, increasing the quality of service that will be perceived by the clients of these services.

In addition, as telecare services can be developed for use outside as well as inside the home, human factors aspects relating to the specifics of mobile environments and equipment and service use need to be considered.

2. Material and methods

2.1 Methodology of the work

The overall methodology used to produce the ETSI Guidelines (EG) consists of three main components: The approach and structure of the document itself; the bibliographical review of related scientific, technological or standardisation knowledge; and the procedures followed by the team to identify and document the guidelines.

Within telecare human factors is a complex field. Consequently, the design of the structure for this standardisation document has required a substantial amount of effort within the project work plan. The results of this major task are described in detail within the next section of this paper.

A number of works with ideas that are applicable to improve user experience in Telecare have been published, both in printed and electronic forms. Furthermore, a significant number of these ideas belong to different knowledge areas. Therefore, several sources are being analysed for each human factor issue in Telecare, in order to produce a relevant, centralised reference for targeted readers. The most relevant sources will be specifically mentioned within the final version of the EG.

The team producing the guidelines is following the normal procedures used in ETSI Specialist Task Force (STF) activities, consisting partly of e-collaboration and partly of common sessions at ETSI's premises in Sophia Antipolis, France.

2.2 Approach and structure

Several approaches were considered and analysed for structuring the guidelines, based on either the development and deployment lifecycle of a telecare system, or the main human factors issues associated with developing and deploying a telecare system. In addition several hybrid approaches were considered which incorporated the benefits of both the lifecycle and human factors approaches. A major consideration in choosing the approach was to keep the duplication of guidelines in different sections to a minimum.

2.2.1 Human Factors (HF) approach

This approach would require the guide to be divided into five sections with each section addressing a major HF issue:

1. Interaction with equipment;
2. Operational issues;
3. Reliability;
4. Privacy;
5. Service related issues.

The advantage of this approach is that the human factors issues are given a high visibility within the document, which is important given the fact that the guide is aimed at addressing human factors issues related to the user experience of Telecare services.

2.2.2 Lifecycle (LC) approach

This approach would require the guide to be divided into four sections with each section addressing a specific part of the telecare service lifecycle:

1. Research;
2. Development;
3. Manufacturing;
4. Service deployment.

The advantage with this approach is that specific stakeholder groups would be able to easily locate those guidelines most relevant to them.

2.2.3 Hybrid HF/LC approach

This approach would require the guide to be divided into the four sections listed within LC approach above. Each section would then contain subsections focusing on the human factors issues described in the HF section. Stakeholders would be able to easily locate the guidelines most relevant to them, whilst the human factors issues would still be given a high profile. Alternatively the human factor issues could be promoted to become the higher level sections with the lifecycle stages as subsections.

2.2.4 The chosen approach

The approach that was chosen was based on the hybrid HF/LC approach but with some further modifications: The HF issues were expanded to create more specific headings, the first five of which can be grouped under the theme of 'trust', with the remainder grouped under the theme of 'usability'.

The expanded list of HF issues used as section headings:

1. Trust:
    - Confidentiality and privacy;
    - Legal aspects;
    - Availability and privacy;
    - Integrity;
    - Safety.

2. Usability:
    - Installation, setup, configuration and maintenance;
    - User interaction;
    - Localisations and customisation;
    - Service and system aspects;
    - Organisational aspects;
    - User education;
    - Interoperability;
    - Development process and testing.

Each of the above sections was subdivided into the following three subsections:

- Generic guidelines;
- Research, design & development related guidelines;
- Service provision related guidelines.

An important part of each HF section is the introduction which determines the degree of focus within that section. Our approach was to use the introduction as a short discussion of the issue addressed and from that identify the main, high-level, generic guidelines which must be considered by all stakeholders. This approach has proven to be useful and practical in helping us to begin identifying the generic and specific guidelines.

3. Preliminary results

3.1 Common user experience and usability testing guidelines

In this clause, the ETSI Guide will provide common user experience design principles and meta-guidelines. These are intended to be generic to the widest possible extent and applicable to a large variety of user interface design, user interaction and user experience areas in ICT.

By applying these common user experience principles across the elements and lifecycles of telecare services, combined with a user-centred development process, the human factors of telecare services will be well addressed.

In addition, the specific design guidelines provided in the following clauses should be applied, in order to optimize the user experience of telecare services and its elements.

