

Testing the first portable system for monitoring patients with Parkinson's disease

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The European project REMPARK.

Parkinson's disease is the second neurodegenerative disease in number of patients after Alzheimer's disease. The Technical Research Centre for Dependency Care and Autonomous Living (CETpD) of the Universitat Politècnica de Catalunya has developed a pioneering portable system for monitoring the motor status of Parkinson's disease patients in real time. The system also determines the status of patients while they are walking

or during their daily activities and acts when the person has gait problems such as slowing or freezing. This system is being developed within the European project REMPARK (Personal Health Device for the Remote and Autonomous Management of Parkinson's Disease), coordinated by the CETpD. The project's aim is to improve the quality of life of patients with Parkinson's disease.

In addition to the UPC, also participating in the project are the Parkinson's Disease Unit of the Hospital Quirón Teknon, Telefónica I+D, the European Parkinson's Disease Association and research centres and companies in Germany, Portugal, Italy, Israel, Ireland and Sweden.

REMPARK's overall objective is to accurately determine and quantify the symptoms of the disease associated with motor status and to monitor their progression. Due to fluctuations, patients do not have a steady motor status throughout the day, but in some cases undergo dramatic changes. It is almost impossible for patients to record this information accurately. Since the treatment of Parkinson's disease is symptomatic, detailed knowledge of the patients' motor status is crucial in order to optimise treatment and improve their quality of life. This information will allow patients to be monitored more effectively and allow doctors to personalise and tailor treatment to the specific needs of the patients. The REMPARK system aims to be non-invasive and highly effective.

This is the first time in Europe that work has been done with outpatient data on Parkinson's disease: the system has been tested with 50 patients at home rather than in the laboratory. A total of more than 50 volunteers from Spain, Italy, Ireland and Israel have participated in REMPARK.

The project ends on April 30. The preliminary results are good and pilot tests have compared the data of volunteers from the three countries. These results will be presented in a workshop on 21 April in Madrid, at which the contribution of the medical, social and economic benefits will

be assessed.

The application of REMPARK will increase the independence of patients; it will improve management of the disease and treatment and rehabilitation of patients, and will avoid hospital admissions due to falls or poor compliance with medication. If REMPARK is incorporated as a tool for diagnosis and monitoring of the disease, it will improve the healthcare system in Europe, provide higher quality and more personalised care for Parkinson's disease patients, and increase the sustainability of the public resources used.

The REMPARK project



The fundamental part of REMPARK is an inertial system attached to the

waist by a belt of biocompatible material, about the size of a [mobile phone](#). It is fitted with a set of sensors and a wireless transmission system to send the measurement and treatment data. This system is capable of detecting symptomatological parameters of the disease and determining the status of the patient at all times (on-off fluctuations, freezing, and other disorders of Parkinson's disease).

