STUDENT SHOWCASE

Materials (Hard)

Materials (Soft)

Food and Bio-related

Digital Tech

Electronics

- Sitting duck game
- Remote-controlled lawn mower
- Spinning LED display
- Automatic Gate Opener
- Portable Wind Turbine
- Electronic Matchbox Bug
- PICAXE GPS Autopilot
- House Alarm
- Remote Stoat Trap Monitor
- Motorised Projector Mount
- Electronic Scoring Hoop
- Rugby Practice Target
- Fridge Door Alarm
- MP3 Speaker Unit
- Heated Slippers
- Drinking Fountain

Graphics

Scholarship Exemplars

User-programmable spinning LED display

Logan Glasson

Burnside High School, Christchurch

Year 9

Logan's father saw a novelty handheld fan that produced simple messages with LED lights and suggested that Logan could make something better. Logan took up his father's challenge, planning to vastly improve upon the shop-bought fan, which could only display text and limited characters in a circle, making part of the message upside down. These limitations formed the basis of Logan's initial brief: To create a spinning LED disc that could be programmed to display straight lines, squares, pictures and straight text. The brief also specified that the display must be easily programmed and that the image must appear still to the human eye and be bright enough to be seen clearly in daylight.

Before making his own example, Logan looked on the internet to see if there was an existing product that fulfilled his father's (now his client) specification. Although there were some hobbyist projects, they mostly relied on a constant speed to create their images.

Although Logan initially planned to have a motor to spin the LED disc, he decided to try and make a hand-spun version. "It became clear that having it work under varying speeds would actually be a unique design strength and make it more commercially useful, so this became part of my goal for the project."

Logan found one other example on the net that used variable speeds but it was difficult and time consuming to use as it only used its own program and couldn't convert bitmap images. By solving both the timing and programming concerns Logan knew that he would be creating a unique product with a marketable point of difference.

Logan started experimenting with different combinations of processors and sensors, starting with a Picaxe microcontroller with a reed switch. While the Picaxe is cheap and easy to programme, Logan found its processing too slow to power the number of LED lights he wanted to use, and, in combination with the slow, mechanical reed switch, could only produce one wavering dot. Logan decided to try and master the configurations of an optical switch - a much faster system that works by sending a light beam across a gap, detecting when the gap is obstructed. Logan says the switch revolutionised the timing aspect of his project by giving reliable and precise positioning information. Logan still wasn't happy with the overall results he was getting however.

"I was still frustrated with the Picaxe being so slow so I experimented with a new timing method, cutting a disc with 72 teeth so that the Picaxe wouldn't have to do any timing. This worked but there was no indication of orientation so the unit would display semi-rotated images at random and the disc was also very delicate and time-consuming to make."

Logan talked to an electronics expert at his father's work, who recommended a ATtiny 2313 microprocessor which operates up to 20,000 times faster than the

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Drug abuse learning tool


Sitting duck game


Fashion collection

Picaxe and has added features that proved invaluable to Logan's projects such as internal timers, interrupt capability and the memory to store up to ten 55-pixel-diameter images. The ATtiny's increased capability also added an extra challenge to Logan's skills as he had to learn 'C' – a programming language he was unfamiliar with – in order to use it, which Logan found a "time consuming but rewarding aspect of the project".

The combination of the optical switch with the ATtiny 2313 microprocessor proved to be the winning combination for Logan to achieve his initial goal, giving him "fast, clear data acquisition, processing and display".

To obtain maximum visibility, Logan trialled several different LEDs before choosing super bright red LEDs with a wide viewing angle, enabling the unit to appear just as bright when viewed from the side. Logan also enhanced the resolution for daytime viewing by filing the edges off each of the 28 LEDs, enabling them to fit closer together on the disc.

The finished project enables the user to draw images in Microsoft Paint, which are then converted, with a program Logan wrote himself, to a compatible format. This is then loaded onto the LED unit with programming header sockets.

Logan says he found the project extremely enjoyable and rewarding as he had to learn about several unfamiliar areas along the way including the 'C' programming language, circuit design, trigonometry LEDs, sensors, and even using a lathe.

Logan is happy with his finished project and feels that he has created a truly unique combination of software and hardware. "No other product that I found can display images at varying speeds and show square images, so I think that I will develop this further and try to make a commercially viable product. I believe it could be developed to be mounted on a small wind turbine which would generate its own energy and show company logos, or be used on a car wheel to display a picture as you drive."

Logan's project has already attracted interest from electronics retailer SICOM and several marketing firms who believe the unit has serious advertising potential. Logan has also received numerous awards including first place in the 13-14 Years category and the People's Choice Award at the national Bright Sparks Awards 2009, and the Secondary Technology first prize at the Canterbury/Westland Science Fair. He has since earned a spot at the Genesis Energy Realise the Dream event, which "celebrates, rewards, challenges and showcases the work of extraordinary school students from all over New Zealand", for which he has made a trip to Wellington.

See also:

Logan's description of his project for Techlink: Spinning LED Display (pdf, 2Mb)

Video of logan explaining his project, from the Bright Sparks site:
http://www.brightsparksawards.org.nz/finalists/13-14-years/logan-glasson-2

Student Showcase of Logan's Year 8 Technology Project: Remote stoat trap

monitor