ENGINEERING STUDENTS @ WORK

The Development of the *iThing* –

A Motor Skills Enhancing Device

Working in association with Akorn Educational Services, Victoria University and SCOPE

Students from St Catherine's – Gina Naylor, Sophie Gray, Julia Milone, Ali Dvorscek, and Philippa Sutherland

SCOPE
FOR PEOPLE WITH A DISABILITY

VICTORIA UNIVERSITY

Akorn
Educational Services

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NOTHING IS GREAT UNLESS IT IS GOOD

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Acknowledgements

John Chlond – Victoria University

Georgene Bridgeman – Akorn Educational Services

Kathy Harman – SCOPE Lilydale

Alec Simcock – Victoria University

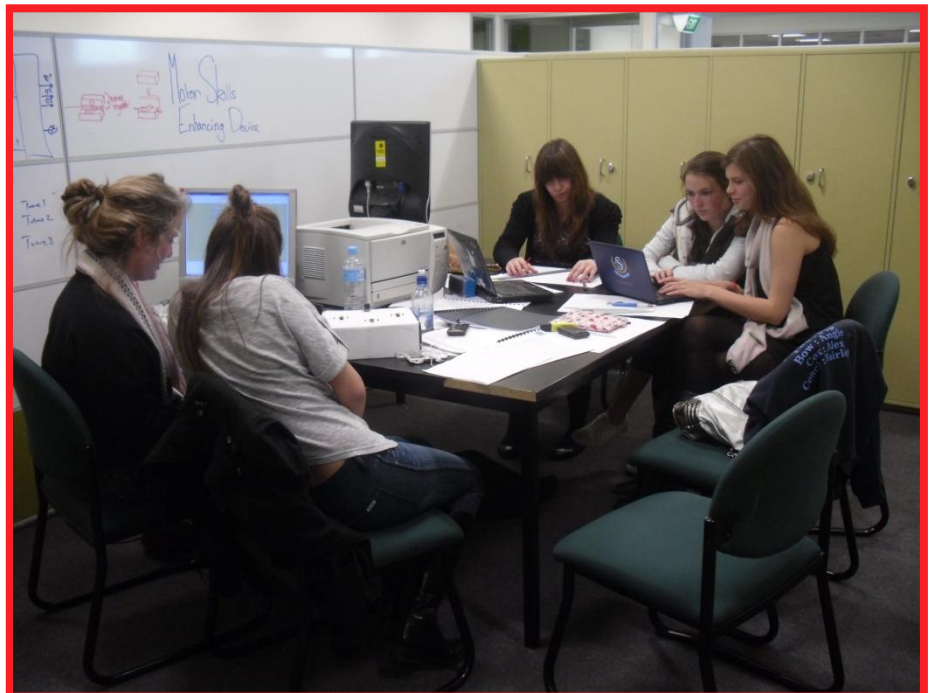Vanessa Jackson McRae – Head of Science Faculty, St Catherine's School

