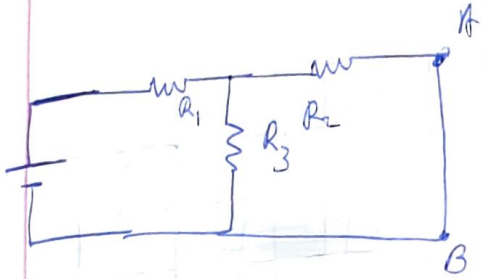
LHRCC

SECTOR 7

Complex and
Low level projects

2013



$$U_{AB} = \frac{E}{R_1 + \left(\frac{R_2 \cdot R_3}{R_2 + R_3}\right)} = \frac{10}{\left(\frac{50}{15}\right)}$$

$$= \frac{50}{15} = 750\ A =$$

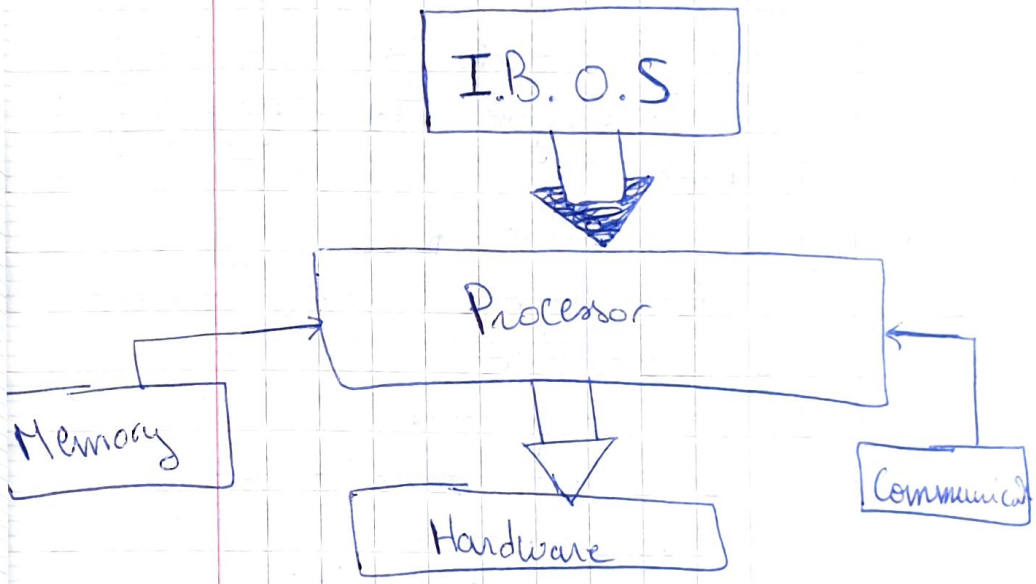
$$U_{AB} =$$

Project ABS.

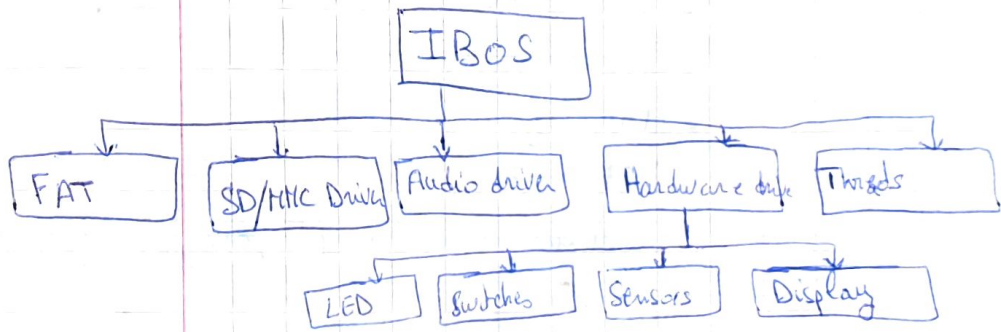
Life:

