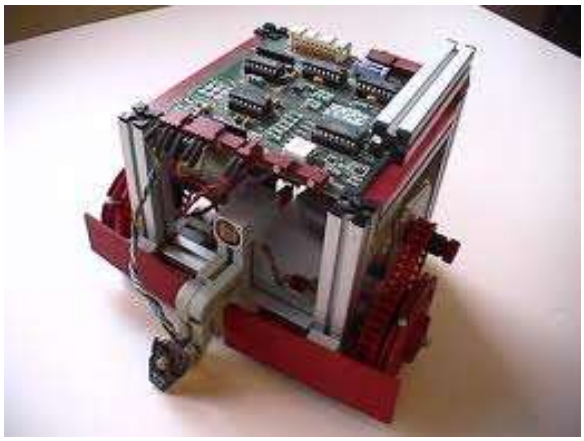
Cheap and cheerful digital technology kit for kids (of all ages)

Adrian Oldknow aoldknow@yahoo.co.uk March 2012

In 1982 the BBC launched its digital literacy programme on television, based around the BBC micro created by Acorn Computers in Cambridge, Kenneth Baker became the first Minister for Information Technology in Sir Keith Joseph's Department for Industry and Mrs. Thatcher announced the establishment of the Microelectronics Education Programme for Schools. This was all in response to what was then seen as the "challenge of the chip". Now, 30 years on, we are back in a similar situation. This time the challenge is to develop in young people the technical skills, curiosity, inventiveness and creativity required to maintain the UK's international competitiveness and prosperity. While we are still waiting for the government to show leadership in encouraging schools and teachers to play their full part in this, the good news is that the kit has never been cheaper or easier to use than right now. But first - a look back to see what could be achieved.

The BBC micro had a very high specification which included a "user port" for the connection of a range of peripheral equipment. One of these was the "BBC Buggy" which could be programmed to control motion and to respond to sensed data e.g. with a pressure sensor.



Another device was the Versatile Electronic Laboratory Aid called VELA for data-logging in Science.

http://www.retro-kit.co.uk/VELA/

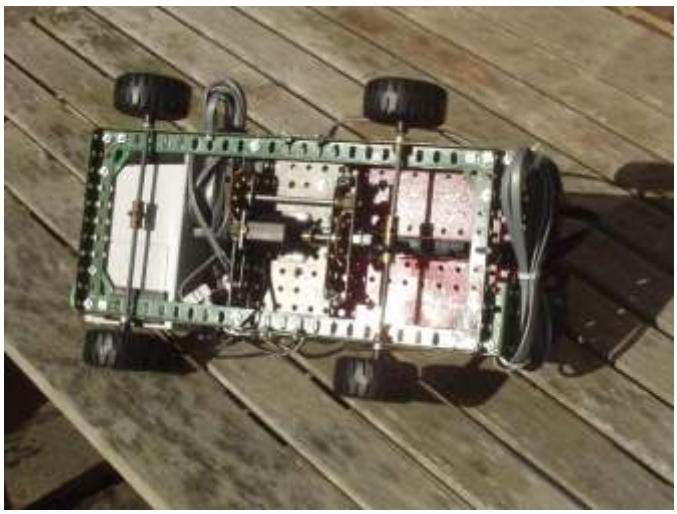
http://www.computinghistory.org.uk/det/16958/Vela-Mk-2-Data-Logging-Unit/

There was also a motion sensor based on the ultrasound system used by the range-finder in early Polaroid cameras. Needless to say these tools did not come cheap!

By the end of the 1980s there was a range of hand-held devices generally know as Graphical Calculators which began to find their way into education. These were in fact versatile computing devices and were much more portable, robust and cheap than their desk-based cousins. So a range of peripheral devices were developed for use with them, such as the Texas Instruments' CBR and Vernier Go!Motion range-finders.

The first photo shows a graphical calculator connected to a range-finder – just fine for outdoor use.

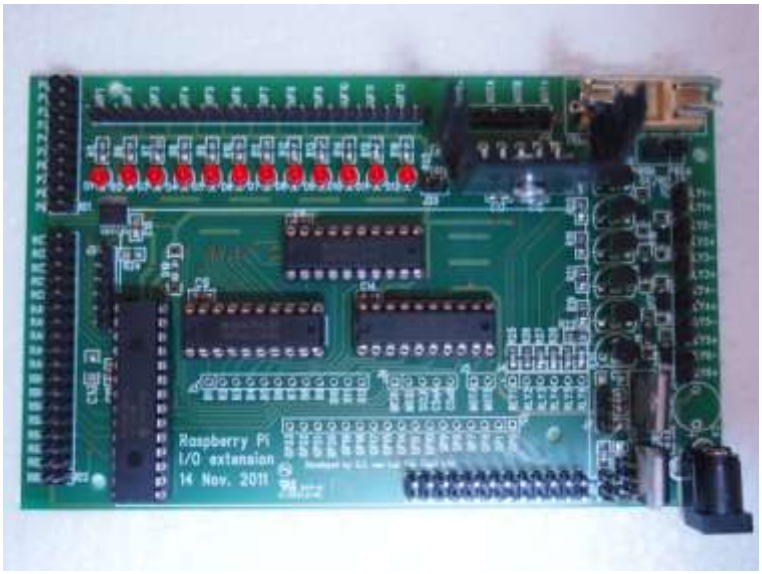
Whereas the BBC Buggy had been built with expensive Fischertechnik components there was now the opportunity to devise self-contained robotic projects using cheaper Meccano and Lego components. The model shown here is based on the "Sojourner" Mars explorer vehicle and uses a graphical calculator program to sense when the light detector has reached a critical value (representing sunrise on Mars) and then to fire a relay on the primary school control box which puts the electric motor into action. The buggy moves forward slowly while sensing its distance from any object in its path using the range-finder. When this is within 1 metre, it stops, flashes its light and sounds it buzzer, before reversing away to a safe distance!



