Fish Tank Heater

Design Brief

Design a precision temperature control system for a tropical fish tank.

Circuit Explanation

The circuit makes use of a digital temperature sensor type DS18B20. This sensor outputs an exact temperature in degrees Celsius, rather than a thermistor or thermocouple which only give relative values which are hard to calibrate.

The small 8 pin microcontroller communicates with the DS18B20 and translates the temperature into a serial string which can then be read by the PICAXE via the 'serin' command.

The 12V heater is switched on and off via a FET. Note how two separate DC power supplies are interfaced here – remember it is necessary to connect the two ground (0V) lines when working like this.

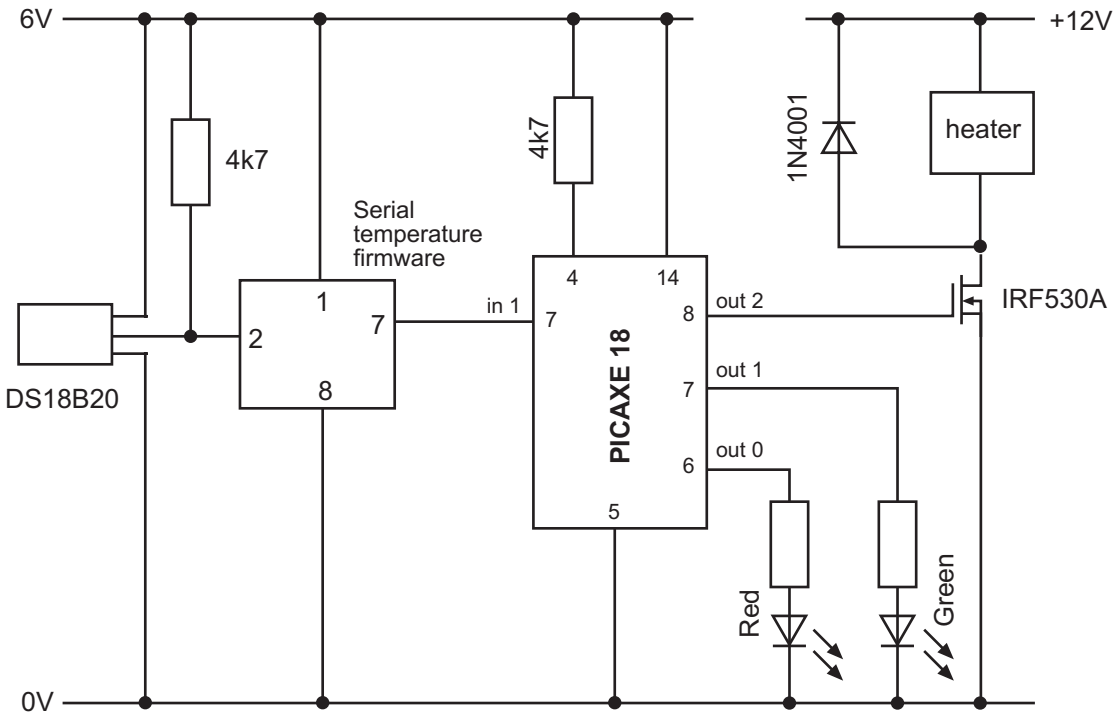
Note that a serial LCD module could easily be connected to this circuit, so that the actual water temperature could be permanently displayed on the LCD.

Program Explanation

The program waits for serial signals via the serin command. When the temperature is received bit 7 is checked by ANDing with 128, as this bit indicates a positive (0) or negative(-) number.

The number is then compared against the threshold temperature (26 degrees) and the FET is either switched on or off.

The extra commented lines in the program show how the temperature could be displayed on a serial LCD if it was connected to output 7.



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Program Listing

```
‘ Fish Tank Heater
‘ For PICAXE-18

‘ temp serial signal on input1
‘ red LED on output0
‘ green LED on output1
‘ heater on output2

symbol delay = b1
symbol counter = b2
symbol temp = b3
symbol neg = b4
symbol red = 0
symbol green = 1
symbol heater = 2

‘ first wait for temp signal
main:
     serin 1,T2400,(254,temp)

‘check for negative temp by
‘checking bit7 to see if it is 1
‘if it is then correct number
     let neg = 0
     let b6 = temp & %10000000
     if b6 = %10000000 then correct_temp

‘see if the temp is below threshold value
process_temp:

‘ *** optional to display value
‘ *** on serial LCD module on output7
‘    serout N,T2400,(254,128,”Temp = “)
‘    if neg = 0 then no_sign
‘neg_sign:
‘    serout 7,N2400,(“-”)
‘no_sign:
‘    serout 7,N2400,(#temp,”   “)
‘ ***
     if temp < 26 then heater_on

‘switch heater on
heater_off:
     high green
     low red
     low heater
     goto main

‘switch heater off
heater_on:
     low green
     high red
     high heater
     goto main

‘ temp is negative
‘ therefore set negative flag and
‘ mask out bit 7 so correct number
‘ is stored in temp variable

correct_temp:
     let neg = 1
     let temp = temp & %01111111
     goto process_temp
```

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