
i-CREATe
2014
SDC
2014

Content

Student Design Challenge @ *i*-CREATe

The Student Design Challenge is an annual event held at the International Convention on Rehabilitation Engineering and Assistive Technology (*i*-CREATe). It provides a platform to encourage students from all over the world to develop creative and innovative devices or solutions to improve the quality of living of elderly and people with disability. It showcases the extraordinary talents of these students while providing them the opportunity to work with clients and clinicians to develop these innovative ideas. There are 2 category in this challenge.

Design Category

Students are required to apply User-Centered Design process to produce a concept that makes life easier for its users. These solutions could use any type of technologies and result in an improvement to the quality of life, 'make life easier' for its users or enhance the user experience (ux) of the solution.

Technology Category

Students are required to apply principles in engineering and information technology principles to design and implement Assistive & Rehabilitative Technology solutions to address the issues faced by the needy, their caregiver and clinicians.

Participation

This challenge is open to post-secondary education, undergraduates and post graduates. These include Universities, Polytechnics, and Institutes of Technical Education. Submissions are invited from all students at all stages of their academic studies.

There is no limit to the number of teams that may compete from any given academic institute and each team is allowed to have up to 4 members.

Individual / teams will submit the Entry form to sdc@icreateasia.org. Expert reviewers will evaluate submissions to be selected to attend the final Student Design Challenge at *i*-CREATe Convention.

Requirements

Selected teams will be required to attend the convention with an A1 size poster outlining their design and innovation. Prototypes will have to be displayed together with the posters at the convention to a panel of Student Design Challenge Judges.

The finalists will be given 5 minutes for oral presentation covering the key ideas of the project to the panel of the Student Design Challenge Judges and follow by a 1 to 2 minutes Q&A.

There will also be a prototype walk-through for the judges to grade each team during the convention. Each team will be given 5 minutes for their prototype demonstration and follow by Q&A.

Judging Guidelines

Technology Category

Creativity / Idea Novelty (20%)
Impact on Society and/or Professional Practice (20%)
Commercialization Potential (20%)
Prototype Engineering (20%)
Usability / Ergonomics (20%)

Design Category

Creativity / Idea Novelty (20%)
Impact on Society and/or Professional Practice (20%)
Commercialization Potential (20%)
Prototype Design and Implementation (20%)
Usability / Ergonomics (20%)

Awards

	Design Category	Technology Category
Champion	A trophy, USD 1,400.00 and certificate for all members	A trophy, USD 1,400.00 and certificate for all members
1st Runner-up	A trophy, USD 700.00 and certificate for all members	A trophy, USD 700.00 and certificate for all members
2nd Runner-up	A trophy, USD 350.00 and certificate for all members	A trophy, USD 350.00 and certificate for all members
Merit award	certificate for all members	certificate for all members

Peer's Choice Award- certificates for all members.
The award is to be decided by the SDC participants. Each team is allowed to cast one vote on the most deserving team entry but cannot vote for their team. The votes have to be casted at the end of the presentation session.

Delegate's Choice Award- certificates for all members.
The award is to be decided by the public visiting the exhibition. Upon registering for the conference, each visitor will be given a voting sheet where they have to complete and drop into the voting box at the registration booth after visiting the SDC booths.

Exhibitor's Choice Award – certificate for all members
The award is to be decided by the companies participating in the exhibition. The voting sheet will be provided on the first day of exhibition. Each company will have representative to vote for their best team.

Best Presentation Award- certificates for all members.
The award will be decided by the panel of judges based on the presentation part of the judging criteria.

Best Poster Award- certificates for all members.
The award will be decided by the panel of judges based on the poster part of the judging criteria.

Best Prototype Award- certificates for all members.
The award will be decided by the panel of judges based on the prototype part of the judging criteria.

The result of the top 3 winners from each category will be announced at the Gala Dinner.

