Better diabetes compensation in OLDES project

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EU project OLDES aims at developing a very low cost and easy to use entertainment and health care platform designed to ease the life of older people in their homes. The platform is based on a PC corresponding to Negroponte's paradigm of a € 100 device. OLDES combines user entertainment services (through easy-to-access thematic interactive channels and special interest forums supported by animators) and health care facilities.

1 Introduction

The main goal of Prague's pilot is to achieve better compensation of diabetes in hard-to-compensate patients by flexible individualized approach to insulin dose adjustment. Diabetic patients are frequently affected by diseases associated with diabetes (eg. arterial hypertension and other disorders of cardiovascular system) and use much concomitant medication which could be cause of many complications (deviations of blood pressure, heart rate, etc.).

2 Methods

The system is developed system for monitoring of physiological functions and self-diagnostics of diabetes in form of advisory system for a patient who is "feeling bad"– this situation is often caused by changes of arterial blood pressure (bad compensated hypertension, hypotension caused by high dose of antihypertensives).

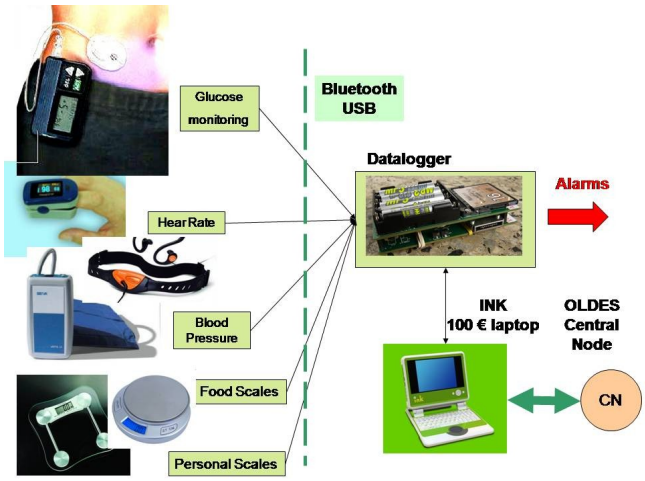


Fig 1. Main setup of diabetes pilot system

The following parameters are monitored: continuous glucose measurement, blood pressure, heart rate, weight of patients and weight of patients' daily food. – see Fig. 1. The data are

gathered using a ***datalogger device***. After the data are transmitted via ***low cost INK computer*** to the OLDES central, the physician can make recommendations of further procedures (acute intervention, event. modification of chronic medication at home conditions without necessity of stay in the hospital, etc.). Therefore is a very important to develop and test a suitable ***user interface*** between patient and OLDES system [1]. In order to reduce system costs, open source software is used as Linux in case of operational system.

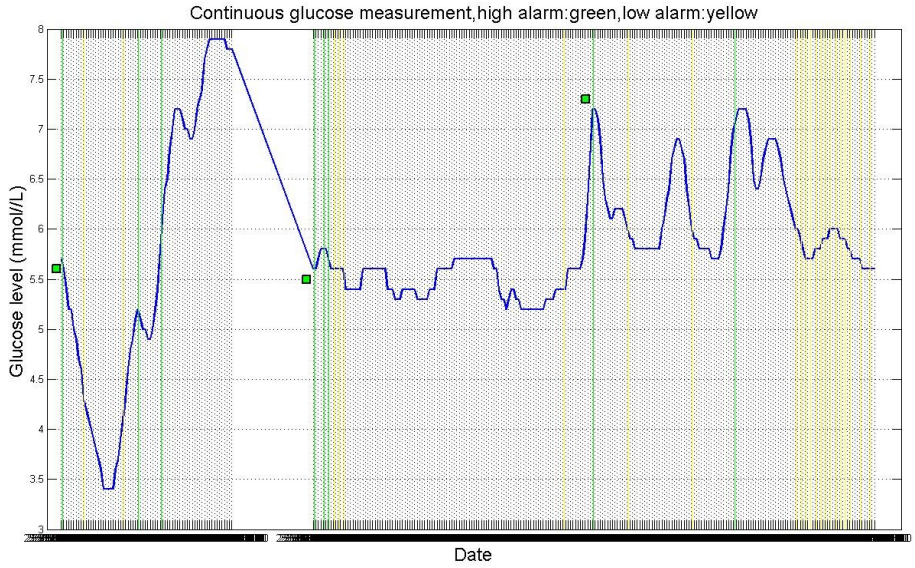


Fig 2. Example of continuous glucose measurement. Calibrations by standard glucometer are marked by rectangles. High (green) and low (yellow) alarms are shown as vertical lines. 3 hours sensor drop-out can be noted. The glucose is recorded each 5 minutes.

