e-Health Technical Committee Newsletter

April 2022

On behalf of the e-Health Technical Committee (TC) of the IEEE Communications Society (ComSoc), we wish all our members a very instructive reading of this letter.

The contribution in this edition is coming from: Gordon Johnson and Christos Politis (g.johnson@kingston.ac.uk , c.politis@kingston.ac.uk) from Kingston University, London, United Kingdom. The contribution is related to the UbiTheraPlay project https://ubitheraplay.com

Members of the e-Health community are invited to contact the author for further information or collaborations.

We also welcome all our members to share their research activities and field experiences through this open newsletter and to open up new opportunities for discussions and collaborations.

Editor: Dr. Nada Philip (Kingston University London, UK)

Table of Contents

EXERGAMES WITH ELECTROMYOGRAPHY OVER INTELLIGENT PLATFORMS (UBITHERAPLAY)

Gordon Johnson and Christos Politis
(g.johnson@kingston.ac.uk, c.politis@kingston.ac.uk)
Kingston University, London, UK

Impairment of motor control can significantly impact the mobility of people with Neurological Limitations (NL), which for Cerebral Palsy (CP) occurs in 2.11 per 1000 live births. Physiotherapy focusing on maintaining motor control and can be beneficial for patients with NL.

Typically, exercise or therapy is very structured and repetitive, and it can be hard to maintain enthusiasm for it. Whereas video games are a fun, often social, medium that are designed to motivate a player to continue to engage with them. Gamification is a process that turns something mundane, such as a structured sequence of events, into a game-like process to motivate the patients.

Games such as ExerGames or Exercise Games are a form of gamification, and as such can be used as a method of physiotherapy. These types of games can help to create an engaging and motivating exercise or therapy session, by integrating the exercises into a video game. Making the exercises more enjoyable and can also help motivate the individual to practise the exercises outside of the clinical environment.

Electromyography (EMG) within physiotherapy clinics, can be used as a diagnostic aid and supplementary tool while performing therapy. Adding ExerGames controlled by the EMG output, can provide a pre-prescribed rehabilitation therapy of actions that specifically target a particular muscle group.

There has been recent research into utilising machine learning architectures, to classify EMG output as a controller. A trained neural network model on a single arm, can classify subtle and complex unique differences

and scenarios. Ultimately, these classification models can provide inference to control the games.

We propose to bind ExerGames, EMG and controllers together using intelligent platforms powered by 5G/6G networks. Here we'd like to research the concept of Meta-Surfaces to be applied in such a platform. These Reconfigurable Intelligent Surfaces (RIS) is an exciting new idea for the utilisation of physical surfaces to provide fast wireless communications and non-communication applications such as localisation and sensing. This reconfigurable reflective meta-surface with integrated sensing capabilities can be used together with the intelligent gaming platform to create a smart rehabilitation environment for the patient.

UbiTheraPlay (UTP) ExerGames, aim to incorporate existing technologies that can be used within both clinical and home settings. These technologies interface with the custom UbiTheraPlay video games, which respond to user movement. During gameplay the functions performed by the patient contain elements that mimic traditional rehabilitation methods for the targeted muscle groups.

Furthermore, this process provides real time biometric feedback from the platform software. A visualisation representation of the data indicates if the exercise is being performed appropriately.

Using a gaming platform as a form of modern treatment, provides an enjoyable and motivational approach for various neurologically limited patients of all ages. In turn, when patients are motivated, this can provide a higher number of repetitions than traditional therapeutic approaches.

During a therapy session, playing such games can have various impacts depending on the muscle groups targeted. Such as providing therapeutic and rehabilitation benefits to the patient, whilst providing muscle information to the medical professional for analysis of performance and ability, which enables a focused assessment.

The output from the assessment can be transferred by using advanced 5G/6G technologies, called reconfigurable intelligent surfaces with integrating sensing capabilities back to the hospital or clinic that can monitor the patient's well-being and thus having a positive impact on their Quality of Care (QoC).

Recent collaboration with the EU Horizon 2020 funded GABLE project, a study was conducted that demonstrated positive improvements of balancing function in children with CP, after a two-week course of training with personalised rehabilitation video games.

UTP was further developed, to provide a platform for various innovative technologies that measure the motor control of neurologically limited patients. The UTP field trials are currently being conducted in various clinics, hospitals and schools, predominantly in the UK but also within Nepal.

The Orchard Hill Academy Trust, an educational provider that fully represents all designations of special educational needs and disabilities, is one of the trialling sites for UTP. Initial feedback has been extremely positive from a non-medical perspective, including a positive social impact with peers, an increase of participation and inclusion of differing abilities.

UTP with the above improvements, is initially being focused on clinical, hospital and school settings, but can also be taken as an at-home package for enhanced quality of care. The communication between the platform and the utilised technologies, provides increased repeatability and longevity of the rehabilitation programme.

This innovative idea will be further enhanced by utilising the idea of RIS, so it provides QoC to all patients independent of their condition, age, gender, and cognitive ability. RIS coupled together with the EMG will rehabilitate, invigorate, and improve the quality of care as well as communicate the medical findings recorded by the intelligent platform back to the hospital or clinic in real time for further processing and actioning. In turn, this will enable the medical team to effectively monitor the patient in a sustained way without interfering with their treatment and enjoyment of the ExerGames.

Website: https://ubitheraplay.com

IEEE Healthcom 2022

IEEE Healthcom aims at bringing together interested parties from around the world working in the healthcare field to exchange ideas, discuss innovative and emerging solutions, and develop collaborations.

CALL FOR PAPERS

Authors are cordially invited to submit their original papers within the eHealth area. The topics include but are not limited to the list via this link https://healthcom2022.ieee-healthcom.org/authors/call-papers

CALL FOR POSTER SUBMISSIONS

The conference will host a poster session dedicated to contributions of PhD students and young Researchers (less than 3 years after graduation) in the following selected area of communications related (but not limited to) topics https://healthcom2022.ieee-healthcom.org/program/student-contest

IMPORTANT DATES

Paper Submission: 15 May 2022

Notification of Acceptance: 30 July 2022

Final Manuscript (Camera ready): 30 August 2022

SUBMISSION GUIDELINES

Paper submissions shall be done via EDAS system using this here