



# NEWSLETTER

## VR for Rehabilitation



WELCOME TO OUR QUARTERLY NEWSLETTER

## PRIME-VR2 First Demonstrators

Our project partners University of Pisa, Malta, Strathclyde and Global Disability Innovation Hub are working on the setup of the demonstrators for the assessment of the patient. The plan is to send a demonstrator to each of the involved living labs to start testing it with real patients and provide feedback about the implementation. The team is working also on the development of the User Profile Toolkit in order to improve the graphical user interface experience and accomplish with the feedback received from preliminary tests with clinical users.

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### 3D scan and motion capture

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### Spotlight on partners

Meet our 3 Living Labs partners: Saint James Hospital, Kinisiforo Ltd, Global Disability Innovation Hub.

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### Next events

Have a look at our social media and contact details and read at which events our project partners will participate.

## 3D scan and motion capture for upper limb assessment in rehabilitation

The measurement of human body parts plays a significant role in many research and industrial fields such as human biology, medical rehabilitation, apparel industry, ergonomics. In the medical rehabilitation field, the patient's anatomy information is typically used for the selection of the most suitable size of the required medical device. Upper limb rehabilitation can greatly benefit from the use of bespoke assistive controllers. Their design and development require an advanced biomechanical profile of the patient. Traditionally, body sizes are taken by manual measurements, which are characterized by invasive and time-consuming processes, and the accuracy depends on the skills of the operator. 3D optical scanning systems have huge potential in replacing manual measurements of human body parts, shortening the acquisition times, and increasing reliability and accuracy. Factors as low invasiveness, speed and portability are of utmost importance. Particularly, upper limb (i.e., hands, fingers, wrists, and forearms) scanning, is a complex task due to self-occlusions and difficulties to keep the limb in a stable position. Real-time single-shot 3D scanning technique would be preferable for most situations. In recent years, the introduction of RGB-D cameras has allowed the development of scanning procedures by means of low-cost equipment. Among the plethora of commercial devices, the Intel RealSense depth cameras have proved to be a suitable device, providing a good trade-off between cost, ease of use, compactness, and accuracy. Motion capture is an integral part of the overall biometric scanning process, because it aims to collect data about the range



3D acquisition of a human hand with an optical scanner

of motion of the hand (flexion/extension of each finger) and wrist joints (flexion/extension and adduction/abduction). The assessment of the range of motion of hand and wrist joints in clinics is typically performed with manual goniometers. This method represents the easiest approach but is labour intensive and time consuming. A more effective approach is based on the use of motion capture technologies.

In the PRIME-VR2 project getting a 360° view of the patient's arm gives rise to issues about the acquisition time and registration of the different point clouds. To solve both issues, a multi-sensor layout has been designed. This layout allows the acquisition of target surfaces in the case of patients with impaired mobility. For the acquisition of the range of motion the Leap Motion Controller by Ultraleap has been selected. It is an optical marker-less device, which does not require patients to wear markers or suits. The device consists of IR cameras and a skeletal model of the hand. It tracks hands in a 3D interactive zone that extends from the device in a 120x150° field of view up to 60 cm. This device allows discerning 27 distinct hand elements (bones and joints) and tracking them even when mutually occluded. A calibration procedure has been developed to allow the automatic alignment and positioning of data acquired by the devices.



Acquisition of range of motion of a human hand

## Data protection practice in PRIME-VR2



The PRIME-VR2 project has defined a data protection policy in order to guarantee the privacy and anonymity of subjects involved in the research.

The project aims at developing customised software and hardware systems by using a human centered design approach. Both patients undergoing motor rehabilitation at the rehabilitation centers and partners of the project participate to the research activities relative to the definition of the systems requirements, and subsequently to the tests of the prototypes developed. The project has defined measures for collection and access to data, and also for communication and conservation of data.



The rehabilitation centers operate according to medical-ethical procedures, which have been approved by the local boards and put in place. Before involving any subject in the research activities, an informed consent is presented and signed by each of them.

Data acquired by researchers and practitioners at the rehabilitation centers include patients' personal data (name, age, gender) and sensitive data (medical data, bio data). After the acquisition, the data are moved to a shared space and anonymised. The correlation between the data subject and the sensitive data is managed by the project coordinator, who is also responsible for the data security, storage and back-up. These measures are guaranteed by the University of Pisa, which manages the repository space. The PRIME-VR2 researchers can use these data, which are password protected, solely for the purposes of the project.

At the end of the first year, the project will identify what are the innovative results of the research and decide to apply for patents. After these decisions are taken, the project will decide to make publicly available some of the acquired and anonymised data sets through the EU research data repository openair (<https://www.openaire.eu/>), for the benefits of the research community at large.



