CONFIDENCE STAND-ALONE SW SYSTEMS

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ABSTRACT

CONFIDENCE - Ubiquitous Care System to Support Independent Living - is one of the most interesting FP7 projects for The department of intelligent systems at JSI. In this paper we present WP3, the major SW component of the system that is also implemented as two stand-alone versions of the system. In this paper, the two systems are presented from the user viewpoint based on five manuals.

1 INTRODUCTION

The population in the developed countries and particularly in Europe is aging due to the increase in life expectancy and decrease in birth rate. As a consequence of this process, the number of elderly will exceed the society's capacity for taking care of them. Therefore, technical solutions are being sought by the EU other countries to ensure that the elderly can live longer independently with minimal support of the working-age population. Many of these efforts belong to the area of ambient assisted living (AAL), whose objective is to make daily life easier and safer by placing unobtrusive smart devices and services into the environment. This is also the goal of the European FP7 project CONFIDENCE – Ubiquitous Care System to Support Independent Living FP7-ICT-214986 [1].

The CONFIDENCE system will unobtrusively monitor the user in order to detect health problems, such as falls, unusual behavior and some diseases. Literature suggests that the fear of falling or being left unattended in case of trouble can lead the elderly to the refusal of mobility, isolation, decline in the ability to perform daily activities and eventually admission to institution care. The target group are the elderly aged over 65 who live on their own, and do not have serious mobility problems. With the CONFIDENCE system, such people will gain confidence and security and will have a better quality of life and a longer active participation in the society. The beneficiaries will be not only the elderly, but also their families and caregivers, since the burden on them will be reduced. In practical terms, the goal of the project is to extend the independent life of the elderly by several years, which will also save the cost of institutional care.

The system is based on tags that are attached to the user's body and sensors in the top corners of the room [2,3]. The system learns and adapts to each particular user [5,6,7].

Here we present WP3 of the EU FP7 project Confidence [1]. The main objectives of this work package are the development of SW subsystems that will

a) reconstruct the user's body in the environment
b) interpret the body posture within the environment
c) ring an alarm when hazardous situations are detected
d) issue a warning when unusual behavior is detected.

The subsystems originally have to be integrated into the complete system that must be able to gather user position and acceleration from a real-time position and acceleration systems and has to send alarm messages about the detected hazardous situations to an independent portable device. This device is used to communicate with the user and is able to decide whether a hospital or a specialized care-giving institution has to be noticed.

The described system has already been developed. It uses the Ubisense, a real-time localization system [2], and an accelerometer system developed at the Fraunhofer Society [3] in order to get the positions and accelerations of the user from dedicated body tags and sends the alarm messages to a simulated portable device. The official version of the system is already being intensively tested and presented in public.

In addition to the official Confidence version, two additional stand-alone versions were produced:

a) technical version
b) simple version.

Both share practically the same algorithms, and mainly differ in the user communication – the technical version provides information about the system at a level, appropriate for technically educated while the simple version provides only simple communication. Both versions also need only the PC that is already part of the Confidence system, i.e. the screen and the keyboard. Both versions also do not call or communicate in any other way than through the PC.

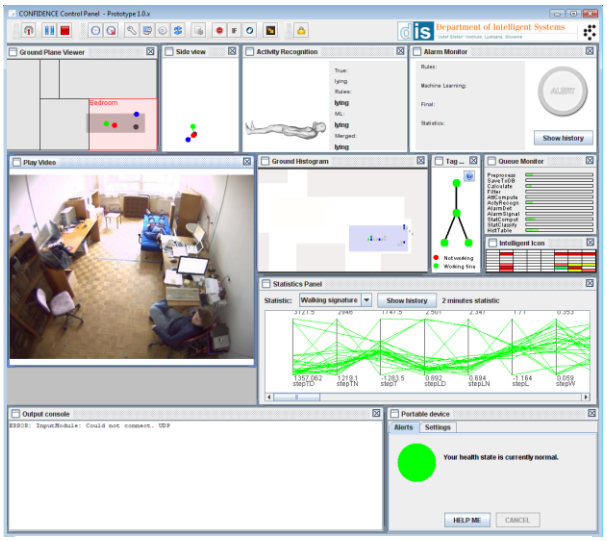

Figure 1: *The technical screen*

2 TECHNICAL VERSION

All three versions of the system: the official one, the technical and the simple one use the same algorithms, although some parameters are usually set differently.

