ABSTRACT
Gamification is the concept of applying game mechanics and game design techniques to engage and motivate people to achieve their goals. 'runTropica’ incorporates this concept into the physical rehabilitation process of children with brain injuries in a novel approach, where it complements the current conventional rehabilitation program. The main aim of this project was to design and develop a prototype of an active video game based virtual rehabilitation system which focused on targeted physical therapy of the lower limbs of the user. The main target group of this product was the pediatric population with brain injuries or disorders that have rendered disabilities in the lower limbs (E.g Cerebral palsy).

1 Introduction
Cerebral palsy (CP) is the most common pediatric physical disability, affecting 2.3-3.6/1000 live births [1]. CP describes a group of permanent disorders of the development of movement and posture, causing activity limitations, attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication and behavior, epilepsy, and by secondary musculoskeletal problems.

With the growing popularity of movement based or ‘active’ video gaming systems (e.g.Microsoft’s Kinect), there is now the potential to use mainstream equipment to facilitate widespread access to low-cost, home-based virtual reality therapies (VRTs)[2]. In contrast to expensive robotics, virtual immersive environments and technologically complex accessories housed at a handful of specialized rehabilitation facilities, 87% of American youth reportedly own at least one video console and spend an average of 73 min in play each day [3]. This widespread availability and use is reviving and accelerating interest in video games for physical rehabilitation. 'runTropica’ is based on Free and Open Source frameworks and it uses off-the-shelf commodity hardware. Development Environment consists of Unity 3D, Open N/NIITE and C sharp Mono Development. It uses more flexible and distributed architecture to cater a wide range of requirements.

CCS CONCEPTS
• Software and its engineering → Interactive games;

KEYWORDS
Kinect sensor, gamification, physical rehabilitation

2 Results and Contribution
Visual results for the Knee flexion movement is illustrated in Figure 1. Yellow circles indicate the depth map of the tracked person and red circles denote the game characters’ state changes according to the actions of the tracked person.

Self-Regulated Physical Therapy: Virtual rehabilitation in the context of In-Home rehabilitation is not a new concept. Yet, this study incorporates a novel concept of specifically designed movement definitions into the 2D infinite running gaming architecture resulting in a unique self-regulated lower limb rehabilitation technique.

Non-Discrete Movement Mapping: This product employs non-discrete movement mapping to the games function where the user’s lower limb movement is continually mapped to the character’s jump function. Example scenario: Hip flexion movement type.

The game play is created in such a manner that extra physical effort is rewarded with more points.

REFERENCES