3.2 Privacy and confidentiality

Privacy and confidentiality are important factors which help create a sense of trust between the client and the telecare service provider. Other factors that affect trust are: ethics; legal aspects; availability & reliability; integrity and safety, all of which are covered in other parts of this document. We believe that developers and service providers can create trust in their systems by following the guidelines within this section.

Privacy can be defined as the ability of an individual or group to keep their lives and personal affairs out of public view, or to control the flow of information about themselves. Within the telecare domain privacy can be achieved through the service provider adhering to a set of protocols agreed beforehand with the client and/or client's representatives. These protocols describe who should have access to the client's information and how detailed that information should be. The protocols should also take into account the service provider's duty of confidentiality towards their client. In summary we can describe privacy as the right of the client and confidentiality as the duty of service provider.

Within the information security domain, Confidentiality has a more precise definition: "ensuring that information is accessible only to those authorized to have access" (International Organization for Standardization, ISO). It is often described as one of the cornerstones of Information security - the others being Integrity and Availability. Guidelines which relate to this more specific definition of confidentiality will also be covered within this section.

The following generic guidelines summarise the guidelines for privacy and confidentiality:

- (PRV-G) 1. Stakeholders should be aware that clients have a right to control access to and disclosure of their own health information by giving withholding or withdrawing consent. Telecare systems should be designed and operated to protect this right.

- (PRV-G) 2. Stakeholders should be aware that if a client gives consent to the service provider for their health information to be disclosed, or that non-consensual disclosure is approved, the telecare service provider then has a duty of confidentiality towards that client. Telecare systems should be designed and operated such that the service provider is able to carry out this duty.

3.3 Ethics

Within the social care domain ethics can be considered in terms of two basic principles: the universal duty of good care i.e. the use of expertise to protect the well-being of clients, and the universal duty to respect the autonomy of the client. When assessing the requirements of their clients, health and care professionals may often find these two principles create a dilemma, especially in situations where the client is suffering from a mild cognitive impairment or early signs of dementia. The purpose of these guidelines is to provide advice to all stakeholders involved in the telecare lifecycle helping them address these ethical principles whilst also attempting, where ever possible, to avoid provoking ethical dilemmas.

Health and care professionals should consider the ethics of a using telecare on a case-by-case basis. In some situations telecare might be considered unethical, whilst in others it may not, and if quality of life is affected it can sometimes be unethical not to use the technology. In helping make the right choice it is recommended that health and care professionals continually ask themselves the following questions:

- Is the client capable of consenting to the technology?
- Who benefits from the technology?
- Is the technology being used instead of human input?

The two basic principles of ethics are represented individually within the generic guidelines section below. These generic guidelines clearly state the potentially conflicting ethical requirements which all stakeholders need to keep in mind, see [4] and [5]:

- (ETH-G) 1. Telecare systems should protect the well-being of the client in terms of their physical health, mental health and social interaction, with the aim of supporting or improving the independence of the client.
- (ETH-G) 2. Telecare systems should respect the autonomy of the client: the decisions, dignity, integrity and preferences of the client.

3.4 Legal aspects

The guidelines described within this section are based upon the legal requirements associated with providing health and social care to individuals. As with all of the guidelines within this document the wording has been chosen to convey a sense of good advice rather than compulsory instructions. However, stakeholders should bear in mind that because these guidelines are based on current legislation it may be unwise to consider them as optional.
The legal aspects considered here are: laws, liability and contracts. Most of the laws relating specifically to privacy, ethics and safety are considered within other sections.

The following generic guidelines summarise the guidelines for legal aspects:

- (LEG-G) 1. Stakeholders should respect European and national laws regarding the development and provision of telecare services and the equipment used to support those services.

- (LEG-G) 2. Stakeholders should understand the liabilities associated with developing or providing telecare services and implement procedures to protect themselves and their clients.
- (LEG-G) 3. Stakeholders should ensure that contracts exist between themselves at every stage of the telecare lifecycle and that these contracts clearly state the contractual undertakings.

3.5 Availability and reliability

Availability describes the degree to which a system can be expected to function when it is required to be set into operation. The reliability of a system is its ability to continue to function, both in routine use and in case of unexpected, adverse circumstances. The guidelines treat these two factors in more detail, with a focus on those aspects that relate to human factors.

Systems for personal health should ideally have a high degree of availability and reliability. However, there can be high costs associated with implementing a secure system. These costs should be weighed against the risks associated with system malfunctioning or non-availability. As an example, a heart pacemaker must operate very reliably, whereas the failure of a body-worn blood-pressure sensor may have no immediate adverse effects (but should be signalled). Risk assessment should therefore be an integral part of the work to make a system secure, as will also be reflected in the guidelines.