The presented system recognizes hazardous situations from user's movement and reports them to the user/caregiver. In order to do that, several modules have been developed and integrated in the final system. In the following subsections we firstly present the architecture of the whole system. Secondly, we present each module/method that has been developed. Besides, we present the interface that was developed as an extension of the portable device, namely control panel, for the advanced users, system developers and for presentation purposes.

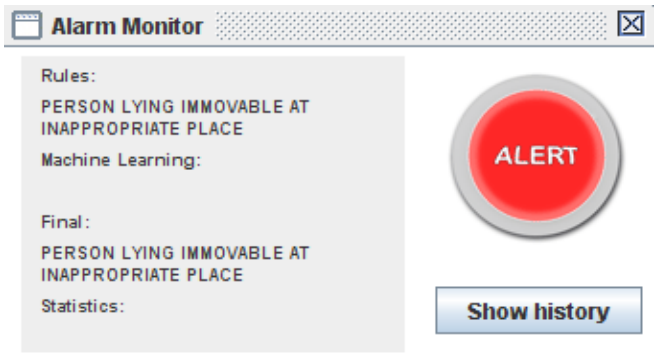

Figure 2: *Alarm monitor showing an alarm*

The system has been developed as a set of independent modules/threads. They are organized as a pipeline where a module gathers the data from the previous module(s), processes them and sends them to the next module(s) in the pipeline. The main modules are the reconstruction modules (consisting of posture modules) and interpretation modules (consisting of interpretation and prevention modules). In addition, the communication modules were also implemented that communicate with a localization system and portable device, and that show the system status in details on the computer screen.

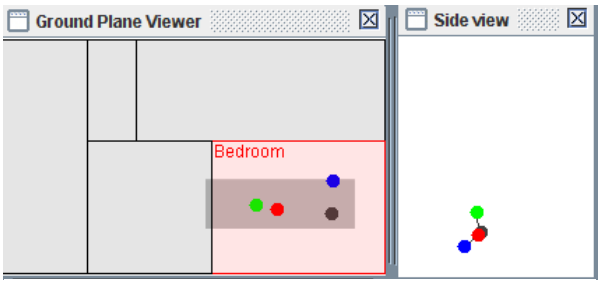

Figure 3: *Ground plane viewer and side view*

In this paper we present the system through communication with the user, mostly through the screen, presented in Figure 1. This screen can be observed in the three versions of the system through remote access, but on the physical PC screen only in the technical version of the system.

The screen consists of the top menu bar and of several windows. In the middle left is the video view of the room where the HW is installed. In the top right is the alarm window as shown in Figure 2. It starts blinking in red and is accompanied by sound alarm if the system observes an alarm. In addition, the bottom right window also reports an alarm since this is a simulation of the portable device. An alarm can be refuted or cancelled by clicking the ignore button on the portable device simulator.

Left alone, the alarm goes on until refuted or the alarm situation ends (e.g. user walking again). The list of previous alarms is stored in the left down windows and can be reviewed and thus reanalyzed.