- Design:
  - Schematic
  - Programming
- Simulation
  - Isis proteus
- Production
  - Creation
    - Solder
    - Programming Nc
    - Wiring
- Test
  - error test
  - Real world test

Smart Bike



IBOS



① base OS:

a) startup:
Show Manufacturer logo : ArssLensoft

b) Initialisation:
After the initialisation of LCD the OS start loading data and executing each

c) Modes
- SHUTDOWN
  - Show logo → initialize session
- SLEEP Mode
  - enable protection
  - waiting for contact insert
  - blink alarm LED
  - Lock Mode (blink lights.)
- Wake Mode
  - Main Screen
  - Sensor Hook
  - Data log
  - LCD refresh
  - functions execution (TS, BMB, Brake, Audio)
  - Lock Mode.

the LCD Refresh frequency is 1 Hz

compatible Chip:

ATmega328 / ATmega32

STEP1: LED Driver
Completed : 5 bits → 1 byte T/90

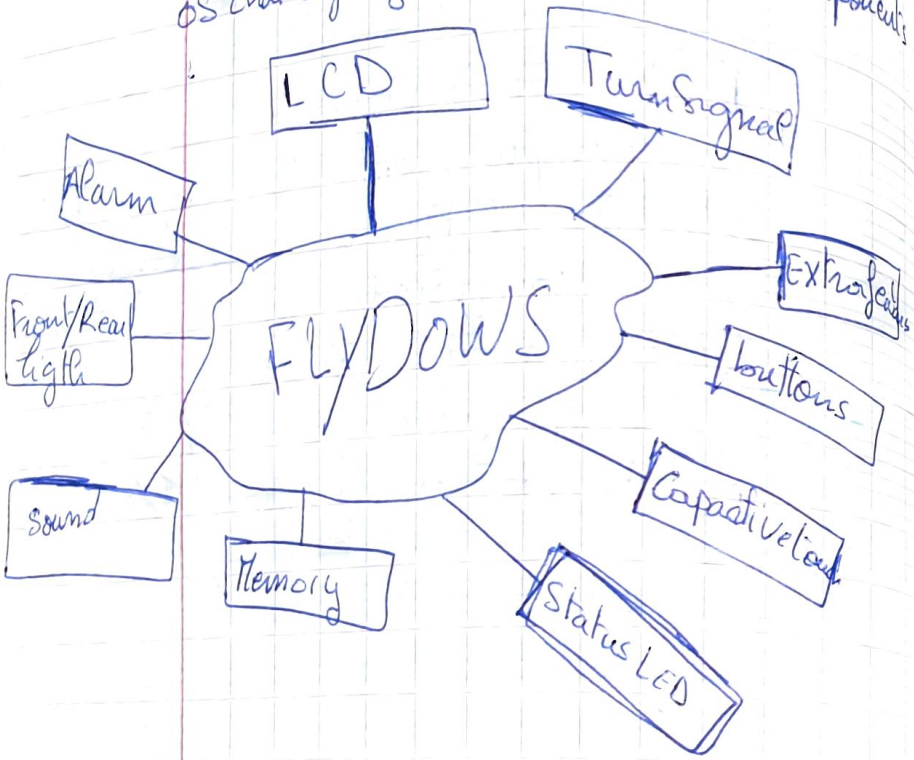
STEP2: LCD Driver
Completed T/100

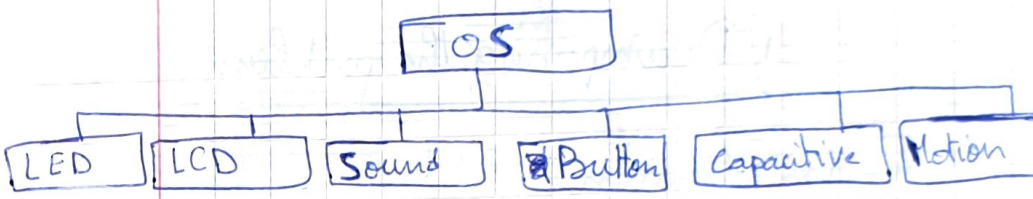
STEP3: SD/MMC Driver
Completed T/50

STEP4: Audio Driver T/30
Completed

FLYDOWS MT

FLYDOWSMOTOR is a small bicycle OS that organize the bike electronic components:



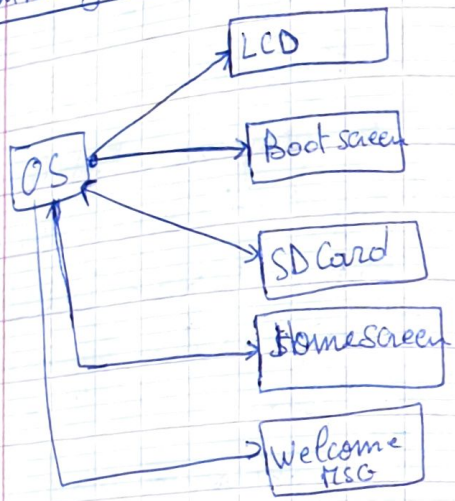


System Basics:

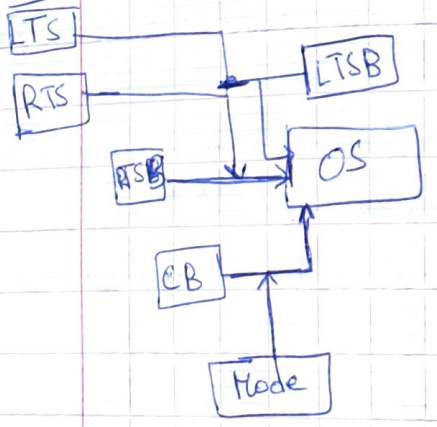
- When we plug the contact the lock value will change to the opposite value
- When TSB are triggered TS states change
- When the speed sensor triggers send signal calculate speed.
- When the brake sensor triggers send signal calculate speed. and determine time left
- When the capacitance change on sensor launch alarm.
- When speed sensor triggers on alarm mode
- When event action executed the sound is activated
- When the information processed it can be shown
- Basic OS functions boot...

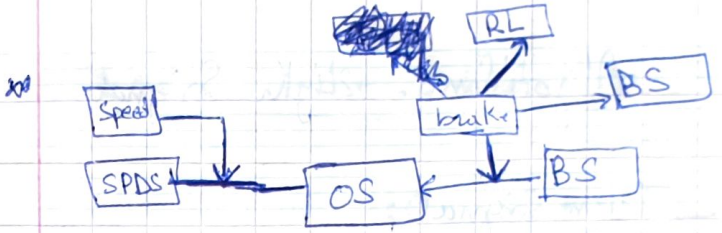
1/ Decomposing the problem

A- Initialization :