## Conference paper

### Empathy and Explorations of the Design of a Virtual Reality Controller for Rehabilitation

Preliminary work of the University of Oulu on PRIME-VR2 was recently presented and published on the Proceedings of the Sixth International Conference on Design Creativity (ICDC 2020), held 26th-28th August 2020 in Oulu, Finland. In the paper, the authors Yazan Barhoush (University of Oulu), Georgi V. Georgiev (University of Oulu) and Brian



Loudon (Loud1Design) explore the ideation and design of a VR proof-of-concept controller for rehabilitation of users with upper-limb disability. An existing tracker solution is used to map actions and movements in VR. The main challenge was integrating some of the default functionalities existing in current commercial VR controllers, while providing an empathic setup and a use-case for disability rehabilitation, as well as keeping the controller compact, lightweight, and handheld. The prototyping process followed a human-centred explorative design idea generation. A limited functionality of existing commercial controllers was maintained, with the feasibility and readiness for implementing additional functionality for future use cases. An experiment was performed to investigate the usability of the system and the effectiveness and reliability of the controller in empathic re-mapping of real-life disability to VR.

<http://icdc2020.org/>

## Certifying Medical Devices



**KinisiForo**  
SYSTEM OF ELLIPTICAL TRAINING



**NICOMED**  
REHABILITATION  
CENTER

PRIME-VR2 are proud to congratulate our partner Kinisiforo for passing the ISO 13485 examination. ISO 13485 specifies requirements for a quality management system where an organization needs to demonstrate its ability to provide medical devices and related services that consistently meet customer and applicable regulatory requirements. Kinisiforo is now authorised to certify medical devices, a great achievement for the company.

Kinisiforo Ltd constantly works on improvement of its products in order to maintain strong competitive capabilities. We continually strive to combine the highest standards of quality and efficiency. The NicoMed Rehabilitation Centers are registered trademarks of Kinisiforo Ltd.

The centres are designed for people with a wide range of motor impairments and patients with physical or mental disabilities. NicoMed was established with a mission to offer, "A Holistic Approach to Rehabilitation, for Quality of Life!". The staff and management are highly motivated, well-respected and compassionate professionals who are fully qualified and very experienced to understand the needs and expectations of their patients to structure an effective rehabilitation programme.



## MEET THE TEAM: SAINT JAMES HOSPITAL

Saint James Hospital (STJH) is a 70-bed private hospital, set up more than 25 years ago. Its services include a 24hr Emergency Department, Ambulance service, a fully-fledged Radiology Department, Out-patient Clinics for various specialities, Dental and Implantology Clinic, Hospital Pharmacy, Operating and Endoscopy Theatres, on site Laboratory and a dedicated physiotherapy unit including an in-patient and out-patient gymnasium. Its vision is to continually improve its services and facilities by investing in the latest technology, employing the highest level of medical specialists and maintaining a dynamic and motivated workforce, which has become the flagship of the group.

As part of its physiotherapy services, STJH collaborates with Planet Health Ltd, to provide physiotherapeutic and rehabilitation services, with the aim of providing a more holistic one stop shop approach to the management of pain and injuries. The multidisciplinary team provides unique individual assessment and patient treatment plans depending on the patients' specific presenting complaint. Other services include management and treatment of all orthopaedic, musculoskeletal, sports and neurological ailments and injuries in adolescents, adults and geriatric patients.

Saint James Hospital together with Planet Health Ltd will be providing a living lab environment with a specific focus on musculoskeletal injuries. Within the living lab the bespoke controller and VRHAB-IT platform can be assessed, tested and monitored. Professionals including physiotherapists, occupational therapists and gym attendants will be involved in the co-design activities of the game and will monitor the metrics to assess improvements in the patients' rehabilitation progress.



**Maria Bugeja**

Ms Bugeja is the Chief (Operations) Executive Officer of Saint James Hospital.



**Milos Stanisavljevic**

Mr Stanisavljevic is the Director of Planet Health Ltd.



**Alison Mizzi**

Ms Mizzi is the EU Funding Project Administrator.



## MEET THE TEAM: **KINISIFORO LTD**

The NicoMed Rehabilitation Centers are registered trademarks of Kinisiforo Ltd and could be found in two locations on the island of Cyprus; Limassol and Paphos. The centres are specially designed for people with a wide range of motor impairments and patients with physical or mental disabilities. NicoMed was established in 2004, with a mission to offer, “A Holistic Approach to Rehabilitation, for Quality of Life!”. A truly independent, rehabilitation center, providing physical therapy and rehabilitation services, such as Clinical Psychology, Speech Therapy, occupational therapy and a Workshop for Orthosis and Prosthesis all under one roof at NicoMed Center. Our staff and management are highly motivated, well-respected and compassionate professionals who are fully qualified and very experienced.

It is an honour to participate in a EU funding project that collaborate Universities with SMES to develop an innovative technology for the rehabilitation of the Upper Extremities of people with various disabilities based on Virtual reality environment. Our role to the project is to contribute to overall development of the device based on our experience with patients as well as the continuously testing of the device. In addition, we will play an important role to the commercialization and certification of the device.



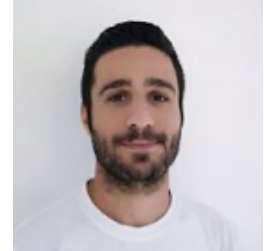
**Onisiforos Hadjionisiforou**

Mr Onisiforos Hadjionisiforou finished his studies in kinesiography and specialised with M.Sc. in Rehabilitation and is today the CEO of Kinisiforo Ltd and manager of the NicoMed Rehabilitation Centers.



