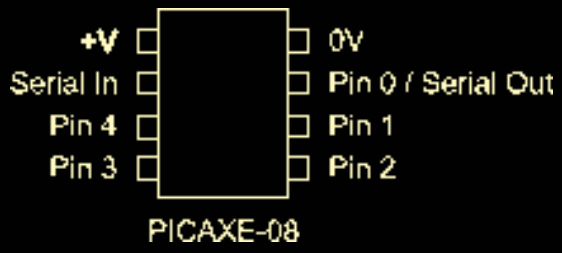
AN INTRODUCTION TO PRACTICAL PICAXE

This is the first in a series of articles by John Cook a TEP associate with wide experience of all things PIC based. Aimed at colleagues who as yet have not found the joy of using PIC's, confidently and reliably. The PICAXE programming system is commonly used in schools today and was developed by Clive Seagar of Revolution Education.

For the past twenty years 555 Timers, 741 Operational Amplifiers and Decade Counters were the basic building blocks for most of my GCSE Projects. When I was introduced to PIC Technology the potential was obvious, there use in a vast range of everyday products which pupils own or use on a daily bases gives real purpose and relevance to integrating them into classroom activities and pupils projects.

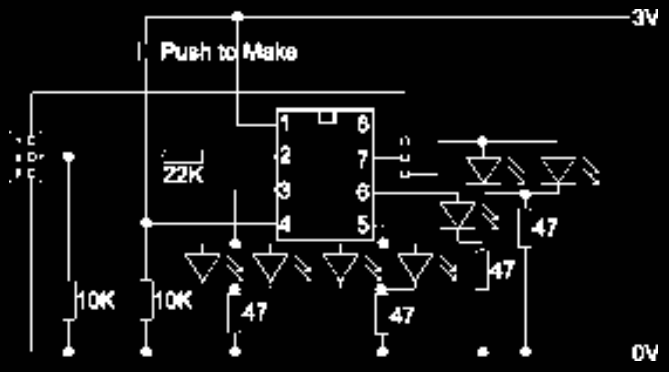
Industry is moving to Micro-controllers; in 1998 300,000 were used by 2000 this had risen to a staggering 300 Billion. The most appealing aspect of these computers on a chip is there versatility, one chip programmed in different ways can be utilised in a wide variety of products. If we are supposed to be educating pupils for the real world then this sort of technology should be an entitlement for all pupils.

The PICAXE software is free from the WEB and does not require an expensive programmer; all that is required is a serial download cable that programmes the chips on the pupil's circuit boards. This has many advantages, apart from cost, one being the chip never needs to be removed for reprogramming and another is pupils can access the software at home to experiment with different programmes until they achieve their desired outcome. There are a range of chips available, these will be mentioned in future articles, but the lowest cost is the PICAXE-08.



As can be seen this chip has 5 input / output pins. Pin 0 must always be an output and pin 4 must always be an input. The other 3 pins pin 1, 2 and 3 can be selected as inputs or outputs through the programming. This labelling can be confusing as we normally think of pin 1 as top left and numbered anticlockwise to pin 8 top right of the chip. (A simple wall chart diagram in class or worksheet will keep pupils and some of us teachers on the right track).

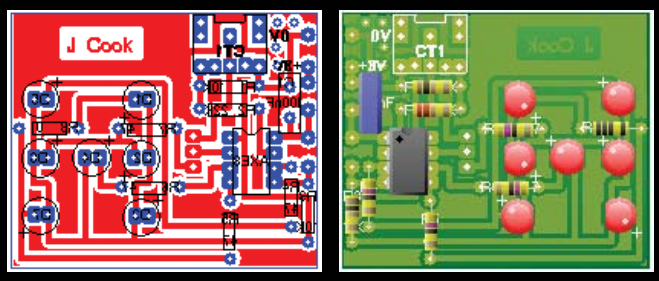
The Focused Practical Task for this article is a Dice. The input to generate a number will be a push to make switch and 7 LED's will be the outputs. This random output generator is useful for all sorts of other project applications.



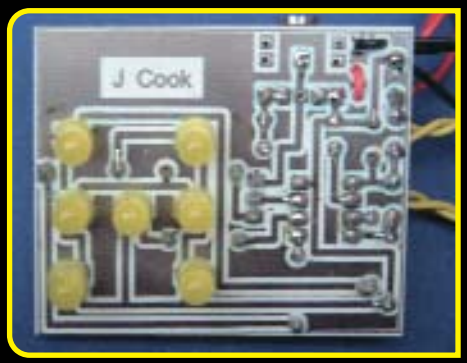
Circuit Diagram for 8 Pin Dice

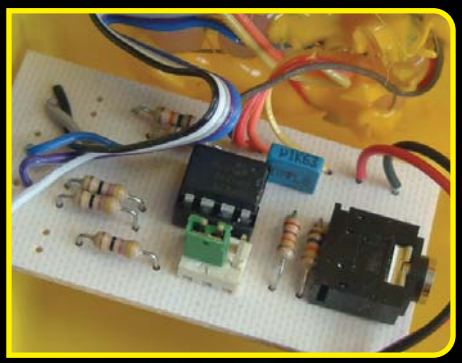
The circuit shows the pin-outs for an integrated circuit but care needs to be taken not to confuse these with the output input pins, for example pin 4 is input pin 3. Pupils can experiment within Crocodile Technology to establish how to get two LED's to light brightly and what size resistor is suitable for a 3V or 4.5V supply. Note that four outputs easily drive the six alternative LED combinations.