Laszlo Kovaks

Donald Ermel

Victoria University

SCOPE

Akorn Educational Services

Project Brief

As a group of five St Catherine's students from year 10, we were accompanied by Mrs Jackson McRae and travelled to Lilydale to see the Scope Centre. We were met by Kathy who runs the centre, Georgene from AKORN and our electrical engineer from Victoria University, John Chlond. We were lucky enough to have the privilege of meeting several people who visit the centre on a daily basis and are sadly affected by a disability. It was a moving experience meeting these people and hearing their stories; we were told that we would be able to create a device that would assist the motor skills of these people and be something that would improve their quality of life. We would be able to utilise our creativity and scientific skills to complete our choice of an electrical device. This prospect was very exciting and also nerve racking as we would have to overcome several obstacles and learn many new skills to enable us to complete this challenge.
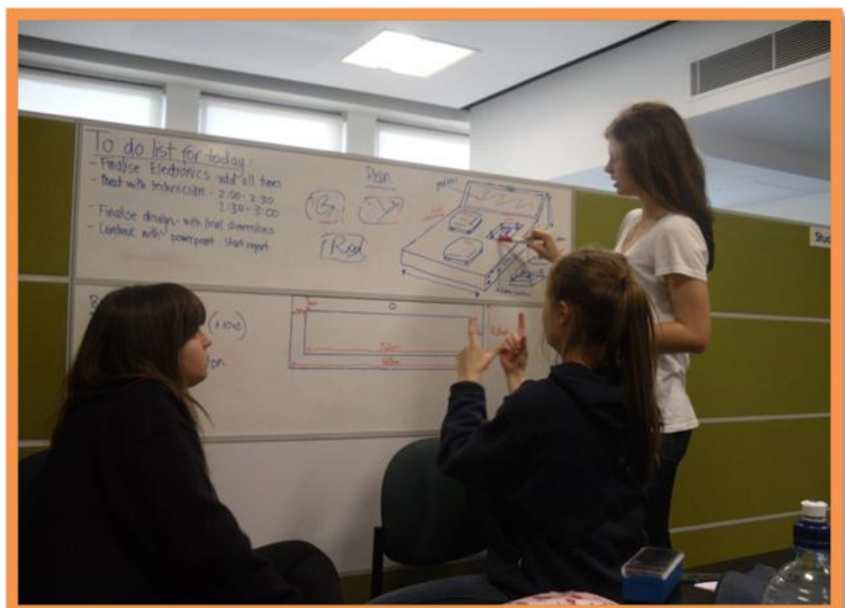
Summary of Our Time At Victoria University

Day 1: Wednesday 8th September 2010

- Arrive at Victoria University
- Meet with John, Alec and Georgene
- Introduction to PICAXE programming software
- Exploration of technology by commanding and programming an electric car

DAY 2: Thursday 9th September 2010

- Modify design for device
- Choose tunes, modify
- Learn to program computer chips in collaboration
- Discussion of device construction

Day 3: Friday 10th September 2010

- Modify design
- Meet with Don and Laszlo – fabricators
- Brief them on our design
- Finalize electronic circuit using PICAXE

Day four: Monday 13th September 2010

- Finalize measurements and sketches for design
- Finalize plans
- Meet with representatives of the Computer Engineering Department from the Polish Technical University of Lodz

Day 5: Tuesday 14th September 2010

- Presentation to St Catherine's representatives, members from the Scope institute, and representatives from Akorn.

Our Experience at SCOPE Lilydale

When approaching Lilydale we didn't really know what to expect as we weren't entirely aware of the severity of the disabilities. We met some of the people who attend SCOPE on a daily basis; they were two girls with Retts Syndrome, Shenae and Elia, and two other people, Nick and Jim. Kathy explained that when Jim was a child of only 7 years he was hit by bus which essentially changed his life. The fact that he could not have lived a normal life was very confronting and upsetting for us. However, we were reminded that he, along with many others at SCOPE, live a happy life at the centre because of the fantastic staff and assistance they are all provided with. We also met Nick who loved scrunching and ripping paper which gave us an insight into the vast range of enjoyments we could potentially cater for and the complexity of device which we could hopefully create. We were shown a few of the recreational toys such as lava lamp which greatly entertained the people and a textural mirror which the girls with Retts enjoy because they like to look at themselves in the mirror and to feel different textures. However, we wanted to provide them with an exciting tool to improve their motor skills maybe in addition to a sensory toy. The tool would help them keep active as Kathy explained that they would just sit for most of the day in their wheelchair, if they had one, or otherwise remain immobile if it weren't for the interactive environment at SCOPE. We wanted to create a, hopefully, valuable addition to this fabulous environment. Meeting the people who attend the SCOPE centre immediately inspired us to do something to help improve their lives.