The following generic guidelines summarize the guidelines for availability and reliability:

- (AVA-G) 1. Telecare systems should be designed and operated such that the availability of the service is appropriate to the needs of the end user, and provides an acceptable user experience.
- (AVA-G) 2. Telecare systems should be designed and operated such that the reliability of the service is appropriate to the needs of the end user, and provides an acceptable user experience.

3.6 Integrity

Integrity is related to the confidence that can be had that data is not tampered with or accidentally changed during storage, transfer or retrieval. This is again related to the following properties: Data consistency, repeatability of measurements and security of data against errors or attacks. The integrity guidelines are applicable not only to the technical parts of the system, but also to its human counterparts insofar as they have an influence on system behaviour and data.

The following generic guidelines summarize the guidelines on integrity:

- (INT-G) 1. Telecare systems should be designed and operated such that data and information within the system is identically maintained during transfer.

- (INT-G) 2. Telecare systems should be designed and operated such that data and information within then system is identically maintained during storage.

- (INT-G) 3. Telecare systems should be designed and operated such that data and information within the system is identically maintained during retrieval.

3.7 Safety

The general concept of safety is very broad, covering security, reliability, confidentiality, privacy etc. In the guidelines document the term is restricted to mean “non-harmfulness”. The guidelines are directed towards making the equipment safe both in routine use (by minimizing the chances of user errors or minimizing their adverse consequences) and during emergency situations (by helping the user to make the right decisions and take the right corrective actions).

The following generic guidelines summarize the guidelines on safety:

- (SAF-G) 1. Telecare systems should be designed and operated such that the probability of a user introducing an error that may have adverse consequences is minimized.
- (SAF-G) 2. Telecare systems should be designed and operated such that if any errors are introduced by the user the adverse effects of those errors are kept to a minimum.

3.8 Installation, setup, configuration and maintenance

To be able to access Telecare services, users should ideally not have to be exposed to any installation, setup, configuration and maintenance procedures. These processes should be addressed by service providers through either manual preconfiguration or automatic procedures, which should remain as transparent as possible, demanding minimal interaction from the user.

3.9 User interaction

This HF issue is mainly concerned with what the different ‘end users’ experiences are when interacting with physical equipment and interfaces associated with a telecare service. We distinguish different end-users as: clients receiving the care, carers who provide care to the client and coordination agents who coordinate the delivery of care through the telecare service. The degree of interaction the end user has with the system will depend partly on their role (i.e. whether they are a client, carer or coordinator) and partly on the nature of the telecare system (i.e. whether it is designed just to monitor the client, to provide information/assistance to the client, or both).

Accessibility and usability will be considered within the Interaction category. These factors will be applicable to users who will directly interact with the Telecare equipment, namely clients and carers. It must be stressed that users falling in any of these stakeholder categories may face problems to use Telecare equipment, because of a limited ICT proficiency or limited physical, cognitive or sensory abilities.

The following generic guidelines summarise the guidelines for user interaction aspects:

- (ITR-G) 1. Users must be able to perceive the information presented by the Telecare equipment and services. This includes static and dynamic information used for indicating the existence and location of telecare equipment and its controls, feedback from operations, the status of controls and the progress of system's actions. Alarms must be effectively notified to users. The output of the Telecare equipment must be multimodal, i.e. alternative and redundant means of presenting information should be used.

- (ITR-G) 2. Users must be able to operate the Telecare equipment efficiently. This includes being able to use all system functions with comfort, avoiding accidental activation of functions, receiving help to recover from errors, and optimizing the consumption of resources (time, energy, etc.). All users must have equivalent security and privacy, and the use of the system must not cause unnecessary health risk. Users must be able to easily notify alarm situations and be informed on what to expect. The input of the Telecare equipment must be multimodal, i.e. alternative and redundant means of introducing information should be used.
- (ITR-G) 3. Telecare operation must be understandable by users. Users must be able to orient themselves to products, to understand how to use the product, including discovery and activation of any access features needed, and to understand the output or displayed material, even after they perceive it accurately.
- (ITR-G) 4. Assistive technologies must be usable in conjunction with Telecare equipment. Users must be able to use the Telecare equipment either directly or by means of assistive technologies.