2013 SDC Winners (Technology Category)

Champion

Project Title: Ankle-Foot Passive Motion Device for Footdrop
Student's name: Kittichai Tharawadeepimuk, Nida Vongsavat, Sitthichai Iampetch
School: Mahidol University, Thailand

Project Description

The design of Ankle-Foot Passive Motion (AFPM) device for footdrop employs the principle of passive movement technique provides assistance between patient's strong and weak ankles. By using the proposed device, the stronger ankle can assists the weaker ankle to move in the range of pre-set angle that corresponds to the ability of each patient's weak ankle. There are an LED light and beep sound on the devices that patients can select. It will feedback to the patient when his ankle reaches the pre-set angle. The device limits the angle and ensures that the patient will not move his angle beyond the range of normal ankle movement. The device can be implemented in both lying and sitting positions to suit the need of each patient. Furthermore, the device is designed to attract patient by adding a display monitor and virtual reality (VR) game. While performing the exercise, the patients will feel as if they are moving in the real environment of the game. When the device moves, the game in VR will moves accordingly. Moreover, the monitor also displays the score obtained during the exercise. If the patient can follow the device and exercise correctly, the score displayed on the monitor will be added up which will protect the patient from moving the ankle too fast, and can attract and draw patient's attention.

Photograph(s) or drawing(s) of your prototype

1st Runner-up

Project Title: Compact Rehabilitation Robot
Student's name: Khor Kang Xiang, Patrick Chin Jun Hua, Fu Suan Kian
School: Universiti Teknologi Malaysia, Malaysia

Project Description

1 in 6 of Malaysians suffer stroke annually, and the number of patients is keep increasing every year around the world. In fact, 500,000 cases of stroke occur in Indonesia annually, 800,000 in UK and close to 2 million in China. Fortunately, rehabilitation can help the stroke patients to regain their movements. However, conventional rehabilitation methods with physiotherapists are labour intensive, subjective, costly and inconsistent. This led to the shortage of physiotherapist due to large number of patients. Rehabilitation robot is another good solution but the current available robots are huge, complex and expensive. Therefore, the objective of this project is to develop a robot that can provide a low cost, effective and interactive rehabilitation alternative for the stroke patients. The targeted customer is the stroke patient who needs upper limbs rehabilitation. This robot is known as CR2 (Compact Rehabilitation Robot). It can be used to train upper limb of the stroke patients in the virtual reality environment, where the patients can train themselves while playing games. More importantly, training while playing games motivate patients to train more frequent which is very crucial for fast recovery.

This robot provides three training modes, which are passive, assistive and active mode. The passive mode is for the patient who cannot move their arm at all and the robot will help to move their arm. In assistive mode, the robot will help the patient to move their arm if they can only move in a small range of movement. While, in active mode, the robot can improve the muscle function of the stroke patient by increasing the resistance according to their recover rate. The robot software will provide the virtual reality games for the patient to train accordingly in these 3 modes. Besides that, the robot has haptic mode that able to deliver tactile sensation for the patients to experience the virtual object like virtual weight, spring, sponge and wall.

Apart from that, this robot also has a tele-monitoring system that enables therapists to monitor patients' progress through internet by analyzing their collected data such as force and position (range of movements) via the robot.

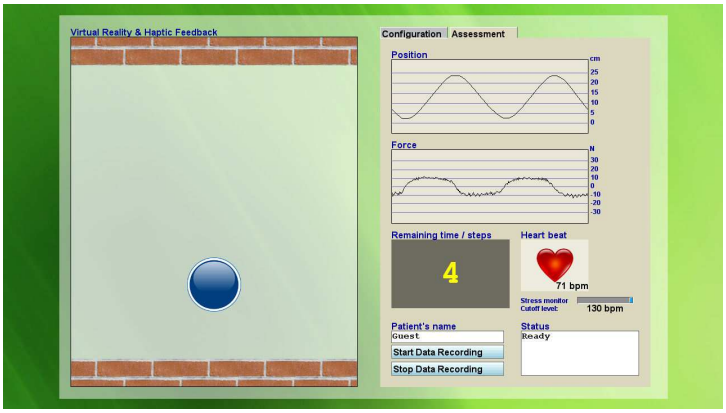
The safety precautions that stroke patients should take care is their sitting posture and their heartbeat level. This is because, incorrect sitting posture will affect the outcome of the rehabilitation training. Besides that, their heartbeat level should be maintained in a reasonable range so that they are not over-excited. Therefore, this robot is equipped with the heartbeat monitoring sensor that able to monitor the heartbeat level of the patients, in order to ensure they are trained in safe condition. Moreover, we also built a smart chair that able to monitor their posture during the training and buzzer will be activated to alert the user if their sitting posture is incorrect.