What We Hoped to Achieve

After meeting with the potential recipients of our device, we were inspired to enhance their quality of life by developing their motor skills. We were moved by their enthusiasm towards the simplest things such as lights, tunes, texture, etc., which they interact with currently at SCOPE and we wanted to provide an additional, and the best possible, device which would increase their happiness whilst improving their motor skills. We were excited by this fantastic opportunity and couldn't wait to get started
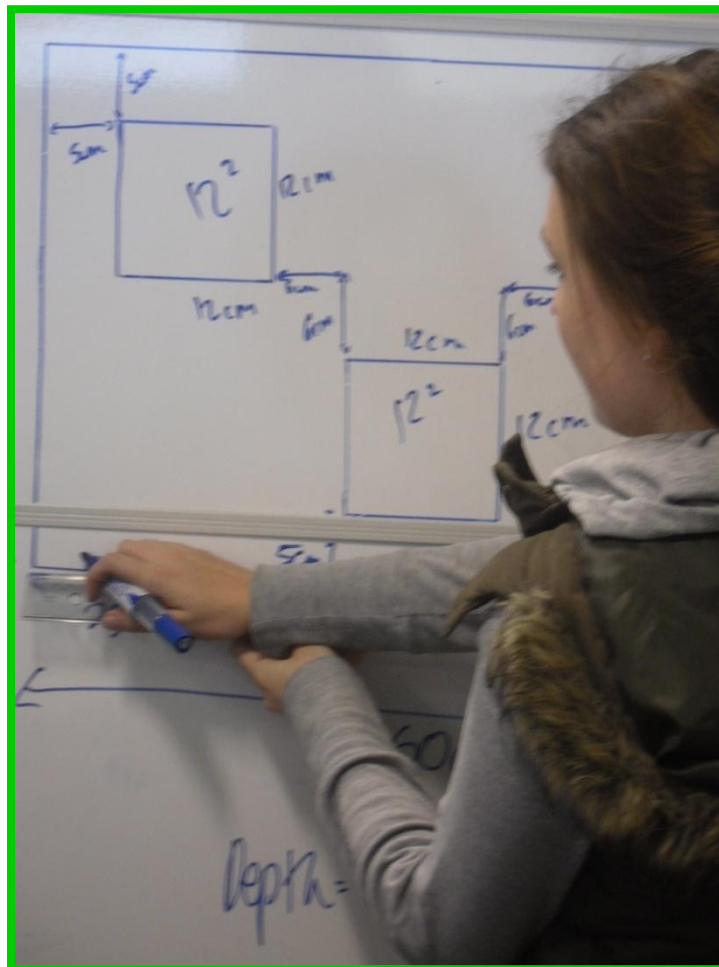
How can we help? First Ideas

When presented with this exciting challenge an immediate idea was generated due to a game on the iPhone named TapTap which involves waiting for a moving light to flash over a circle and tapping it. The inspiration from the game lead to the initial development of the device we would create. We didn't know the extent of the technology we would be able to use before going to the University so initially our ideas were quite ambitious. We wanted to provide something to engage them. We planned to have a light flash on a single button and this would be an incentive to have the user press the button which would activate an approval sound. The device would enhance their motor skills by inviting them to move to press the bright button with the cheerful approval tune which would in turn stimulate serotonin production in the brain. Proof of the motor skill enhancement was evident when playing TapTap because as one plays more (of course with practise) one can become quicker and more accurate which is what we hoped would result with people who play with our device, though in a much more simplistic way. In summary we developed this idea with the aim to improve their motor skills and mental health.

Expansion of Ideas and Designs

An idea we had in the beginning was a sensory board which would provide several textures, along with a mirror, this would provide the user with enjoyment but we decided against this idea as it failed to utilise our scientific skills or any electronic engineering.

