09/2/2016

Lab 4:

To Power Peltier: around 5V (N: ours 4.5V) to get 40-45°C (saturation active)

→ we needed variable (0 → 12V) but current not sufficient (0.5A needed, but elvis 275mA)

↓

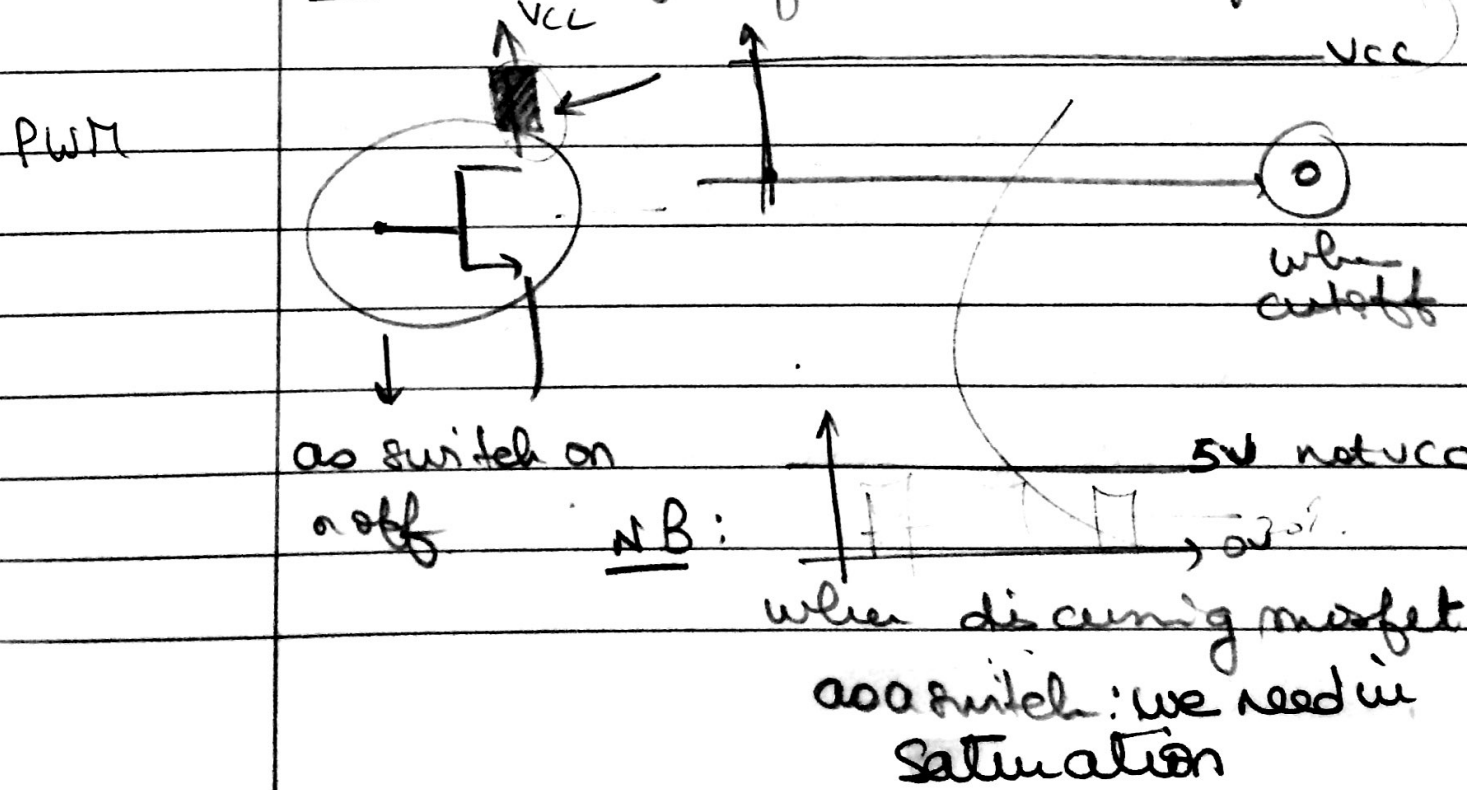
Solution:

amplify current

? - Problem of BJT: High power consumption in active

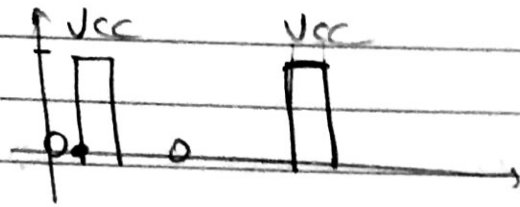
- PWM: Pulse width modulation

N.B: iteration of design (added to design)



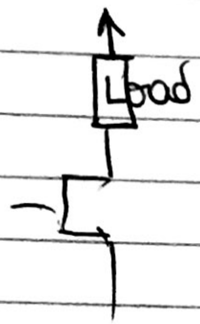
it all depends
on duty cycle
(not frequency)

• Switch Mosfet
→ saturation region



depends on duty
cycle
→ Vcc is now just like
a variable power supply (with high current)

N.B: This mosfet used must choose a
good frequency men shen ma yetHere?