3.10 Localization and customization

3.10.1 Localization

Localization refers to the provision of product and user-guide variants for different markets, taking into account market specific, local linguistic and cultural difference. In certain countries, the localization of products is required by regulation. In addition, a reasonable degree of localization is recommended, as users expect to be informed about their products in their own, native or other preferred language.

A main challenge related to localizing user guides [6] is that as user guides are being completed fairly late in the development process, the localization efforts of user guides comes after completion of master draft, i.e. at a very late stage. Since all last-minute changes to the master also have to be made to all language variants, correct and complete language variants are only available in later editions.

3.10.2 Translation management and validation

Most ICT products are produced for a global market and are be translated into many languages. As English is the most frequently used foreign language and it is usually easy to find translators who work with translations from English into their native language, the master text is written in English by most producers. The consequence is that many technical communicators do not write in their own first language (even though it is recommended to use technical communicators who write in their own native language). This requires an extra effort to deliver good master texts. It is therefore recommended to have a well structured workflow, with an editor who works with standardization of the language and proofreading and to have close contact with the translators (or translation firm). An important step is to provide a style guide for the technical communicators.

3.11 Service and system aspects

This part of the ETSI Guide will probably become integrated with other areas. According to the current plans, it is intended to address issues relating to the maintenance of telecare equipment and services, applicable throughout the entire product lifecycle.

3.12 Organizational aspects

This section will address the existing procedures for the handling of care service provisioning-not imposing telecare solutions, but offering them as an alternative to improve the quality of life and care at a maintained or reduced cost.

3.13 User education

Users must be able to understand and learn how to efficiently use their telecare services. The present clause will provide a set of guidelines on how user instructions for telecare services ought to be provided, taking into account the requirement and abilities of different user groups (e.g. young, older, disabled and less literate users) and the possibilities offered by different media. The guidelines will have a practical focus on the most common difficulties and problems faced by telecare service users.

3.14 Interoperability

Connectivity and interoperability between telecare equipment, services and the Internet offer considerable potentials for improving the quality of care services, if compatible and accessible to all users. This section will provide guidelines addressing these areas.

3.15 Development process and testing

This section will provide guidelines applicable to usability testing of telecare equipment and services and possibly, on the deployment of user-centred development methodologies.

4. Discussion and conclusions

Telecare equipment is too often conceived and designed with a purely technical approach, resulting in equipment that is difficult to use for non-specialists. End users may not necessarily be familiar with computers or other technologies, as well as having physical or mental impairments that render interaction with technical equipment difficult. Telecare services should therefore be designed and deployed with these restrictions in mind, and human factors should be taken into account to the largest possible extent during the whole process from service conception, research, design and development, to installation and deployment. ETSI has, directly and through its members, extensive and detailed know-how and experience in human factors applied to telecommunications and ICT, an experience that is drawn upon in the work reported here and worth applying.

It is not obvious how to structure the human factors guidelines so that they are optimally usable by the stakeholders involved. We have decided to structure the guide first according to the user's point-of-view e.g. confidentiality and privacy, ethics, user interaction, etc, as reflected in the chapter headings of the current paper. The second dimension is the product life-cycle, starting with research and ending with installation and service provisioning. We also considered structuring the guidelines according to the stakeholders, but soon found that the many of the guidelines would be relevant to several stakeholders, leading to unnecessary duplication.

Although Telecare services are becoming more common, they are still not widespread. It is probable that many individuals in need of care could profit from telecare services to achieve more independent living, and that society at large would at the same time see a reduction in healthcare costs and an increased level of perceived quality. For this to happen, telecare equipment and services must be made more acceptable for the intended user groups and more flexible across technology platforms, country borders and commercial agreements. We believe that if the developers and suppliers of telecare equipment adhere to the guidelines set forth in our guidelines document, the services will be more easily accepted and used by the users, thereby contributing to telecare becoming more common.

In conclusion, the guidelines for human factors in telecare systems, currently (Sep. 2006) in development and summarized here will be useful as a checklist by researchers, designers, developers, suppliers and telecare service providers, to ensure that telecare systems are easy and safe to use and can be trusted in terms of confidentiality, security and reliability, thereby being more readily accepted by the final users.
Input and comments to our work is welcome and will be taken into consideration, see http://portal.etsi.org/stfs/STF_HomePages/STF299/STF299.asp (also including an activity time plan, public workshop details and the latest draft; it is also available through the more easy-to-remember http://stf299.org).

6. References

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All ETSI publications are available free of charge through www.etsi.org. Those referred to in the current paper can most easily found through http://stf299.org