StrokeBack

Telemedicine System Empowering Stroke Patients to Fight Back

StrokeBack targets at developing a telemedicine system which supports ambulant rehabilitation at home for stroke patients with minimal human intervention. It will empower the patient to do more for fast recovery than today while providing clinical experts with data not available today. By that it leads also to a better understanding of the stroke recovery process, higher recovery speed and thus, to reduced healthcare cost while improving patients' quality of life.

Objectives of the project

Stroke is hitting about 2 million people per year in Europe. Affected persons lose certain physical and cognitive abilities at least for a certain time period. More than one third of these patients, i.e., more than 670,000 people, return to their home with some level of disability leading to a significant reduction of quality of life. The prevalence of ageing in the European societies will further lead to an increased number of people suffering from stroke in the future. Experts predicted an increase of more than 2.5 times within the next decades.

In addition, stroke is a disease with very high socio-economic impact. In average the healthcare expenditure cost for strokes across different countries in Europe and USA is 3% of their entire healthcare expenditure. Analysis showed that costs of long-term care have increased from 13% to 49% of overall costs in average in recent years. Both effects will put an enormous pressure on the healthcare systems in terms of cost and quality of care. Therefore there is an urgent need for devising an effective long-term care and rehabilitation strategy for Stroke patients, which will involve the patients actively in the process while minimising costly human intervention.

The goal of StrokeBack is the development of a telemedicine system which supports ambulant rehabilitation at home for stroke patients. StrokeBack aims to animate stroke patients to do more for fast recovery themselves, with minimal human intervention. Our system provides just technical assistance empowering stroke patients to reach their own rehabilitation goals with adequate means. Last but not least, the StrokeBack system provides detailed feedback about the rehabilitation progress to the patient and medical care staff as well.

From the medical view, it provides a unique chance to monitor the effects of various exercises in detail. This enables to document the effectiveness of single exercises when applied to different patients suffering from various impairments and hence, it provides stroke experts with high resolution data and knowledge not available today.

Key objectives

- Remote supervision of rehabilitation exercise (telehealth).
- Continuous monitoring of exercises impact, also in "normal" life situations.
- Integration of telemedicine rehabilitation and Personal Health Records for improved long-term evaluation of patient recovery.
- Feedback to health care professionals on the impact of rehabilitation exercises.

Project Description

The StrokeBack project intends to develop an automated remote rehabilitation system by blending advances of ICT and practical clinical knowledge that will empower the patients and their immediate carer for effective application of the rehabilitation protocol in home settings. StrokeBack will combine state-of-the-art monitoring devices forming a wireless Body Area Network that enables simultaneous measurement of multiple vital parameters and currently executed movements that are particularly of interest from a stroke rehabilitation point of view. The measured parameters will be fused using advanced feature extraction and classification algorithms processed on-body, which will denote the accuracy of the executed exercise. StrokeBack aims to monitor and record patients' activities enabling them to regularly, maybe daily, exercise independently from the guidance of the physical therapist. The training parameters along with vital data will be stored in a patient health record to which the responsible clinicians and therapists have access so that they can dynamically update the rehabilitation program.

By employing manual intervention only when actually necessary, it will eliminate costly human intervention and thereby significantly reduce the associated costs. The increased rehabilitation speed as well as the fact that the rehabilitation training can be done at home directly improves quality of life of patients.

Practical Example / Scenario

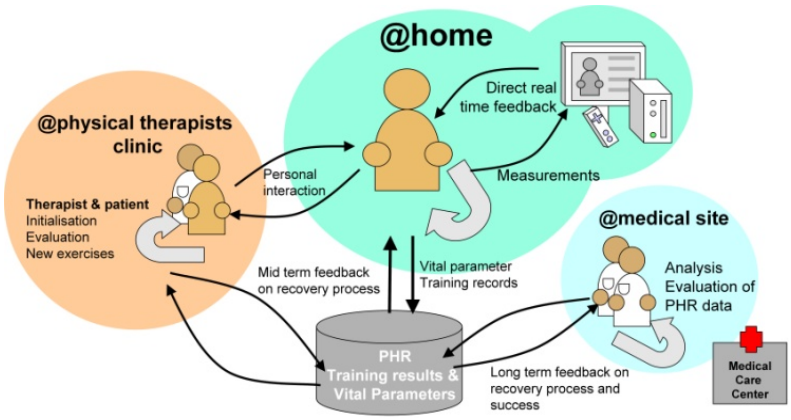
StrokeBack is developed in a way to start the use of the system in very early stage of rehabilitation, i.e., physicians and therapists will introduce it to patients already in the stationary rehabilitation phase. The patients will be guided how to use the system and may co-determine also the rehabilitation goals and the means how to reach these. Having the initial rehabilitation plan and a set of exercises set up, the patient will take the StrokeBack system home.
As one possible application, the physical therapist has to look after the patient once a week only to exploit the level of rehabilitation, to analyse the results of last exercises based on recorded data and to take corrective action if necessary. Further, the physical therapist may show new exercises and configure a new exercise schedule. This can also be done remotely via the personal health record of the patient. By that, we intend to boost the rehabilitation process at home. Finally, it allows the physical therapists and the medical experts to get detailed insights into kind and number of exercises the patient executes during absence of the care persons.

Expected Results & Impacts

StrokeBack aims to already assist in early stage of rehabilitation enabling highly affected patients to profit from our proposed monitoring system as well. Our system is designed for ambulant use and to be adjustable to the abilities of the patient (a patient-centric approach). For example, it can be used by hemiplegic, paretic patients as well as wheelchair users, too. By that we intend to shorten the full time, stationary rehabilitation and treatment program and allow patients to be reintegrated into normal life as early as possible.

StrokeBack concept puts the patient at the centre of the rehabilitation process. It aims at exploiting the fact the patients feel better at home and that training is done more frequently when combined with attractive training environments. The figure below illustrates how we think the vision of such a patient centric approach can come true. First the patients will learn physical rehabilitation exercises from a therapist at the care centre or in a therapists' practice (left part of the figure). Then the patients will do the exercises at home (middle part of the figure) and the StrokeBack system will monitor their execution and provide real time feedback on whether the execution was correct or not.

In addition, it records the training results and vital parameters of the patient. These data will be analysed by medical experts (lower right part of the figure) for assessment of the patient recovery. Also the patient will get midterm feedback on her/his personal recovery process. In order to ensure proper guidance of the patient also the therapist will get information from the Personal Health Record (PHR) to assess the recovery process and decide whether other training sequences should be used, which are then introduced to the patient in the practice again.



To summarize, StrokeBack aims at:

- Motivating and empowering stroke patients in doing physical therapy at home
- Go beyond telesupervision by implementing autonomous assessment features ensuring correct execution of training sequences
- Allowing patients to exercise correctly and more often than physical therapists are available
- Monitoring the patients´ recovery process and evaluating the effect of selected training sequences
- A better understanding of the stroke recovery process
- Higher recovery speed
- Reduced healthcare cost
- **Improving patients' quality of life**

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- Research For Science, Art and Technology LTD (United Kingdom)
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KEYWORDS
Rehabilitation, Stroke, Telemedicine, Human computer interaction, Electronic health records, Wearable medical systems, Virtual reality, Mobile and wireless communications, Mobility of patients, Security and privacy

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