N.B: also load: must choose a good
frequency men shen ma ysale3 ma3eh.

Concept: we are using low current
into variable volt

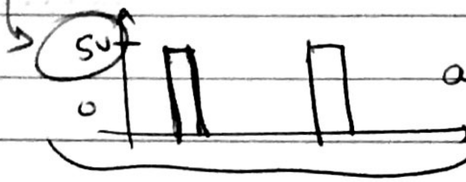
ex: Vcc = 12V
{ duty cycle = 20% ✓

• N.B:

→ have it fixed: of Elvis:
5V fix ~ 2A.

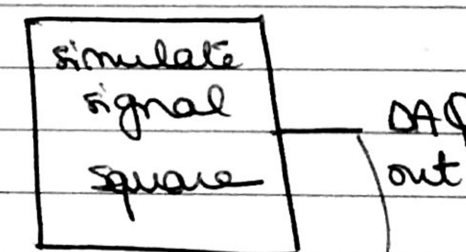
to vary the signal

Connect it
to Gate



PWM
and now change
duty cycle

we can change duty cycle
and parameters on Labview



Fn: square.

.10KHz
.100KHz
.Amplitude (2.5) 2.5 ?
.duty cycle

N.B: take care
of the channel.

$V_{cc} = 5V$

Step 4: 10KHz

0 → 5V using Fn generator → connect it to Gate

* change manually duty on Fn gen.

measure voltage across peltier.

slope

$V = \_\_\_ \times$ duty cycle.

DC fan = 12V

$y = 4.395x - 0.19$

slope is Vcc

- Now: Same exercise using Elvis

1. Simulate offset
2. DAQ out: DAQ 0 → gd.
   DAQ 1 → Gate.
3. duty cycle: let user enter voltage

make sure to multiply ×100

$V = 4.395 \times$ duty cycle

4. all probe in while loop.

5. add duty cycle indicator
6. XY graph. — (autoscale X, Y)
   X: 0,0001)

Use elvis 12V variable

DC fan → variable power supplies *

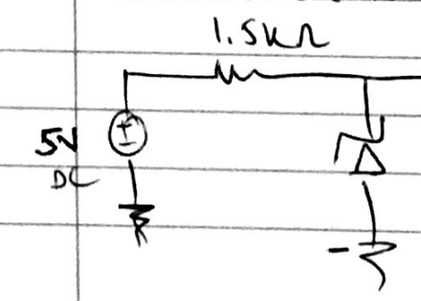
III - Measuring Sensor (IC):

use one of elvis. of RTD → resistance → temperature

- How to measure temperature?

Sensor: LM335 (IC sensor).
it's a zener diode, we can relate to fan voltage.

- Build circuit to Bias it:



: get fan to get to for Vz

10mV/°K

$y = a x + b$

- **to calibrate sensor**: calibration $V = aT + b$

using single point, we can calibrate:

- thermometer
- $\cap\cap$ (elvis)
- R (1.5 kΩ)
- 5V of Elvis.

$\frac{V - b}{a} = T$

✱

→ same (V I) (since ntamel peltier)

Relation: $V = \text{slope} \times T\,°K$

10m.

3.0773 = slope $(T°C + 273)$

$(36 + 273)$

$V = (\ ) \times T(°C) + (\ )$.

- at least 5 sig. figures.

slope = 9.95 V/K

$V = 9.5589 \times 10^{-7} (T + 273)$

$= 9.9589 \times 10^{-3} \times 36 + 9.9589 \times 273$

$+ 2.7187$

Slope = 4.395

* Peltier was on cooling (probably)

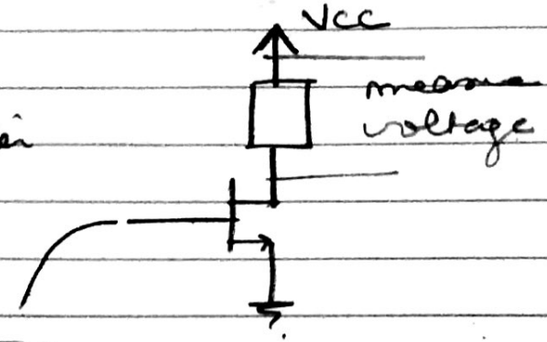
N.B: use DAQ on labview to measure resistance

for next time review
- Lab3
- Lab4

- put all pieces together in your head + practice

Lab5:

- +ve → black lead (heating peltier).
- DC (5V).
- input voltage (0-5V)



N.B connect peltier

DAQ0 : ~~gd~~
DAQ1: connect to gate

Vcc

→ V = dutycycle x slope

we change this to be able to Δ temperature across peltier.