The robot is designed to be compact and portable, so that it can be easily set up and trained by the patients in their house with limited space. By using rehabilitation robot, we are not only can improve the efficiency of the physiotherapy training but also reduce the rehabilitation cost.

Photograph(s) or drawing(s) of your prototype

CR2 with subject on trial

Virtual reality games



Haptic feedback and objective assessment display

2nd Runner-up

Project Title: Kinect Virtual Art program (KVAP)
Student's name: Laura Diment
School: Flinders University, Australia

Project Description

Art can provide recreation and also plays a vital role in a child's development in the areas of communication, problem solving, social and emotional skills, as well as motor control, creativity and self-expression [1]. Providing opportunities for children with disabilities to experiment with art can help their development.
Microsoft's Kinect allows gesture recognition using an infrared projector, a camera and a microchip that can track object movement along the x, y and z axes using 3D image-based reconstruction [2]. In 2011 Microsoft released a Kinect *software development kit (*SDK) for Windows 7. It enabled skeletal tracking which tracked up to 20 joints on the user.

Advantages of a virtual art program include: no parts to accidentally ingest; no mess created; programmable to compensate for impairments; and the system can incorporate additional sensory feedback, such as audio, to improve engagement. Visual and auditory feedback is better for brain development than movement without the sensory feedback [3]. A virtual art program that uses the latest commercial technology can reduce stigma attached to assistive devices because children with impairments are using a popular mainstream product like their able-bodied peers.

The multisensory aspect of the KVAP encourages physical engagement, which is important in developing dexterity, muscle strength, flexibility and endurance. Many children with disabilities regularly see occupational therapists and physiotherapists who prescribe daily exercises to build and maintain muscle tone and flexibility. However, the majority of people with motor disabilities do not perform the exercises as their therapists recommend.

Photograph(s) or drawing(s) of your prototype

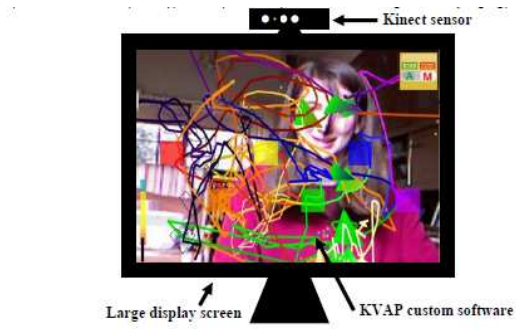


Figure 1. KVAP system set-up in automatic mode.


Figure 2. KVAP in manual mode.

2013 SDC Winners (Design Category)

Champion

Project Title: X-RIGHT
Student's name: Chua RenJun, Hiu Meng Xiong, Henrietta Goh Mei Zi, Kanageswari D/O Muthukumar
School: Nanyang Polytechnic, Singapore

Project Description

X-Right is an innovative radiographic cassette holder unit which aids radiographer in positioning for an anteroposterior(AP) or frontal sitting chest projection done on wheelchair-bound patients. X-RIGHT is designed to firmly anchor and fit wheelchairs. It has an effective translation mechanism coupled with an automatic locking design to enable radiographers to easily translate the image receptor vertically and secure it at the desired height. It will stabilize the image receptor to achieve an optimal chest radiograph with minimum distortion. Hence, it will meet the right angle specifications for chest radiography.