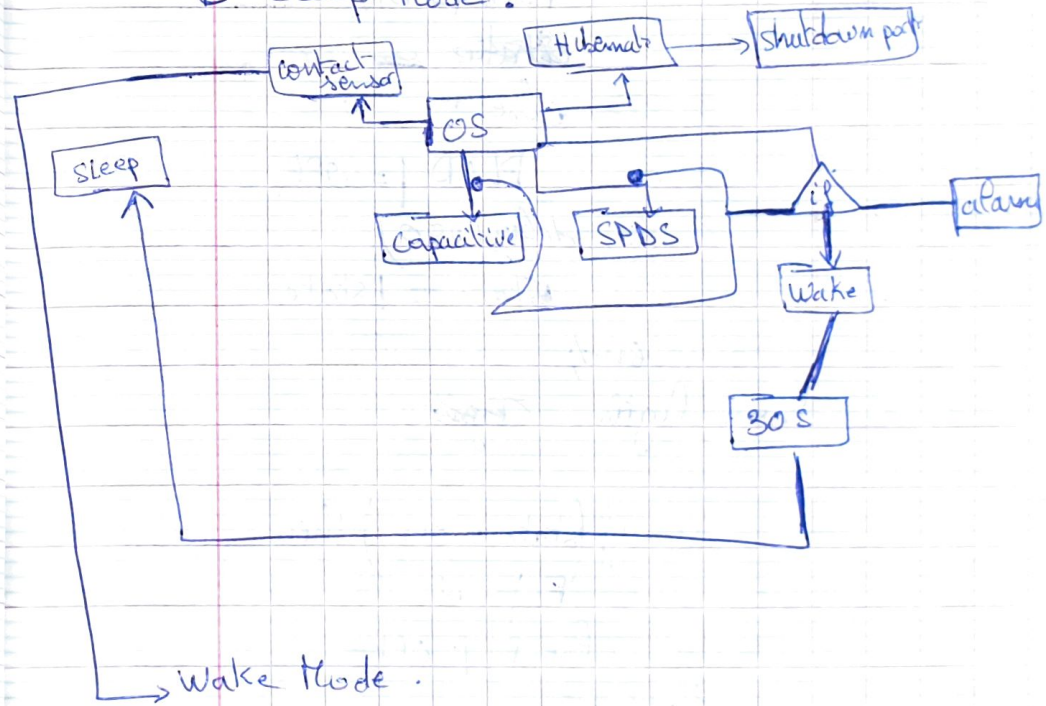


B- Wake Mode





C- Sleep Mode :



Algorithms. Ligth Signal

→ Turn signal:

```
While (Turn) do
begin
  if (ON) then
    PLED |= ON;
  else
    PLED |= OFF;
  delay(250)
  State = !state
end;
```

