

PRACTICAL PICAXE PART 3

Security Projects

Following the work on the security PICAXE work in the last issue of News and Views, John Cook takes us further with a detailed look at DC motor control as an alternative starting point. Readers are reminded that all PCB files featured in Johns articles can be downloaded from the TEP website at www.tep.org.uk

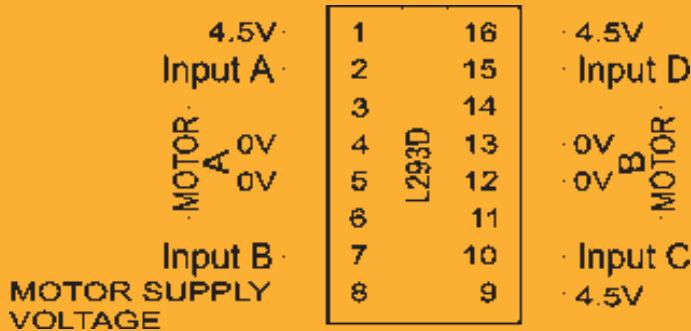
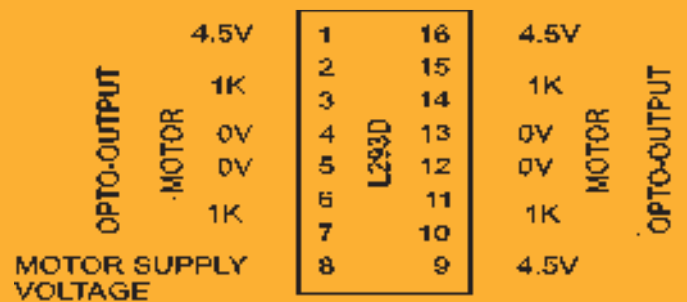


Still continuing with the Security Theme another very popular project for GCSE Systems and Control is Security Cameras that appear to be scanning continuously. With the changes to the syllabuses requiring a project to have a mechanical output this project would satisfy this requirement.

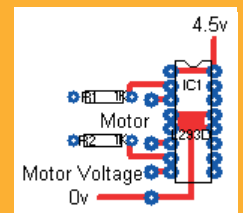
An easy way to achieve a mechanical output is by using an electric motor that can produce rotary motion, or using cams to produce reciprocating motion and cranks and levers that can produce oscillating motion. The aim of this article is to explain how motors can be successfully controlled by PICs. Many years ago, in the days of BBC Computers, I used to teach control using Lego Buggies and Control Boxes. I used to produce my own control boxes, and that is where I remembered about opto-isolators, which required a motor reversing circuit.

Thankfully there is a chip, the L293D stepper motor driver chip, which is capable of controlling two DC motors.

The inputs require a 1K protection resistor and so the final circuit is as below.

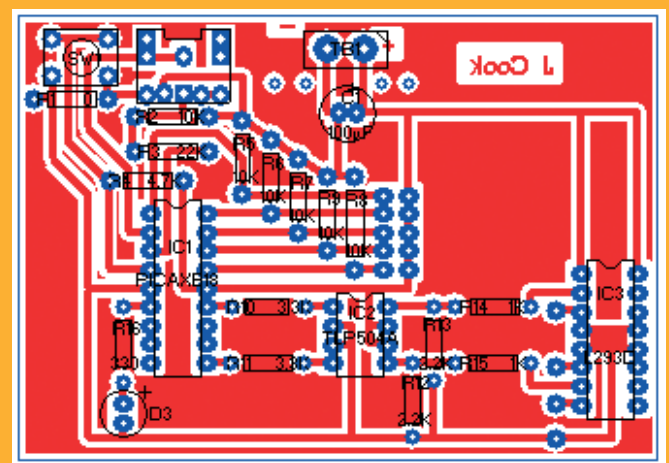


As with the circuits described in the last issue this has been produced as a PCB Wizard Module shown right.

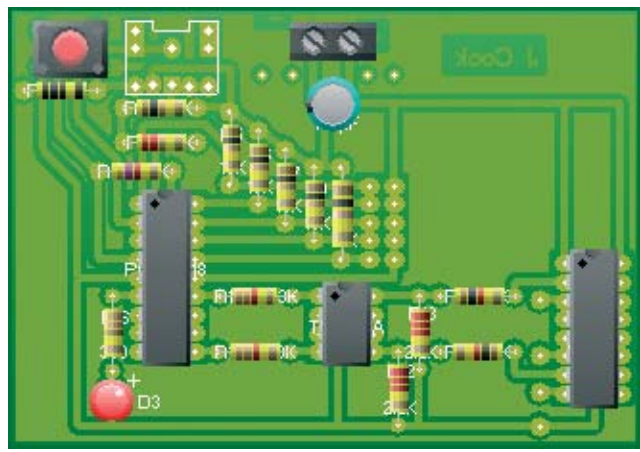


As motors are electromagnetic devices, which can create a lot of noise, I always get pupils to use an opto-isolator. The module above is only driving one motor and for the security camera described here that is all that is required, if there is a need for two motors or indeed a stepper motor the inputs and outputs on the left side of the chip are mirrored on the right side. Pupils can still obtain the highest grades with one motor.