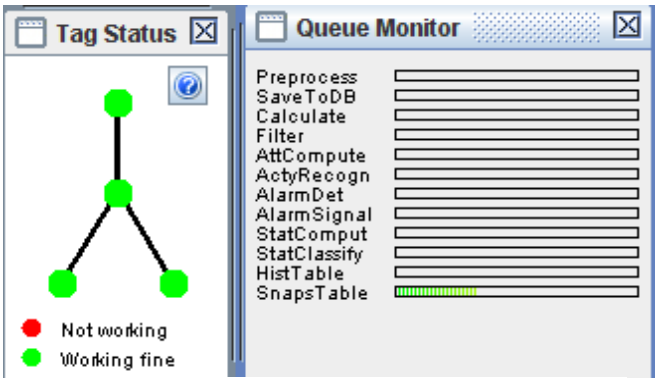

Figure 4: *Tag status and queue monitor*

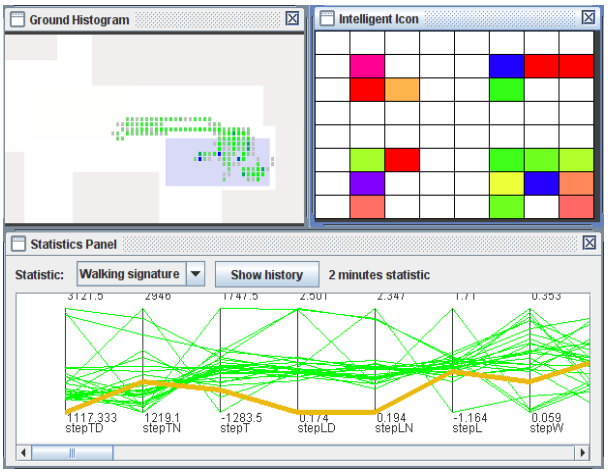

Figure5: *A warning showed in control panel with the yellow line*

The two windows at the top left are presented in Figure 3. One represents the top view of the room, divided into subspaces as set during the initialization, and the position of the bed, in grey. The four tags attached to the body are presented by four colors: Green for neck, red for belt and the two remaining for ankles. The right window in Figure 3 represents the side view of the user. It should be noted that there is currently a time delay of a couple of seconds between the video and the position in Figure 3. The alarm usually triggers 10-20s after lying at an undesired position. At the bed, only macro alarms are triggered.

The next important window is the right one middle as presented in Figure 4. It shows the status of the four legs. If a tag is not attach or not functioning, e.g. it has fallen off, the battery is empty etc., the system reports this and asks for user action (see user manual). Among possibilities is also having only three tags, but the one at the neck is obligatory. In addition to the tag status, the queue status of the system processes is reported.

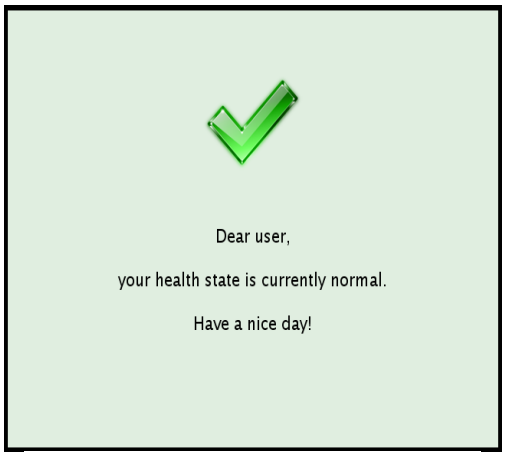

Figure 6: *Normal*

Figure 7: *Alarm*

Figure 5, lower window, shows an example of a warning because of unusual behavior. This screen usually consists of green lines denoting normal movement. An orange line shows unusual movement. Each horizontal line corresponds to a particular attribute, e.g. speed of walk or step length. When averaged over several minutes these attributes resemble normal movement or not – in that case the orange line is displayed. It enables visualizing what was the cause for warning.

The top two windows show macro-level movement. The left top screen shows density of user positions in the room. The top right screen shown the graphical representation of the posture and position of the user. Both top screens by themselves enable visualization of user behavior that enables observing deviances in behavior thus enabling the care personnel to propose appropriate modifications and care actions.

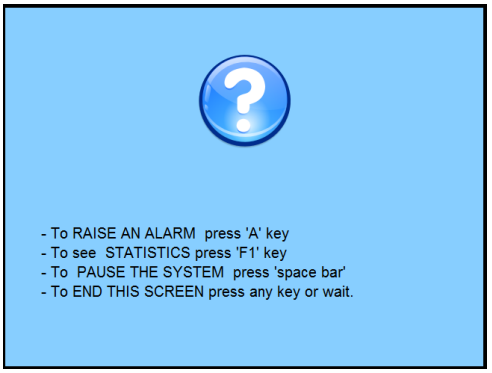

Figure 8: *Help screen*

3 SIMPLE VERSION

There are six simplified screens for elderly or non-technical users, presented in Figures 6 to 10. They report: normal status (6), an alarm (7), and a help screen (8). The alarm can be raised by pressing the A key and cancelled by pressing any key. The help screen is shown if any key but A, F1 or space bar is pressed.