→ Front ligth

```
if (state = OFF) then
  FL|=ON
else FL|=OFF;
```

→ Rear ligth

PWM

```
if (braking) then
  RL |= 100%
else RL |= 0
```

PORT choose: Prototype ATMEGA32

→ PB2, PB3, PB4, PB5 SD card

→ PB3 Speaker

→ PB0, PB1, PB2, PB4 LCD

→ PD3 Speaker

→ PB0 FL

→ PD5 RL

→ PC0 RTS

→ PC1 LTS

→ PC2 contact

→ PC3 SPDS

→ PD6, PD7 ASensor

→ PC4 Brake sensor

→ PB6, PB7 XTAL

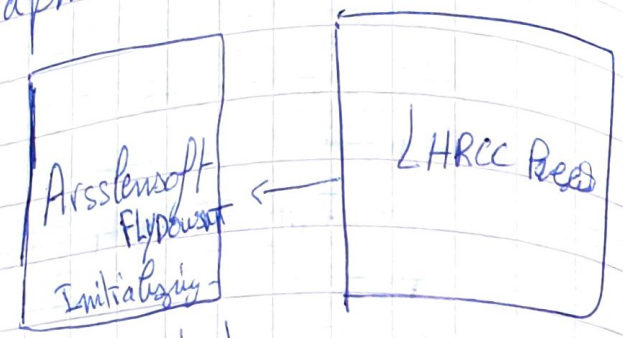
→ PC5 RTSB

→ PB1 LTSB

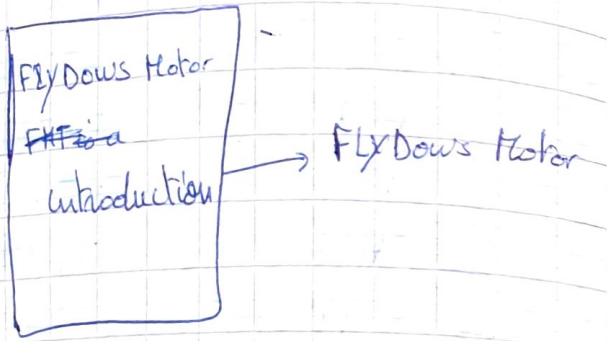
RFUSA

Graphic

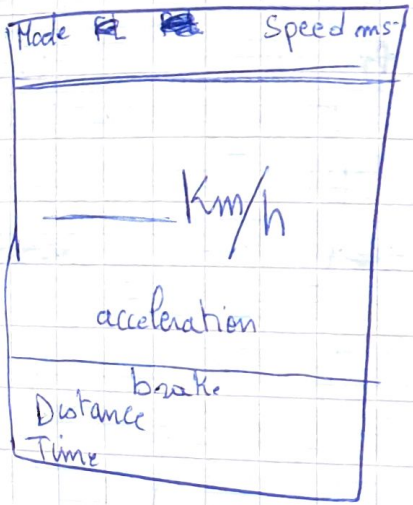
Welcome



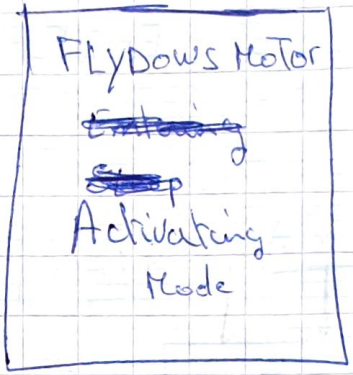
First Run or startup



Main



SHUTDOWN



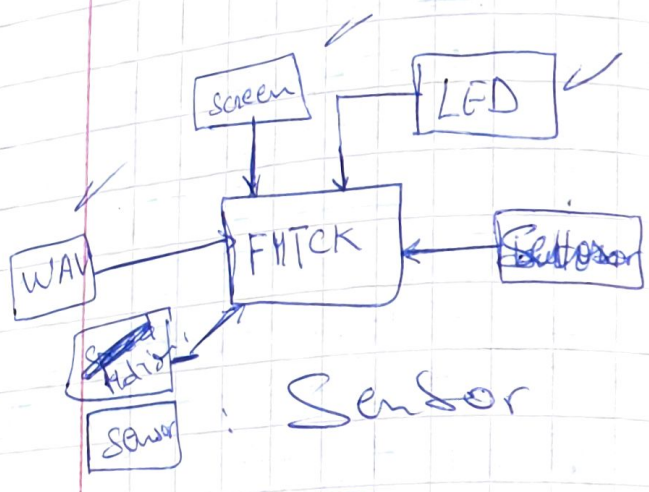
LCD Hook Fully implemented

Sound / MMC Drivers
Hook Fully implem
for ATmega 32
~~ATMEGA328~~

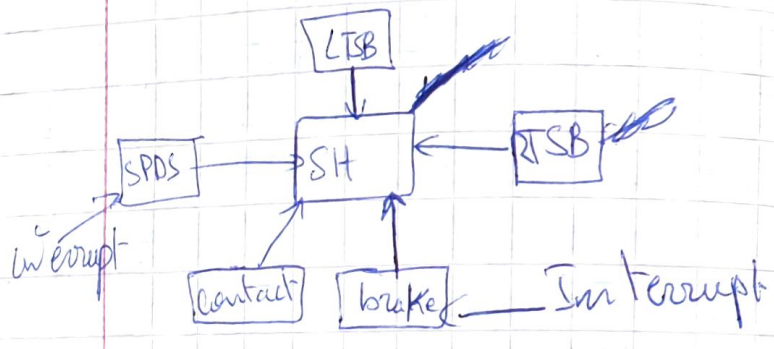
ALL Drivers are Succesfully implemented

THe Heart

FMTH or FMTCK



: Sensor



$61 = \frac{1}{0,150} = 61,015 = (9)$

$61 = \frac{1}{3} = 183$

Sensor implemented successfully

FUSION

Best optimisation :

FLYDOWS MOTOR 1.0

Main Loop

forever
while (1)
- Check
- Calculate
- play wav (if on) wait
- Display 1 Hz
- wait 500 ms