We expanded the above idea by including some form of button that would cause a light to flash and a tune to sound; we were worried that a sensory board plus electronic buttons, and a mirror would be overwhelming for a user and too complicated. We liked this idea but we wanted to simplify it so we created our first sketch which is shown below.
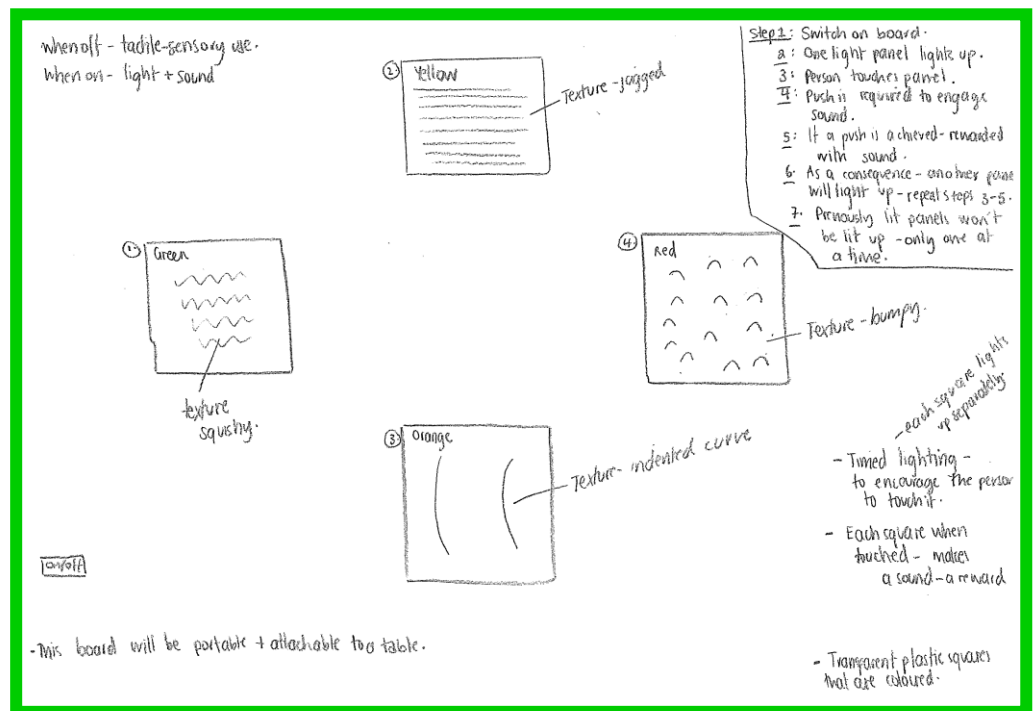
Exploration of New Technology

We were introduced to PICAXE, a programming editor that would eventually allow us to construct the electrical circuit for our final device. We began by performing a simple task of programming an electrical car. The aim of this task was to explore the technology, utilising these basic skills to use later on in a more advanced sequence. Through a series of flowcharts we were able to program the car to perform a 'dance,' which involved a sequence of movement including moving forward, backwards, left, right, and flash lights.
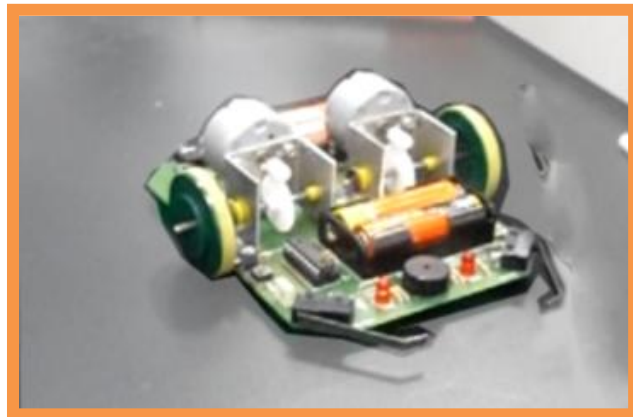
The Electrical Process

Monophonic tunes were downloaded from the web and we edited them so they weren't too long. The three tunes that were selected were row row, blue peter and the Flintstones theme song. These songs were selected as they all had different tempos and familiar tunes, and we thought they would entertain the users. The lights that flash alternatively flash in time with the music for extra effect.