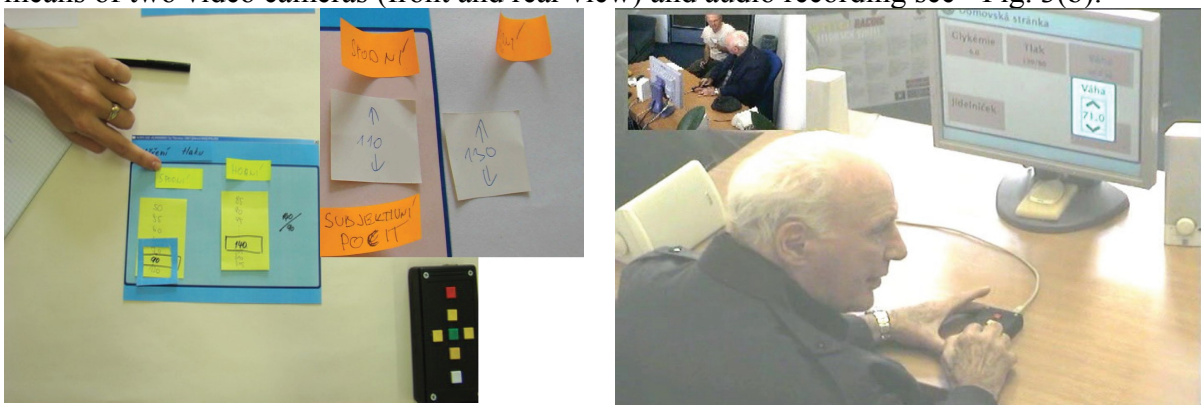
3 Results

Patients are monitored by the existing commercial Medtronic system [2], which ensures continuous or intermittent blood glucose measurements. An example of 24-hour continuous glucose measurement is depicted in Fig 2. Calibration must be performed twice daily at least. The calibration is performed using bluetooth glucometer Lifescane One Touch Ultra. Furthermore, blood pressure and weight are measured using bluetooth equipment from A&D Medical (blood pressure monitor UA-767PBT and scale UC-321PBT).

Another part of therapy is based on diabetic diet with restricted amount of sacharides and movement activities. To keep this relatively strict regimen is very difficult and there is not much information among diabetic population how to take the diet, prepare relatively attractive dishes, patients have no motivation for exercising etc. These patients use ***interactive scale*** connected to a computer database of sacharides amount in frequent foodstuff. Automatic computation of total daily consumption will simplify patient's control of sacharides intake. The resulting information should be exported to a dietitian who can suggest recommendations for modification of patient's diet. Furthermore, input from complementary device, namely ***personal scale*** for measuring the patient's weight is planned to be included among the monitored data. This will support long-period weigh management.

It is crucial to propose the system according to user needs following user-centered design paradigm. We have designed the OLDES personal health care system interface by iterating paper and software prototyping design. The user was accompanied by a moderator who was

guiding him during the usability test. The moderator tried to give the clues as little as possible and to push the user ahead if the user was apparently lost or confused. The user designed himself the user interface according to his point of view. Several mock-ups have been prepared in advance as main menu and sub-menus, icons, titles of the menus. If user suggested any issue and the prepared components were not ready than colored-papers were used substituting the issues as menus, the value of glycemia or picture- see Fig. 3(a). During the software prototype test sessions in the usability lab the user was seated in the testing room along with the moderator. All the user's actions were monitored in the observer room by means of two video cameras (front and rear view) and audio recording see - Fig. 3(b).



(a) *(b)*

Fig 3. *(a) Paper prototyping: e*ntering systolic and diastolic blood pressure: half of seniors preferred to select correct value from the list of possible numbers using Up-arrow and Down-arrow on the remote controller. Another half preferred to select the value step by step not seeing at the same time all possible values as can be seen in the upper sub-figure. *(b) Software prototyping: e*xample of software prototyping set-up. The senior was confused due to misinterpretation of some buttons in the remote controller during the test. He approached the moderator in seeking an advice. However, the moderator tried to intervene as little as possible (left upper outlet figure).

4 Discussion

Monitoring of physiological parameters and controlling food intake including patient's weight management could contribute to better compensation of diabetes, especially in connection with glucose continuous monitoring system. Physician or nutrition therapeutist should have better conditions for effective management of patient’s therapy, especially in case of complicated patient.

Regarding user acceptance, even inexperienced computer users were able to accomplish the set of defined tasks in 30 minutes period. The experienced users spent 10-15 minutes to accomplish defined task. All of them agreed that the OLDES system is user friendly.

5 Conclusions

The diabetes pilot study is intended to increase quality of life and independence of elderly diabetics, reduce the complication rate and need for hospitalisation. A pilot project will be lunch to evaluate the OLDES concept within this year. The user-centered design approach allows the user to be involved in testing the design ideas when performing some well defined tasks in a usability laboratory. It contributes significantly to risk reduction of new technology rejection by the target elderly group.

Acknowledgment

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