· Note: E: draw / block diagram global picture I/O

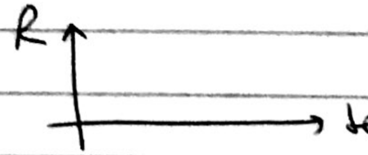
+ VI's.

· upload photos on moodle.

· F: Analysis + Compare anticipated sensor properties.

· G: three problems + solve them

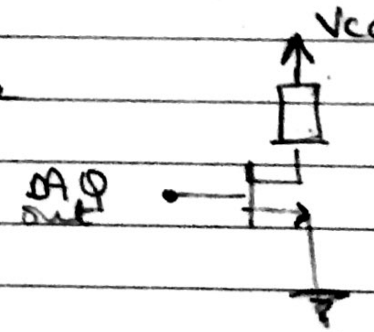
deliverables: graph



charact. DUT.

N.B: gd fan ≠ sensor circuitry gd (for no noise).

* duty cycle



· DUT: RTD : we need Resistance / temperature)

· LM335 used to measure T°

↳ relation: $V = 9.9589 \times 10^{-3} \times T°C + 2.7187$

1V peltier → measure T, measure R
2V " → " T, " R

wait for 2 to 3 mins before taking measurements

6 data pts (lowest t° pt → the room t°)

labview part

BLOCKS: · formula (V = T + ct)

· DAQ assistant (for PWM: gate mosfet)

Square
10KHz: f
A: 2.5
O: 2.5
100k

· duty cycle indicator

· XY waveform graph (to plot R vs. T)

← · sine simulate signal

· DMM → measure V on zener
→ measure R

- Time delay (to enter 2 mins) ← entering value for [illegible]

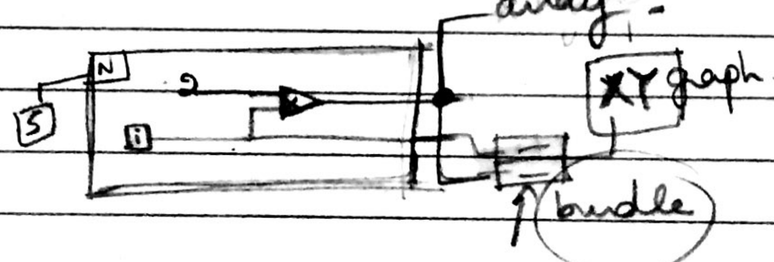
- variable power supplies (for DC fan).
- for loop. ← enable indexing, $i \leq 0 \rightarrow 5$.
- sequence structure (6 times) — ~~[illegible]~~ flat → 6 frames.

V → Formula to get T.

- sequence from DAQ:
  1. 63at PWM
  2. wait for 2-3 mins
  3. measure V
  4. measure R
  5. Convert it
  6. plot it

- store in array
- 6 value of V, 6 value T° + plot

i = count



↓
time delay (programing)

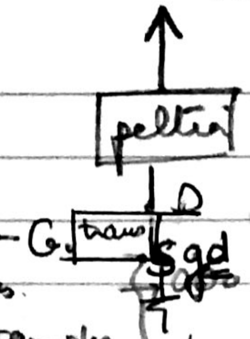
$T = \frac{V}{10m} - 273$

programing
↳ Cluster, class and vari cut
↳ Bundle

① Hardware description:

- How to connect

Vcc = 5V (Fix = Ct PS)
Elvis



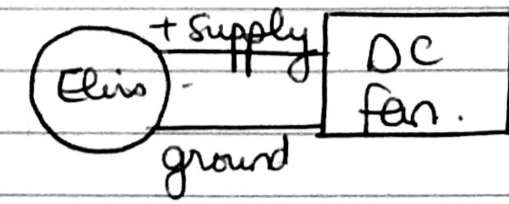
⊕ DAQ0? → [illegible]

$F = \left(\frac{x_1}{4.395}\right)$ [illegible]