After playing with the motor vehicle we learnt how to program tunes to play when we hit a specific button. We constructed the flowchart, so that if we hit a certain button, a certain tune would play. The two chips that were used were an 8M and 18A, the 18A has the buttons connected to it, and when certain buttons are selected, the 18A chip sends a pattern of numbers to the 8M chip, which will then play one of the three tunes imported onto the chip and make the lights flash alternatively. We were able to identify the numbers that would be sent from the 18A to the 8M by using a truth chart. We found the results below:

| Input 1	Input 3	Tune played
Not selected	Not selected	No tune
Selected	Not selected	Tune 1
Not selected	Selected	Tune 2
Selected	Selected	Tune 3
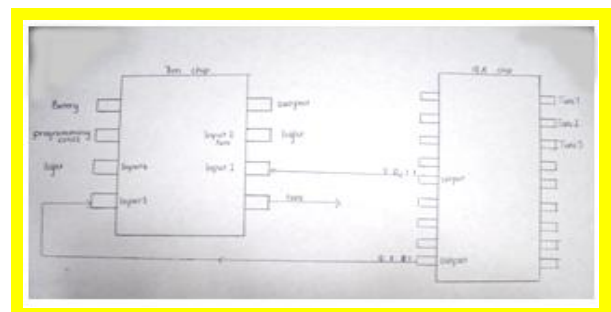
Putting Together the Final Idea

We started with our original idea of a simple box shape with four buttons that had tunes and lights. We transformed the original to a more advanced 'Motor Skills Enhancing Device', this new idea involved 3 buttons which are all spaced in proportion to fit the needs of the disabled users as they have more room in which to move their hands, equalising in less frustration and a better visual effect. The tunes and lights are synchronised when a button is pushed, as a reward. We added a mirror as a part of the design which we had trouble deciding where to place because we wanted it to be able to be used appropriately. We were told when we visited SCOPE that many of the women there appreciated using the mirror to look at their reflection. We decided it had to be angled towards the user, propped up. Instead of a fourth button we added a sensor which was to be placed above the mirror to enhance the user's motor skills, as they would wave their hand in front, this would cause the sensor to pick up the movement and again tunes and lights reacted as the reward.
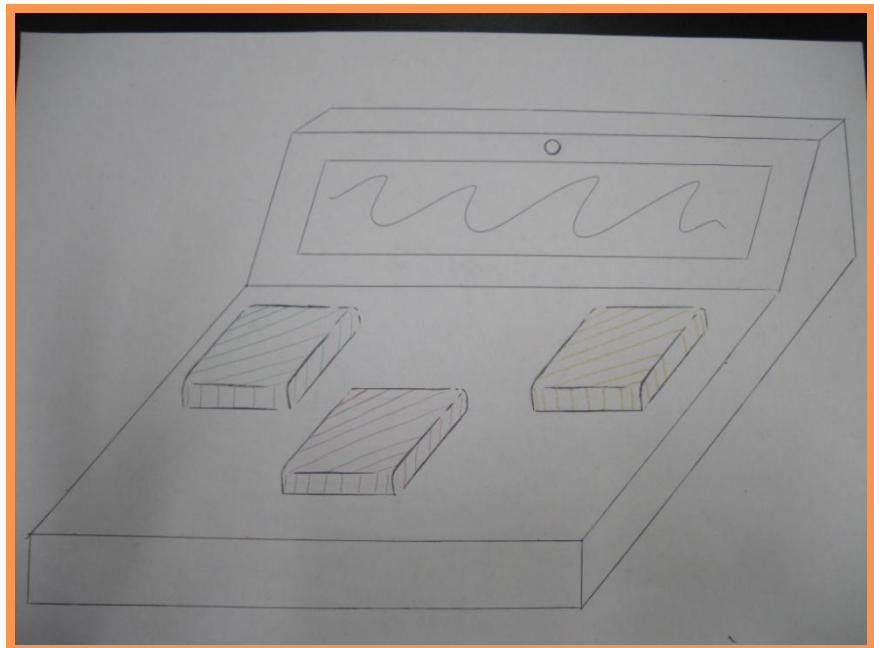
The iThing – Finalized Plans