Other than that, X-RIGHT is also an innovative radiographic image receptor holder made of anodized aluminum used for the frontal sitting chest projection for wheelchair-bound patients. Other materials used in this device include rubber, nylon, plastic and stainless steel. X-RIGHT is also able to anchor firmly and fit most wheelchairs and has an in-built mechanism that allows easy vertical translation that auto-lock at variable heights of 5mm intervals. With a push of the compression handle of wheel chest, it can be returned to the lowest position.

X-RIGHT is novel and unique product. Besides it produces optimal x-ray results, it also increases work productivity in the radiology department. As our product is user friendly, just a simple demonstration of its usage would be sufficient to allow radiographers to use it independently. It is designed for right angle specifications and is mostly made up of lightweight and non-corrosive materials, which thus offer advantages such as quick and smooth operation of the device, durable, reliable, light and portable, easy maintenance, and corrosion resistance.

Photograph(s) or drawing(s) of your prototype

1st Runner-up

Project Title: Home-Auto Lift System (HALS)
Student's name: Pastaporn Suasa, Kornnapat, Lalita Pongpairoj Yankoses
School: Thammasat University, Thailand

Project Description

The big issue of the disable people is transferring problem, especially transferring from the wheelchair to the car or from the car to the wheelchair. In fact, they need to go outside for relaxing and meet other people. The difficulty of transferring cause them do not need to go outside.

The difficulty of transferring without the equipment

The current equipments still have some problem and cannot respond the real needs of user.

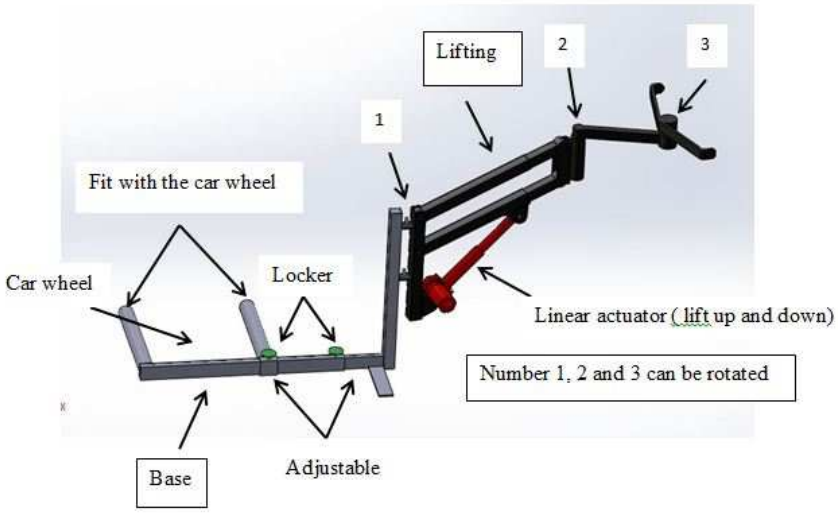
- Need car seat modification
- Cannot be used at home
- Expensive

- Can be used in limited area
- Need home modification

This equipment was designed for the people who cannot help themselves to transferring such as people with disability and the elders. The weight of user can be up to 120 kilogram.

Concept design

- Due to the base of current equipments are large size, therefore we use the car wheel is the base instead so the base can be smaller.
- The most expensive part is the lifting and the equipment will be used at both car and home. Thus the lifting is adjustable for both car base and home base.



At car

At home

Photograph(s) or drawing(s) of your prototype

The prototype

The lifting is the most expensive part; therefore it will be used with both car base and home base

At home

At car

2nd Runner-up

Project Title: QikRehab - Innovative Hand Rehabilitation Device
Student's name: Chan Chun Chiang, Alfred Chua, Tan Lee Chaw
School: National University of Singapore, Singapore

Project Description

QikRehab is a portable and interactive upper limb rehabilitation device. It has multiple functions that require the user to perform different actions, which are targeted to help them achieve improvement in Activities of Daily Living (ADL).

