Licenciatura Engenharia Informática e Multimédia
Instituto Superior de Engenharia de Lisboa
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Sensores e Atuadores

Relatório: Trabalho Lab03 (Parte teórica)

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Objetivo:

Esta experiência teve em vista os alunos saberem ligeiramente mais complexo do que.

Material:

- Breadboard,
- Resistências,
- Fonte dc da bancada,
- Multímetro da bancada,
- Interruptores,
- Cabos

Preparação teórica:

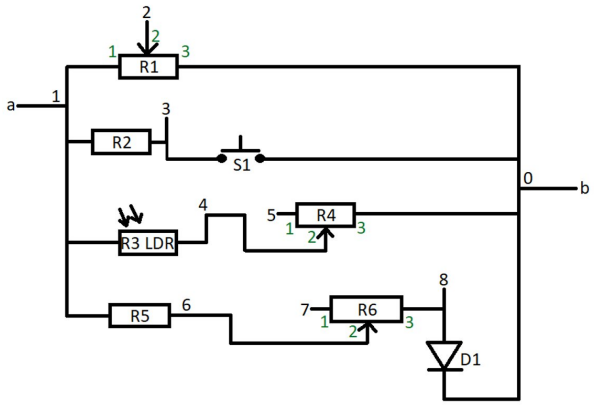

Figura 1 - Circuito montado pelos alunos

1-

R_{23} = 10,0kΩ

0%) x=1

25%) x=0,75

50%) x=0,5

75%) x=0,25

100%) x=0

2-

0%) x=0

I=0

25%)

x=0,25

I_{12}=0,500mA

I_{13}=0,125mA

I_{23}=0,167mA

50%)

x=0,5

I_{12}=0,500mA

I_{13}=0,250mA

I_{23}=0,500mA

75%)

x=0,75

I_{12}=0,500mA

I_{13}=0,375mA

I_{23}=1,50mA

100%)

x=1

I_{12}=0,500mA

I_{13}=0,500mA

I_{23} → Impossível $\left(\frac{5}{0}\right)$

3-

S_1 aberto → $I_{R2}=I_{S1}=0{,}00mA$

$V_3=V_{S1}=5{,}00V$

S_1 fechado → $I_{R2}=I_{S1}=0{,}500mA$

$V_3=V_{S1}=0{,}00V$

4-

a)

x=0,1

$R_4=R_3med=10k\Omega$

$V4 = \frac{5}{R3(LDR)+1}$

$I_{DC}=I_{R3}=I_{R4}$

Sombra: $V_4=0{,}0495V$

$I_{R3}=0{,}0455mA$

Luz: $V_4=2{,}50V$

$I_{R3}=0{,}455mA$

b) R3=f(Brilho) → $R3(LDR)=23{,}48*Brilho^{-0.837}$

Brilho=f(R3) → $Brilho=\sqrt[-0.837]{\frac{R3(LDR)}{23{,}48}}$

R3=f(V4) → $R3(LDR)=\frac{5x*10}{V4}-10x$

Brilho=f(V4) → $Brilho=\sqrt[-0.837]{\frac{5x*10}{23{,}48*V4}-\frac{10x}{23{,}48}}$

5- I= $\frac{VDC-VD}{R}$

0%) I=0,03mA

50%) I=0,0143mA

100%) I= 9,38E-3 mA

6-

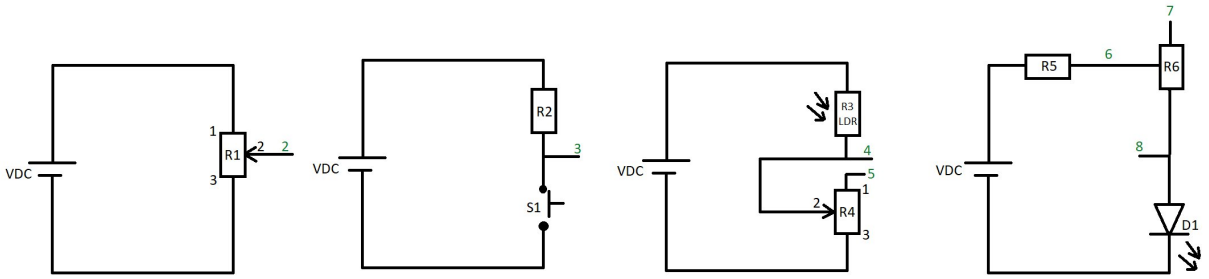

Figura 2 – Divisão por malhas

S1 aberto/RLDR min.:

$V_{1/0}$=5,00V

$R_{1/0}$=5,19kΩ

$I_{1/0}$=0,963mA

$P_{1/0}$=25,95mW

R_{D1}=213kΩ

Malha 1

R_1=10,0kΩ

I_{R1}=0,500mA

V_{R1}=5,00V

P_{R1}=2,50mW

Malha 2

R_2=10,0kΩ

I_{R2}=0,00mA

V_{R2}=0,00V

P_{R2}=0,00mW

I_{R2}=I_{S1}

I_{S1}=0,00mA

V_{S1}=5,00V

P_{S1}=0,00mW

Malha 3

R_3=1,0kΩ

I_{R3}=0,455mA

V_{R3}=0,455V

P_{R3}=0,455mW

R_4=10,0kΩ

V_{R4}=4,55V

I_{R4}=0,455mA

P_{R4}=2,07mW

Malha 4

R_5=100,0kΩ

I_{R5}=9,38E-3 mA

V_{R5}=0,938V

P_{R5}=8,80mW

R_6=220kΩ

V_{R6}=2,06V

I_{R6}=9,36E-3 mA

P_{R6}=0,0193mW

R_{D1}=213kΩ

V_{D1}=2,00V

I_{D1}=9,38E-3 mA

P_{D1}= 0,0188mW

S1 fechado/RLDR min.:

$V_{1/0}$=5,00V

$R_{1/0}$=3,42kΩ

$I_{1/0}$=1,46mA

R_{D1}=213kΩ

Malha 1

R_1=10,0kΩ

V_{R1}=5,00V

I_{R1}=0,500mA

P_{R1}=2,50mW

Malha 2

R_2=10,0kΩ

I_{R2}=0,500mA

V_{R2}=5,00V

P_{R2}=2,50mW

I_{R2}=I_{S1}

I_{S1}=0,500mA

V_{S1}=0,00V

P_{S1}=0,00mW

Malha 3

R_3=1,0kΩ

I_{R3}=0,455mA

V_{R3}=0,455V

P_{R3}= 0,207mW

R_4=10,0kΩ

V_{R4}=4,55V

I_{R4}=0,455mA

P_{R4}=2,07mW

Malha 4

R_5=100,0kΩ

I_{R5}=9,38E-3 mA

V_{R5}=0,938V

P_{R5}=8,80E-3 mW

R_6=220kΩ

V_{R6}=2,06V

I_{R6}=9,36E-3 mA

P_{R6}=0,0193mW

R_{D1}=213kΩ

V_{D1}=2,00V

I_{D1}=9,38E-3 mA

P_{D1}=0,0188mW

S1 aberto/RLDR máx.:

$V_{1/0}$=5,00V

$R_{1/0}$=9,01kΩ

$I_{1/0}$=0,555mA

$P_{1/0}$=0,278mW

R_{D1}=213kΩ

Malha 1

R_1=10,0kΩ

V_{R1}=5,00V

I_{R1}=0,500mA

P_{R1}=2,50mW

Malha 2

R_2=10,0kΩ

I_{R2}=0,00mA

V_{R2}=0,00V

P_{R2}=0,00mW

I_{R2}=I_{S1}

I_{S1}=0,00mA

V_{S1}=5,00V

P_{S1}=0,00mw

Malha 3

R_3=100kΩ

I_{R3}=0,0455mA

V_{R3}=4,55V

P_{R3}=0,207mW

R_4=10,0kΩ

V_{R4}=0,455V

I_{R4}=0,0455mA

P_{R4}=0,0207mW

Malha 4

R_5=100,0kΩ

I_{R5}=9,38E-3 mA

V_{R5}=0,938V

P_{R5}=8,80E-3 mW

R_6=220kΩ

V_{R6}=2,06V

I_{R6}=9,36E-3 mA

P_{R6}=0,0193mW

R_{D1}=213kΩ

V_{D1}=2,00V

I_{D1}=9,38E-3 mA

P_{D1}=0,0188mW

S1 fechado/RLDR máx.:

$V_{1/0}$=5,00V

$R_{1/0}$=4,74kΩ

$I_{1/0}$=1,05mA

$P_{1/0}$=4,98mW

R_{D1}=213kΩ

Malha 1

R_1=10,0kΩ

V_{R1}=5,00V

I_{R1}=0,500mA

P_{R1}=2,5mW

Malha 2

R_2=10,0kΩ

I_{R2}=0,500mA

V_{R2}=5,00V

P_{R2}=2,5mW

I_{R2}=I_{S1}

I_{S1}=0,500mA

V_{S1}=0,00V

P_{S1}=0,00mW

Malha 3

R_3=100kΩ

I_{R3}=0,0455mA

V_{R3}=4,55V

P_{R3}=0,207mW

R_4=10,0kΩ

V_{R4}=0,455V

I_{R4}=0,0455mA

P_{R4}=0,0207mW

Malha 4

R_5=100,0kΩ

I_{R5}=9,38E-3 mA

V_{R5}=0,938V

P_{R5}=8,80E-3 mW

R_6=220kΩ

V_{R6}=2,06V

I_{R6}=9,36E-3 mA

P_{R6}=0,0193 mW

R_{D1}=213kΩ

V_{D1}=2,00V

I_{D1}=9,38E-3 mA

R_{D1}= 0,0193 mW

Lei das Malhas: $\sum V = 0$

S1 aberto/RLDR min:

Malha 1- $\sum V = 0$ (=) $V_{DC}=V_{R1}$ (=) 5.00=5.00 (=) 5.00-5.00=0.00V

Malha 2- $\sum V = 0$ (=) $V_{R1}=V_{R2}+V_{S1}$ (=) 5.00=0.00+5.00 (=) 5.00-5.00=0.00V

Malha 3- $\sum V = 0$ (=) $V_{R2}+V_{S1}=V_{R3}+V_{R4}$ (=) 5.00=0.455+4.55(=) 5.00-5.00=0.00V

Malha 4- $\sum V = 0$ (=) $V_{R3}+V_{R4}=V_{R5}+V_{R6}+V_{D1}$ (=) 5.00=0.938+2.06+2.00(=) 5.00-5.00=0.00V

S1 fechado/RLDR min:

Malha 1- $\sum V = 0$ (=) $V_{DC}=V_{R1}$ (=) 5.00=5.00 (=) 5.00-5.00=0.00V

Malha 2- $\sum V = 0$ (=) $V_{R1}=V_{R2}+V_{S1}$ (=) 5.00=5.00+0.00 (=) 5.00-5.00=0.00V

Malha 3- $\sum V = 0$ (=) $V_{R2}+V_{S1}=V_{R3}+V_{R4}$ (=) 5.00=0.455+4.55(=) 5.00-5.00=0.00V

Malha 4- $\sum V = 0$ (=) $V_{R3}+V_{R4}=V_{R5}+V_{R6}+V_{D1}$ (=) 5.00=0.938+2.06+2.00(=) 5.00-5.00=0.00V

S1 aberto/RLDR máx:

Malha 1- $\sum V = 0$ (=) $V_{DC}=V_{R1}$ (=) 5.00=5.00 (=) 5.00-5.00=0.00V

Malha 2- $\sum V = 0$ (=) $V_{R1}=V_{R2}+V_{S1}$ (=) 5.00=0.00+5.00 (=) 5.00-5.00=0.00V

Malha 3- $\sum V = 0$ (=) $V_{R2}+V_{S1}=V_{R3}+V_{R4}$ (=) 5.00=4.55+0.455(=) 5.00-5.00=0.00V

Malha 4- $\sum V = 0$ (=) $V_{R3}+V_{R4}=V_{R5}+V_{R6}+V_{D1}$ (=) 5.00=0.938+2.06+2.00(=) 5.00-5.00=0.00V

S1 fechado/RLDR máx:

Malha 1- $\sum V = 0$ (=) $V_{DC}=V_{R1}$ (=) 5.00=5.00 (=) 5.00-5.00=0.00V

Malha 2- $\sum V = 0$ (=) $V_{R1}=V_{R2}+V_{S1}$ (=) 5.00=5.00+0.00 (=) 5.00-5.00=0.00V

Malha 3- $\sum V = 0$ (=) $V_{R2}+V_{S1}=V_{R3}+V_{R4}$ (=) 5.00=4.55+0.455(=) 5.00-5.00=0.00V

Malha 4- $\sum V = 0$ (=) $V_{R3}+V_{R4}=V_{R5}+V_{R6}+V_{D1}$ (=) 5.00=0.938+2.06+2.00(=) 5.00-5.00=0.00V

Lei dos Nós: $\sum I = 0$

S1 aberto/RLDR min. ou máx.: $\sum I = 0$ (=) $I_{1/0}-I_{R1}-I_{R3}-I_{R4}=0$

S1 fechado/RLDR min. ou máx.: $\sum I = 0$ (=) $I_{1/0}-I_{R1}-I_{R2}-I_{R3}-I_{R4}=0$

Lei da Conservação de Energia: $\sum P = 0$

$\sum P = 0$ (=) $P_{1/0}-P_{R1}-P_{R2}-P_{R3}-P_{R4}-P_{R5}-P_{R6}-P_{D1}=0$