- ### Front on final plan
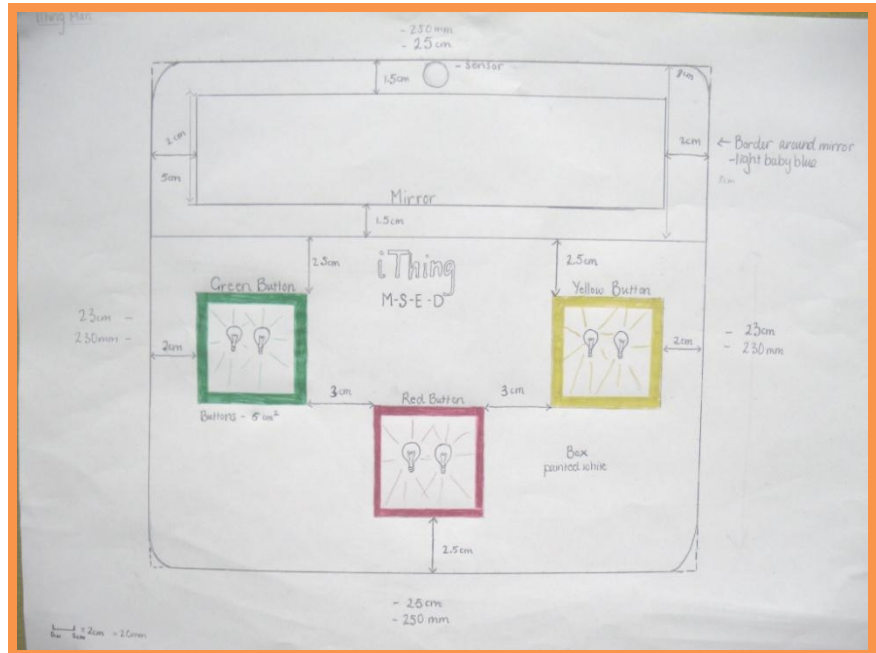
- ### Three dimensional final plan

The Implementation Plan

Now

1. Limited Knowledge of electronic engineering
2. Excited to provide assistance to physically/mentally impaired people
3. Discussions of what will be covered in the coming week
4. Tour and become comfortable with Victoria University
5. Learn the technology we will be using

Where

1. Greater knowledge of electronic engineering and processes
2. Completed PowerPoint
3. Completed documentation of our work – hard copy report
4. Well rounded and quality presentation and motor skill enhancing device

Goals/Objectives   **What must be done to achieve these goals**

Learn: 1. Question/Ask/Research
                 2. Listen to speakers, teachers, instructions
                 3. Take relevant notes

Report: 1. Document as we progress
                 2. Take photos/ videos
                 3. Brainstorm
                 4. Assemble

PowerPoint: 1. Summarise report
                 2. Create visually appealing presentation
                 3. Rehearse and present

Presentation: 1. Plan the speech
                 2. Write up speeches, prepare cue cards
                 3. Rehearse and present

Device: 1. Learn and practise using electronic engineering tools
                    and program
                 2. Begin putting it together
                 3. Deliver plans and measurements for the device to be made

In Reflection

The whole experience of SCOPE and Victoria University has been enlightening, for us to help to make a difference. As a team we have learnt the basics of the technology needed to create this 'Motor Skills Enhancing Device', the flowcharts, PICAXE and the micro-chips. It has been interesting to discover the 'behind the scene' expertise that Victoria University uses daily. We have been working with the experts John and Alec on the educational side and have become more aware of the university experience with a lot of freedom and independence. We hope that our creative design is significant to future students, who will expand on our project, and improve the purpose of motor skills usage. This challenge has been rewarding as giving us the experience we need if we want to have a career based on engineering and science. We trust that this device will give joy and education to the disabled users; we have worked hard to ensure that they do not get bored or frustrated with this machine, but also that it will develop their skills and encourage involvement. We look forward to see what future students will produce and how this advanced technology will help the users improve their motor skills and provide them with entertainment. We are truly grateful to have been given this opportunity.