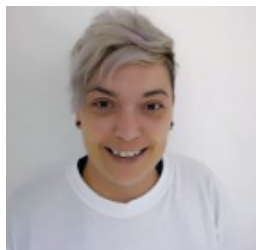
**Chara Vasiliou**

Mrs Chara Vasiliou is a physiotherapist with M.Sc. in Neurology and Psychiatry. She has been working for the last 2 years in Nicomed Rehabilitation Center with stroke patients and patients with neurological conditions.



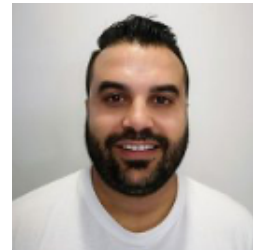
**Andreas Ioannou**

Andreas Ioannou is a physiotherapist who has been working for 7 years at Nicomed Rehabilitation Center in the section of the rehabilitation of patients after stroke and with children with Cerebral palsy.



**Pantelitsa Ioanou**

Mrs Pantelitsa Ioanou has studied Special Rehabilitation and she is a certified kinesiographer who has been working for 10 years at Nicomed Rehabilitation Center for the rehabilitation of young and adult patients with cerebral palsy.



**Stelios Michael**

Mr Stelios Michael is a certified kinesiographer who has been working for 5 years at Nicomed Rehabilitation Center in Paphos, focusing on the rehabilitation of patient after stroke.



## MEET THE TEAM: GLOBAL DISABILITY INNOVATION HUB

It is important that PRIME-VR2 is founded on the reality of life and therapy for the patients that will be using its technology. The Global Disability Innovation Hub was founded in 2016 out of the 2012 London Paralympics legacy. Based at University College London (UCL) on the Queen Elizabeth Olympic Park, GDIH is formed of two parts: a community interest company (CIC) and the academic research centre (ARC), which is part of UCL. The CIC and ARC are delivering a portfolio of research into disability and innovation, working globally with academic, industrial, government and NGO partners. Work in progress includes Innovate Now! – a disability innovation ecosystem and accelerator based in East Africa; and research into smart sensing materials for prostheses, how robots interact with crowds, and mobile phone use by disabled people in informal settlements in low and middle income countries.

We are coordinating the three PRIME-VR2 living labs in London, Cyprus and Malta; and are partnered with the London Evelina Children's Hospital and the UK Dystonia Society to develop our understanding of the needs and aspirations of young people with hyperkinetic movement disorders such as dystonia, and to guide the design teams in their work to create accessible controllers and virtual reality games. We are bringing everyday reality into virtual reality for people with stroke, dystonia and musculoskeletal injury.



**Tim Adlam**

Dr Tim Adlam is an Associate Professor at the GDIH research centre at UCL and is leading the user engagement work in PRIME-VR2. He is an engineer who has worked in assistive technology research for over 20 years, with an interest in technology to support movement and participation by children with movement disorders such as dystonia.



**Hortensia**

Dr Hortensia Gimeño is the lead occupational therapist at the London Evelina Children's Hospital Complex Motor Disorders Service, and is the clinical lead for PRIME-VR2 at GDIH.



**Richard**

Richard Armstrong-Wood is a rehabilitation engineer with a background in communications technology for children with severe disability. He is working with our partners at UCL and Dystonia UK to run our research with young people with movement disorders.

# FOLLOW US



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**PRIME-VR2**  
Personalised recovery  
through a multi-user  
environment  
VR for Rehabilitation

## NEXT ISSUE: DECEMBER '20

In the next issue key findings of an evaluation exercise carried out typical end users of the user profile toolkit will be provided. We will introduce another 3 members of the consortium. We will report on the presentations that were held virtually by some of our team members in the VR days event.

## NEXT EVENTS

**October'20:** Our partner St James Hospital will participate in the MedTech Digital Summit, an online event organised by Sigma that will be held on the 12 to 16 October 2020.  
<https://informaconnect.com/medtech-summit/>

**November'20:** Although PRIME-VR2 is adopting new (digital) methods to work through the COVID-19 pandemic with our research participants and partners across Europe, the consortium decided to move the partnership with VR Days Europe to the upcoming year. Hopefully, we are able to receive our stakeholders (partly) physically in November 2021. Despite the fact that the big partnership is moved to upcoming year, we make use of our partnership to let some PRIME-VR2 partners speak at the digital VR Days Europe which will take place online between the 4th and 6th of November. The VRDays Europe is a 3-day conference and exhibition on Virtual, Augmented and Mixed Reality content, creativity and innovation. The 2020 New Horizons Edition will explore how immersive technologies shape the world of tomorrow.

Make sure to check our LinkedIn, Twitter and website for the announcement of the PRIME-VR2 speakers. We hope to see you there!

CHECK THE WEBSITE REGULARLY FOR MORE NEWS, DOWNLOADABLE CONTENT AND INFORMATION!

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PRIME-VR2 is on the [Virtual Reality Helix](#)



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