Heater with temperature and time dependent buzzer

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Abstract

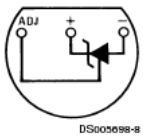
Often we have wanted to set a timer after which we would like to have our tea or coffee or favourite hot drink ready. In my project, I will use an electronic kit to record the temperature of the hot drink. If the temperature crosses a certain threshold (which you can set) then a buzzer will sound. We can also set a certain time after which the buzzer will sound irrespective of whether the temperature threshold has been crossed or not.

1 Materials required

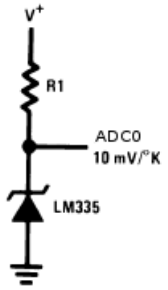
- **LM335Z** is the temperature sensor. It senses the temperature through a circuit involving Zener. The input voltage is fed into the PHOENIX ADC0 port. More information can be found from the manufacturer's website `http://www.national.com/pf/LM/LM335.html`.
- The PHOENIX box (an electronic kit)
- Two 1 kΩ resistors.
- A buzzer.

2 Procedure

LM335Z pin-out diagram is given below:



The circuit is shown as setup below: (The + pin of the LM335Z is connected to the ADC0 and 5V and the buzzer is connected across D0, R1 = 2 kΩ)



2.1 Program

The main work is done by a Python program, which does the following things:

1. Initialise the PHOENIX box
2. Take as input from the user, the temperature threshold, and the time threshold.
3. Write output 0, causing the buzzer to become disabled
4. Start loop
   (a) Poll every 5 seconds for temperature. For the LM335Z we have a linear relationship between voltage and temperature (10 mV/K).
   (b) Display on the screen, the temperature and the time elapsed.
   (c) If time or temperature threshold is crossed, break out of the loop.
5. Write output 1 for 5 seconds, causing the buzzer to activate, signalling that we should stop the heating.

The python program follows:

```
#!/usr/bin/env python
# Abhishek Dasgupta
# Coffee timer!
# Thu Apr 12 15:49:37 IST 2007

import phoenix
import time

t=0.0
# Read temperature
def gettemp():
  p.select_adc(0)
  m = p.read_adc()
  return (m[1]/256.0*500-273) # since the ADC output 0-256 corresponds to 0-5000 mV

def showinfo():
  print
  print "Temperature :",temp
  print "Time elapsed:",t

if __name__=="__main__":
# put in GUI
  p=phoenix.phoenix()
  p.write_outputs(0)
  print "Enter temperature threshold (C):"
  utemp=input()
  print "After what time should the heating stop?"
```

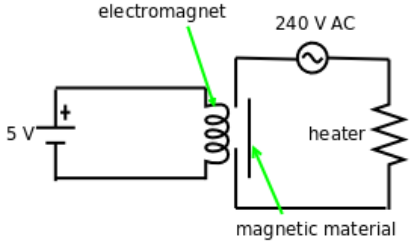
```
utime=input()
print "Start heating now."
while(1):
  time.sleep(5)
  t = t + 5
  temp=gettemp()
  showinfo()
  if(t > utime or temp > utemp): break
print "Stop heating!"
p.write_outputs(1) # Buzz!
time.sleep(5)
p.write_outputs(0)
```

3 Output and Extend

So what we have at the end of this little project is a little program whose only task is to check the temperature after every five seconds, check how much time the user has given it, and depending on whichever happens earlier, it sets off a buzzer reminding us that the heating is done. One important precaution should be observed that the LM335Z is **not** directly inserted into the hot fluid, as that would damage the IC chip!

Due to time constraints, I could not automate this entire procedure. What I initially had in mind was to allow the PHOENIX box to control the heating itself using a relay switch, i.e. turn it on or off without human intervention. Useful additions could also have been made like adding a LED counter to display the temperature. In fact these kind of temperature sensors have a wide range of applications, especially in microelectronic circuits where precision is needed.

The circuit that I could have done using the relay is shown below:



The 5V line is the one which would be controlled by the PHOENIX. The computer program would control the 5V output, and thus the heater.

4 Acknowledgements

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5 References

National Semiconductor LM335Z datasheet
http://www.national.com/pf/LM/LM335.html