Frequency of execution

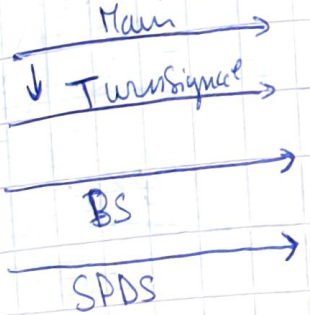
Check 5 Hz

Calculate 1 Hz

Display 1 Hz

play wav ~~no repeat~~ 0 Hz

Tasks: 4 Task executed in the same time



Priority

1) Mode
   a) check
   b) evaluate and execute
      i) if (1Hz) calculate / Display
      ii) if (audio) play wav
2) Set Sleep Mode
   Check SPDS
   wait ~~Contact~~

Case based Suggestion Display

Sound files:

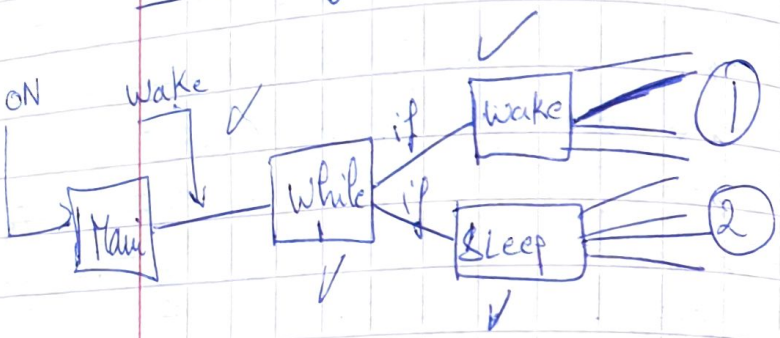
- Braking : used when time is over 3s
- Welcome : used @ startup
- Report : used after wake
- Turn Signal : used on 1 Turn Signal click
- Lock : used when the bike ready to enter sleep Mode
- Alarm : used for 30 seconds on bicycle access
- Sleep : used before Lock
- Emergency : used when brake time is over 9s
- Check : used when the bicycle was accessed in sleep

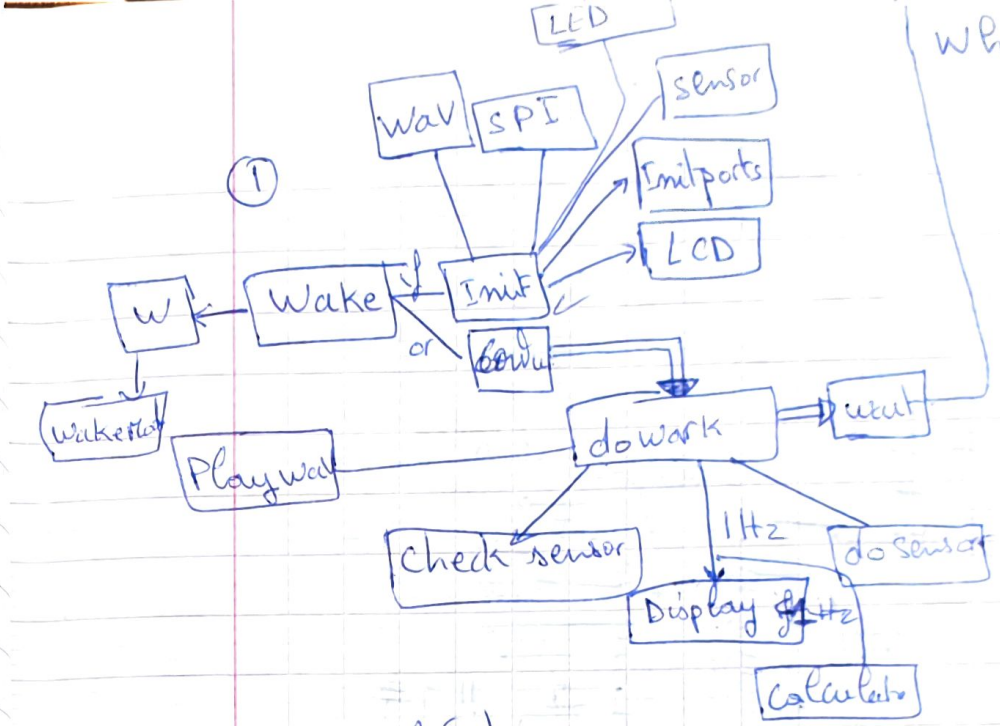
Driving Suggestions:

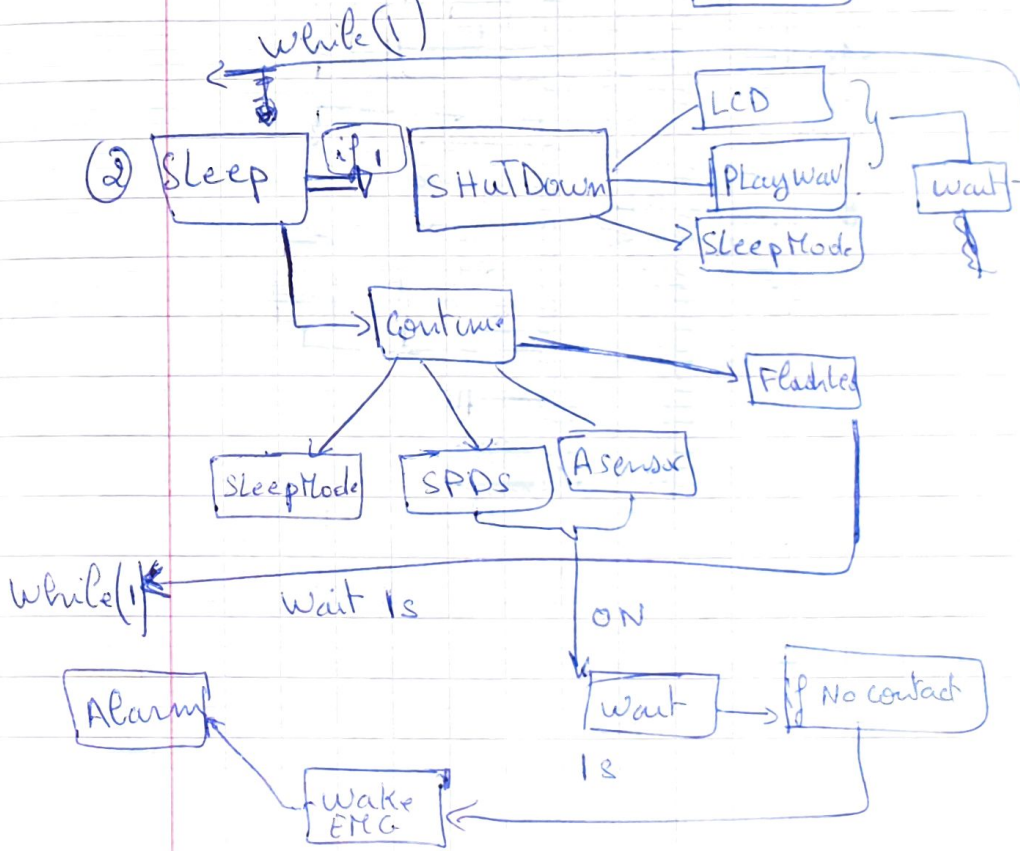
- Drive Safely : RT
- Do not accelerate : $a > 4$
- Slow Down : when TS activated
- Take your Right } RT
- Focus on Riding }
- Check The bicycle
-

Sleep Mode
→ No ADC
→ No screen
→ No switch but contact
→ No SD card until attach
→ No interrupt bit - SPDS
→ Capacitive sensor