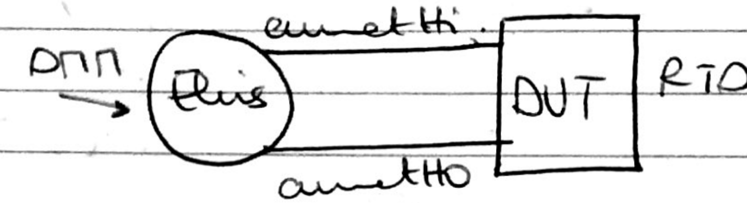
Elvis DAQ0 — G

variable PS

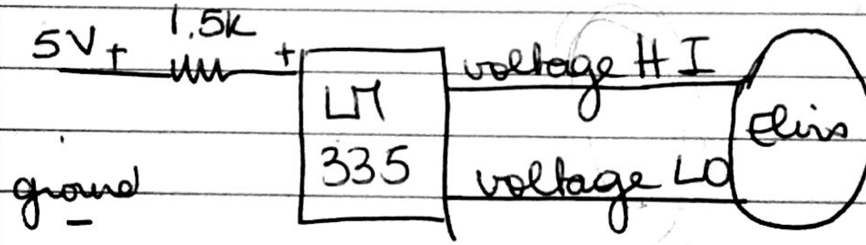
- DAQ:
  - Uncheck write samples.
  - Choose continuous sample
- DMM (0 → 13k)
  - Connect Hi, Lo.
- variable (+12V)



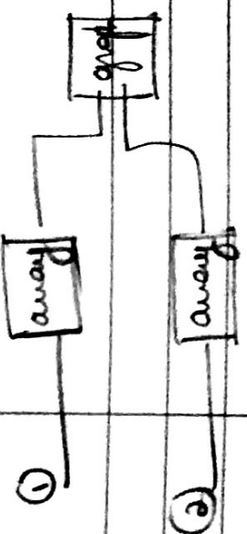
- Connect DMM to indicator.



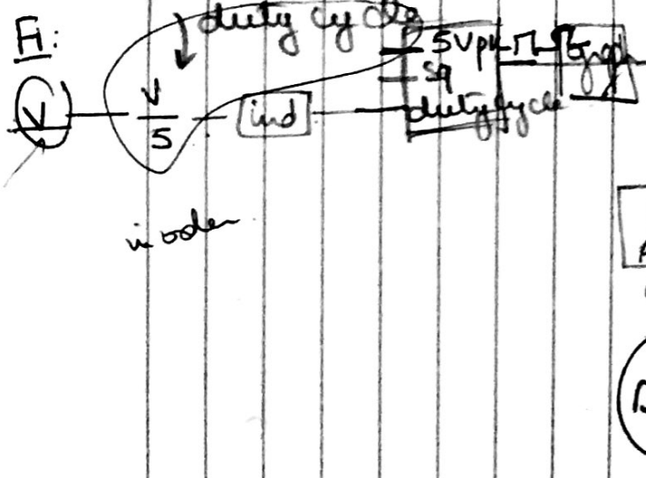
source Elvis



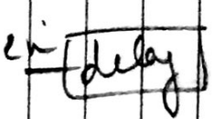
circuit



F1:

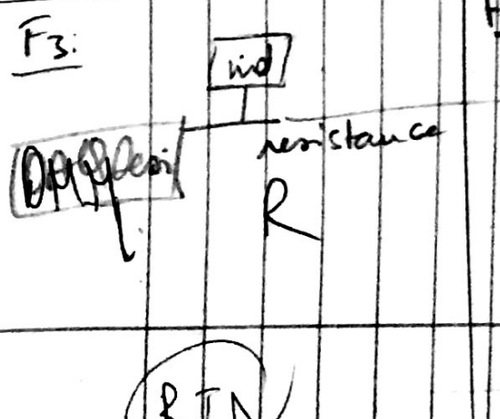


F2:

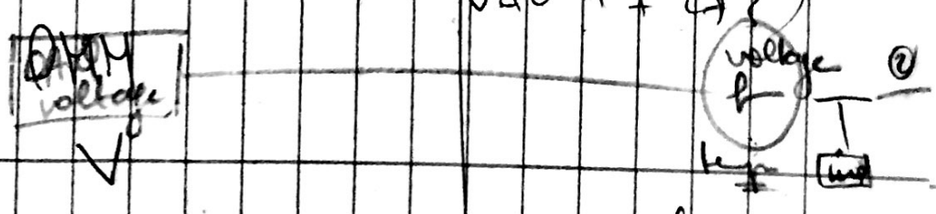


- for loop indicator (0;5)
- case structure 5 frames.
- above outside circuit ahead.

F3:



F4:



$$T = \frac{V}{10} + 273$$

Labs: in lab note:

- only we do Heating part (room t° to 40-45°C)
- 2 min between measurements.
- 6 data points (last data pt at 5)
  - 0 V
  - 1 V
  - 2 V
  - 3 V
  - 4 V
  - 5 V

Hardware:
- Elvis
- DMM and temp measuring device } → for heating

Labview:
- waveform graph
- duty cycle
- DMM
- for loop (I need to repeat same scenario 6 times: 0, 1, 2, 3, 4, 5 V)
- Sequence str: step
  1. Heat Peltier (give PWM)
  2. wait
  3. measuring Res.
  4. measuring volt.
  5. Plot

N = 6 : 1 → 6.

add indicator

Hardware:
- RTD

connect it to sequence

- same trend in the curve

12 V outside of structure (inside for loop).