Now a cheaper and quite versatile, powered educational construction "toy" is available in the range of "K'Nex" components. So what are the control and sensing devices which can now push down the prices of the digital electronic kit to tens rather than hundreds or thousands of pounds?

One key tool is the recently announced Raspberry Pi single board computer designed and created by a group of visionary philanthropists in Cambridge. http://www.raspberrypi.org/faqs

It's a "Raspberry" because it's neither an Apple nor a Blackberry – and the "Pi" is shorthand for the Python programming language. The educational version of the board should be available in the Autumn with a large range of free and open-source software on its memory card. It is anticipated that there will be two versions, one at about £16, and the other, with Ethernet, at £26. As well as programming languages such as Alice, BYOB, Python and Scratch (maybe BBC Basic too) it is anticipated that the powerful GeoGebra software will be included.

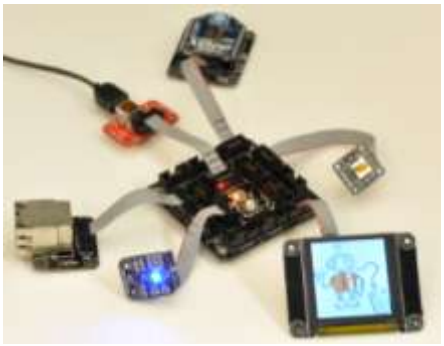


There is also now a range of relatively low cost electronic micro-controllers which can be programmed to carry out tasks like those of the Mars explorer vehicle. One such system comes from the Italian Arduino project: http://www.arduino.cc/ . The Raspberry Pi people have also announced their intention to develop their own "Gertboard" version: http://www.raspberrypi.org/archives/411

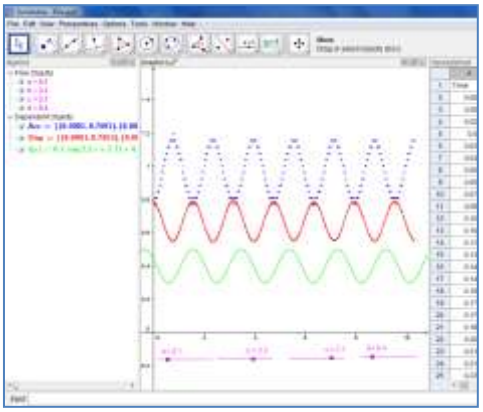
The kit shown in the two photos below is the very cheap and tiny Minimus AVR USB development board (costing less than £5) http://www.modtraders.co.uk/minimus-avr-usb-development-board.html and the expEYES data-logging system for science developed by the Indian Phoenix project at their Accelerator Centre in New Delhi http://expeyes.in/ (costing around $20).

Of course the peripheral devices such as data-loggers and micro-controlled circuits can also be used with existing computer technology including Windows devices. Microsoft has developed a software system to support robotics developments which is free to education: http://msdn.microsoft.com/en-us/robotics/default . The Microsoft software also supports the use of their Kinect sensor bar for experimental work. There is also free software to support development of digital control called .NET Gadgeteer: http://www.netmf.com/gadgeteer/. This can be used with your own kit, or with existing experimental kits such as ones built around the GHI Fez Hydra and Sytech Nano controller boards:





Using wireless connections, such as Bluetooth, other familiar devices, such as Nintendo's WiiMote controllers, can be utilised. WiiMote has an infra-red camera which, together with a simple set of LED emitters, can be used for accurate range-finding. The figures show the elephant in the room dancing up and down, and the data being fitted by sine-curves in GeoGebra.

So we already have a number of practicable approaches around which to build a range of projects and experiments for schools and homes. Of course these techniques are also being built into toys aimed at today's kids! Here is a retro toy, based on the 1980s "bigtrag" device. The boys (aged 5 and 9) are programming it in a Logo-like system to do a lap of the dining table and fire 4 rockets up my leg!

Child's play –

and it isn't rocket science.

But it could be!