Inputs A and B control motor A and inputs C and D control motor B. If the pair of inputs to a motor are both low there will be no output to the motor and similarly if both inputs are high then there will be no output to the motor. If input A is high and input B low the motor will rotate in one direction and if input B is high and input A is low the motor will run in the reverse direction. Obviously the same is true for inputs C and D controlling motor B. Another useful feature of this chip is to be able to run the motors from a separate power supply of a different voltage. This allows the PIC Circuit to run at say 6v and the motors run off 3v that helps keep the motor speeds of the cheap DC Motors down, and also appears to help prevent voltage fluctuations to the PIC Circuit.



The PCB Wizard example shows the basic PICAXE 18 Module, an LED Module, the Opto Isolator Module and the Motor Driver Module.

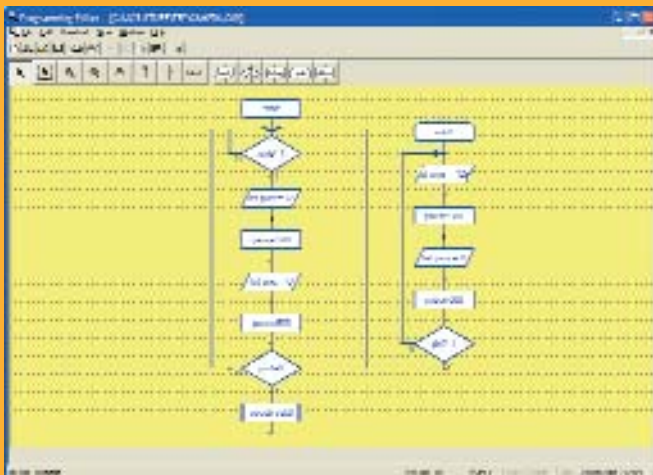


Most pupils wanted a dummy camera to scan within certain limits and to have an LED flashing to catch peoples' attention and act as a deterrent. There were numerous different solutions produced, most used a switch as an input to run a programme when turned on. Limit switches were used as inputs to change the camera direction when turned on. All the pupils used the TEP Universal Gearbox, which with tweaking gave a reasonable output speed.



This model camera shows a typical layout using a bent aluminium strip to activate the limit switches and a Universal Gearbox with extra gears. The programmes were varied with some wanting pauses at certain points, but a basic programme did nothing until a switch was turned on and then the camera moved in one direction and the LED flashed until it hit the limit switch and the camera reversed direction until it hit the other limit switch.

Early programmes made the camera move too fast, so pupils experimented with Pulse Width Modulation (PWM). PWM is where the motor is switched on for say 0.5 second and then switched off for 0.5 second. The on/ off ratio can be varied until the desired effect is achieved.



This programme has the on/off switch on input pin0, nothing will happen until it is switched on. As soon as pin0 goes high the camera moves right, output pin4, and the LED, output pin0, comes on for 500milliseconds, 0.5 second, then the outputs are turned off for

500milliseconds. If the camera has not reached the right limit switch, input pin1, then the camera is moved in 500millisecond pulses until it does or the on/off switch is turned off. When the right limit switch is turned high then the sub routine starts. This pulses the LED and output pin7, which moves the camera left, until the left limit switch, input pin2, is turned high at which point it returns to the main programme. This programme is converted to Basic in the normal way and then the PIC can be programmed via the serial download cable.

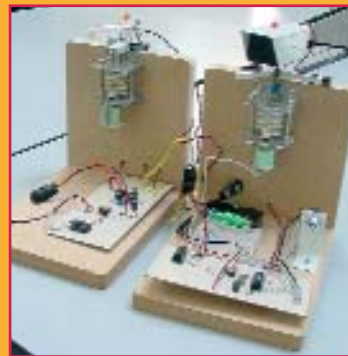
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    BASIC converted from Flowchart.
    CONSOLE: *****CAMERA.CAM
    Converted on 27/04/2004 at 17:28:56

    main:
    label_14:
    if pin0 = 1 then label_14
    goto label_14
    label_10:
    led pin0 = 1
    pulse 500
    led pin0 = 0
    pulse 500
    if pin1 = 1 then label_14
    goto label_14
    label_54:
    goto sub0
    sub0:
    led pin0 = 1
    pulse 500
    led pin0 = 0
    pulse 500
    if pin2 = 1 then label_14
    goto label_60
  
```

The programme can then be easily modified or improved until the desired outcome is achieved. The ease with which changes can be made and downloaded to the chip, without the need for removing the PIC from the pupils circuit is a major plus for PICAXE.

Here are some pupils' examples.



For further help or assistance you can email John Cook at: jcooklgs@hotmail.com