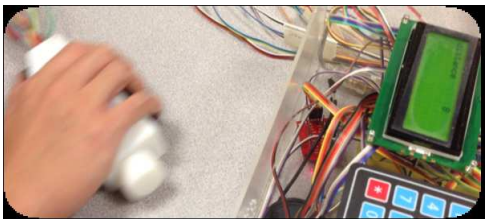
Therapists can use QikRehab to select the appropriate functions wisely, thus it can be applicable to a wide range of stroke patients. We have integrated interactive games with the functions, so as to attract and motivate the patients to use it. There are four functions in total.

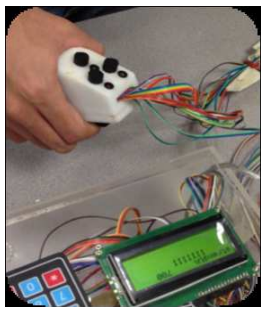
The first function, the pincher, helps patients to exercise their thumb. The user is required to press one of the three rubber buttons, which are ergonomically positioned at an angled surface, corresponding to the randomly lit up LED bulbs.

The second function, the gripper, aims to help patients improve their gripping strength. The user is required to grip on a rubber pad and a display of the intensity bar, which indicates the amount of force exerted, will be shown to motivate the patients. For the pincher and gripper, force resistivity sensors are used to detect the force exerted.

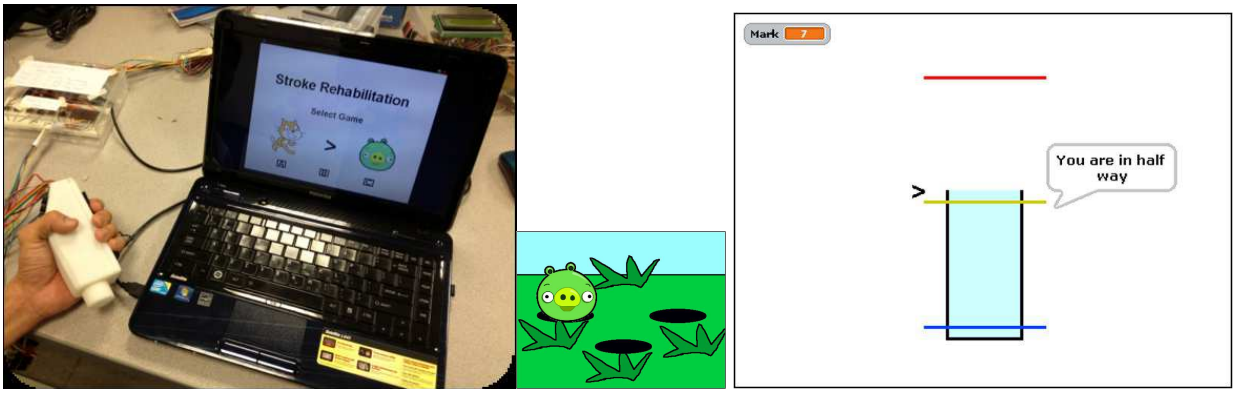
The third function, the twister, helps patients regain the movement of common actions such as turning bottle cap and doorknob. A rotary encoder is used to detect the rotational position. For most of the functions, interactive games and attractive displays are used to enhance the rehabilitation experience of using QikRehab.

Photograph(s) or drawing(s) of your prototype





1. **Measurement mode**: To quantify patient's efforts in doing rehabilitation with the Measurement mode, a patient can perform the exercises with the four functions stated above. It enables a user to measure the following: strength exerted, repetitions, time taken for reaction, and total effort exerted by the patient, with respect to the functions mentioned above.



2. **Interactive mode**: To attract patients to do rehabilitation. With the Interactive mode, rehabilitation will be more enjoyable for the patients. Focusing on the actions described earlier, the games will provide both attractive visual and audio feedback, which is able to attract and motivate the patients in their rehab.