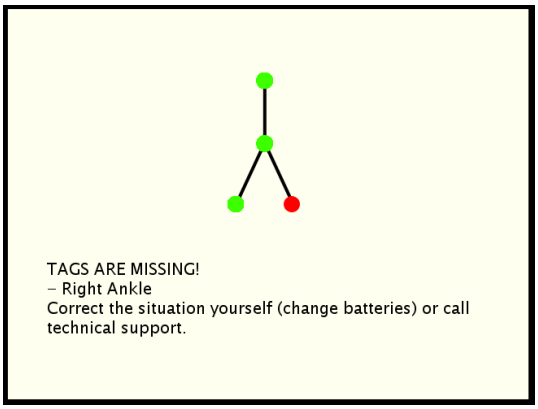

Figure 9: *Tag missing*

Figures 9, 10 and 11 show screens in cases when one tag is missing, when the system was paused (the user wants to freeze the system because of any reasons, e.g. going to a toilet), and the report in case of unusual behavior. These screens are so simple and understandable that they do not demand technical knowledge and as such appropriate for any elderly.

4 MANUALS

Several manuals have been produced describing the presented system and its functionalities. The first one it the System manual that describes the whole system and all of its modules in detail. In addition, it describes the installation of the system and the tag placement.

The second manual is the Recording instructions. It presents how a user can record the data for testing purposes step-by-step. In addition, the preferred scenarios for testing are also described.

The third and forth manual are the User manuals that describe different versions of the system, e.g. the portable device and the possible interaction with it. They show all the possible screens and messages and the keys that can be used to manipulate with the portable device.

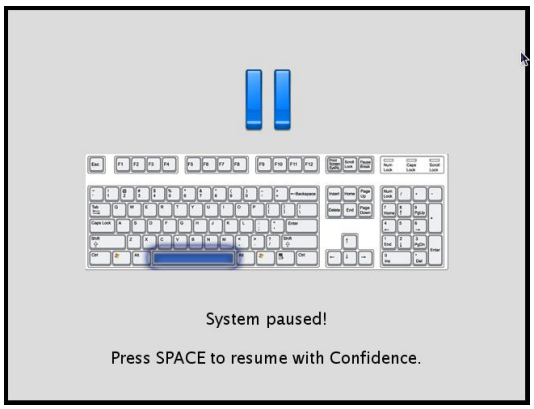

Figure 10: *System paused*

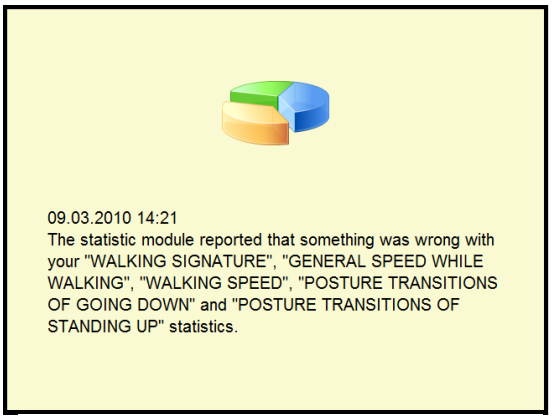

Figure 11: *Unusual behavior*

The last manual is the Init wizard. It describes the required initialization of the system when it is used for the first time. It also describes which actions have to be recorded, possible errors during the initialization, and which data must be inserted by the user.

5 CONCLUSION AND FUTURE WORK

This paper presents the two stand-alone versions of the Confidence system as a result of the EU FP7 project Confidence. It describes the screens as the most important part of the user communication. The tests show that the system is reliable and is ready to be tested in the real world.

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