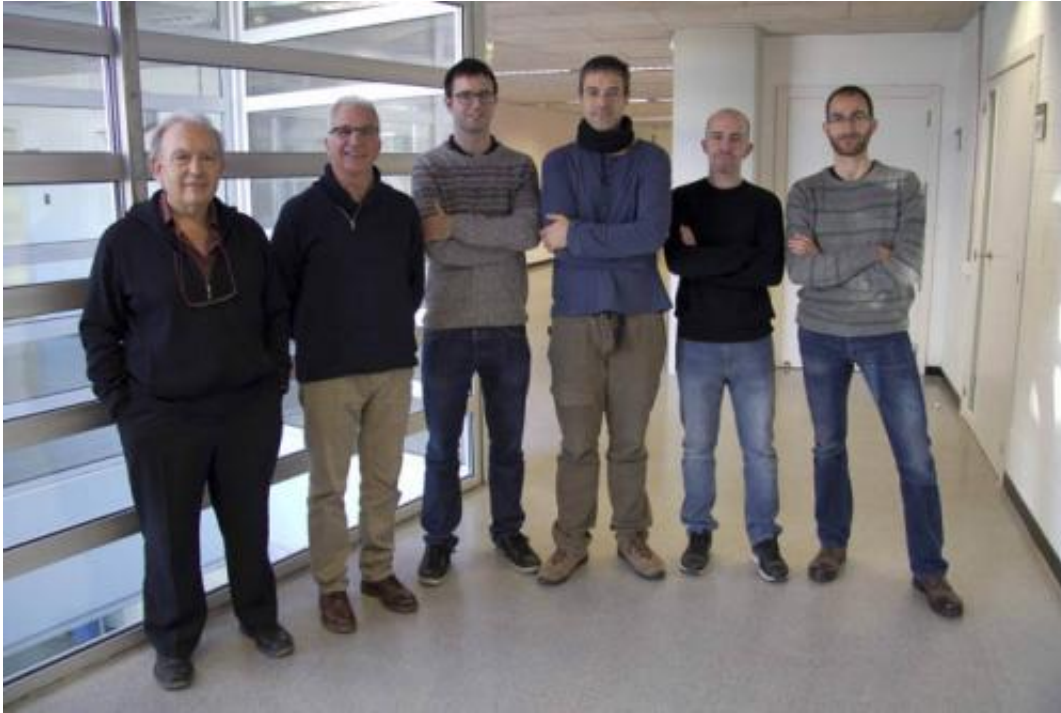
On-off fluctuations affect the patient's status during the day and are of variable and unpredictable duration. They include asymptomatic periods ("on" periods, when the patient is under the effects of the drug), reappearance of slowness and difficulty in walking, and even complete freezing of motion ("off" periods, usually related to discontinued or low medication).

Freezing of gait causes total immobility of patients when they are walking; it occurs suddenly and can last for a few seconds or several minutes.

Sensory stimulation

The REMPARK system is complemented by a subsystem for action consisting of auditory stimulators and electrical stimulation. This subsystem is at an early stage with regard to applicability and effectiveness.

During the pilot tests, the auditory cueing using sound rhythms proved to be effective and successful. It is based on providing auditory stimulation through a wireless headset when the motion sensor detects that gait is altered or frozen. The personal equipment also includes a mobile phone with several functions: connecting the monitoring and action systems; acting as an interface for medical supervision; and transmitting medical questionnaires remotely and simultaneously linking to the data server.



Left to right, Joan Cabestany, Andreu Català, Albert Sama, Carlos Pérez, Daniel Rodríguez and Jaume Romagosa, (CETpD) of the Universitat Politècnica de Catalunya.

The REMPARK system has a central server for storing, processing and analysing all patient data to determine their evolution. It also acts as an intelligent system to support decision making by medical staff.

Previous experience

This project arose from previous research in this field by the CETpD, which is located on the UPC's Campus in Vilanova i la Geltrú. Since 2008, the CETpD has been developing objective systems for measuring symptoms of the [disease](#) and support tools for physicians to facilitate a more accurate diagnosis of its progression. These systems are based on accelerometers and gyroscopes that are used to measure parameters associated with movement.

The first tasks, within the framework of the project "Monitoring the Mobility of Parkinson's Patients" (MOMOPA), focused on detecting the motor status of patients using inertial systems. In the second project, "Home-Based Empowered Living for Parkinson's Disease Patients" (HELP), coordinated by Telefónica I+D, the algorithms were improved and the first real-time tests were carried out. For the first time, this project has tested the regulation of medication by a subcutaneous pump under medical supervision according to the mobility of the patients. The results in six patients were very positive.

The CETpD is currently working on the new project MOMOPA2, which extends the results of the first version to use with outpatients. MOMOPA2 is funded by the Carles III Health Institute and is coordinated by the Garraf Health Consortium. The TV3 Marathon has funded a project to improve some aspects of REMPARK under the coordination of the Hospital Quirón Teknon.

Provided by Universitat Politècnica de Catalunya

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