As this is a Focussed Practical Task, for Year 9 perhaps, there is no necessity for pupils to create their own PCB's, so below is an example that has been produced within PCB Wizard and is available on the TEP Website.

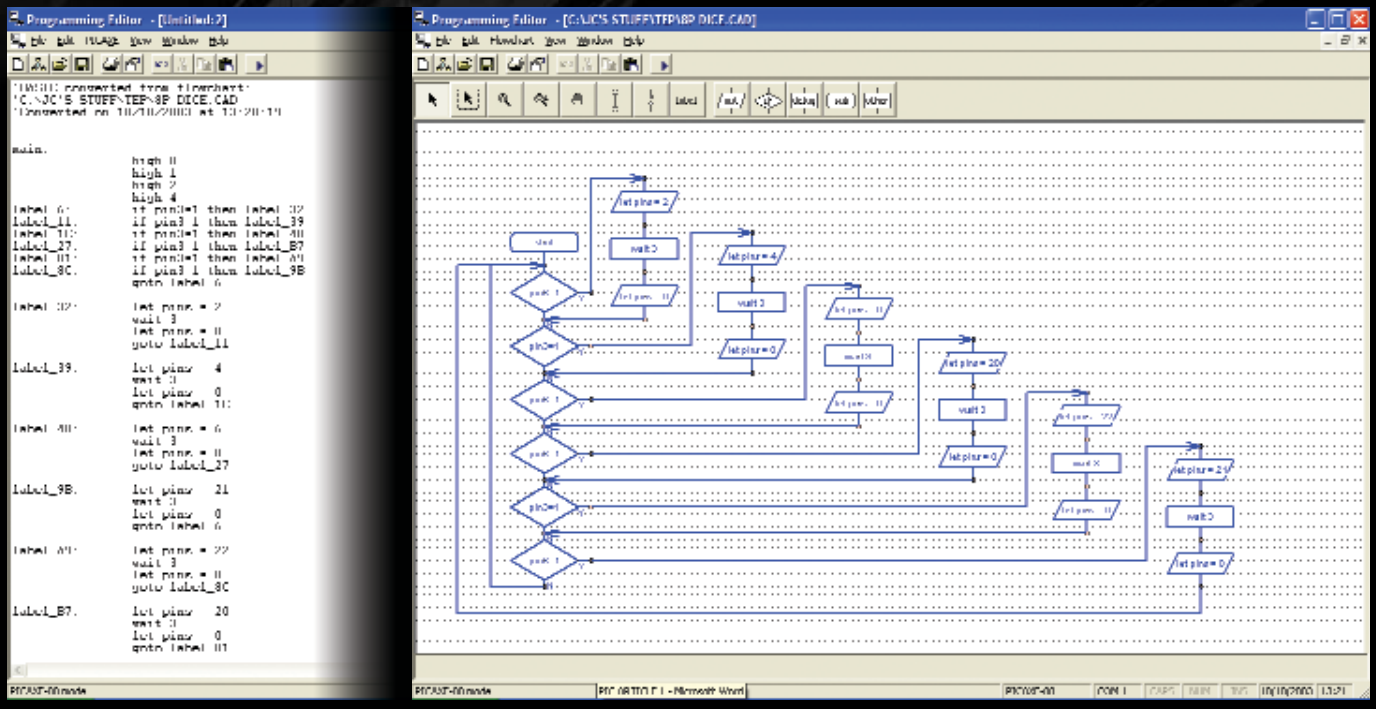


It is then a case of populating the PCB with components which can be obtained from various suppliers, but the chip has got to be a PICAXE-08 and can not be substituted for other 8 pin PIC's. (They are the same cost as un-programmed PICs and can be obtained from Teaching Resources or Revolution Education) The LED's can be mounted on either side of the board depending on whether the project is going to be encased and they could also be attached to longer wires. (See photos below)





There are numerous different ways the dice can be programmed but here is one possibility.



There are subtle programme differences depending on which side of the PCB the LED's are positioned. It is then a simple operation to convert the flowchart to basic under flowchart heading. Draw the flowchart or copy the basic routine in the table and you are ready to programme the PIC.

To programme the chip the serial cable needs to be connected to the computer and plugged into the PCB, there must be at least 3V going to the circuit and switched on and then simply press the blue run arrow. The circuit has been produced to run from two AAA Batteries giving a 3V supply, a problem that can occur is that unless the batteries are in new condition they may not create a high enough voltage to allow programming. To get round this potential problem use 3 AAA Batteries, giving4.5V, to programme and then revert back to 3V for normal use.

For the PICAXE-08 it is necessary to type in either high or low for the output pins. This is because 3 pins can be either inputs or outputs and it is necessary to identify at the beginning of the programme which are the outputs. Note the PCB mounted jump link this is so you can connect and disconnect pins 7 and 8. We do this to switch from programming to output for pin 7. If a jump link is not available or desirable an external slide or toggle switch could be connected instead and mounted on the outside of a cased product making reprogramming easier.

This is an affordable project that has a lot of scope for engaging pupils with today's technologies. Future articles will look at programming aspects as well as more advanced projects, some of which are shown below.

The finished Electronic Dice. The circuit board and battery are encased in a vacuum formed box.

Further help or assistance can be obtained by emailing John Cook at: jcookl ggs@hotmail.com