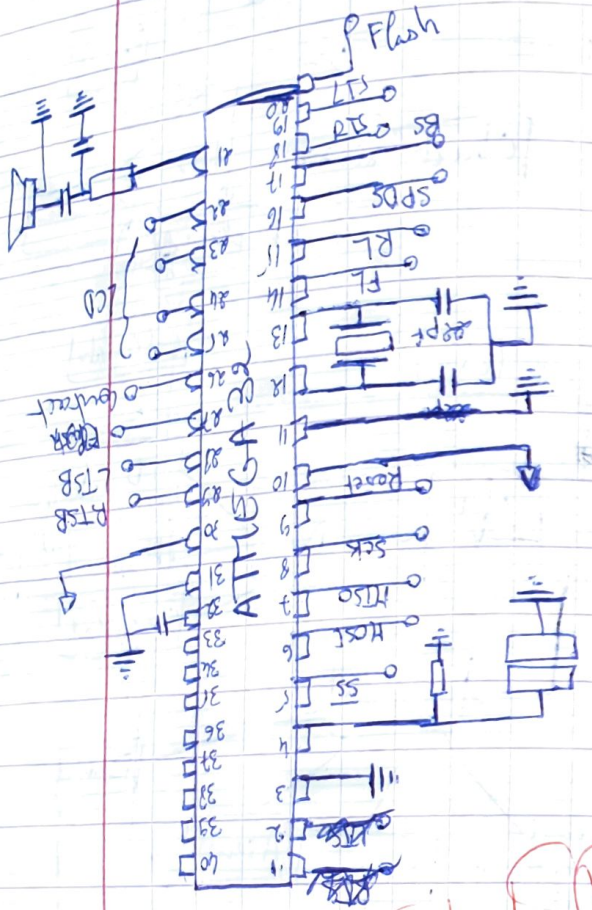
Building the Main Code







MCU:



FAILED

Remove Waffle

THE MCU will change ATMEGA 328

~~an~~ every button on interrupt

FHT Concept

Intro: the bicycle will be able to determ. the physical Movement caracteristics and it has to mode of operations

Wake:
- Speed sensor
- LCD Display
- front light / Rear light (PWM)
- Sensory button
- brake sensor
- Cycle LED Flash.
- Turn Signal Timer
- Task Schedule

Sleep
Check contact
Flash LED

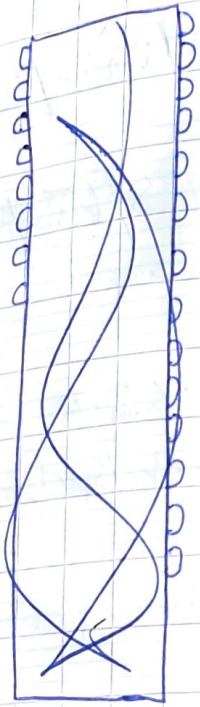
Inputs
LTS / RTS / Contact / Brake / Speed

outputs:
LCD / FL / RL / LTS / RTS / Flash /
Total Number of pins
LCD: 4
O: FL/RL/LTS/RTS/Flash: 5 | Police: 2
I: LTS/RTS/Contact/Brake/Speed: 5

FL / RL connected to pwm outputs

everything is applicable on an

ATmega328 MC



SPI (ISP) PB3/PB4/PB5/PC6

LCD PD0/PD1/PD2/PD3

- RTS: PD7
- FL: PD5
- Flash: PD4
- RTSB: PC1
- SPDS: PC0
- BS: PC3
- LTS PB0
- RL: PD6
- LTSB: PC2
- XTAL: PB6/PB7

Physics Anatomy

AP (Accelerated motion

$a = cste$

$V = at + V_0$

$x = \frac{1}{2} a t^2 + V_0 t + x_0$

$V_2^2 - V_1^2 = 2a(x_2 - x_1)$

d

in realtime or for instantaneous calculation we know V and $t = 1$ and V_0 the last V

$V = 2.07 \times F$

$a = \frac{V_i - V_p}{t} = \frac{V_i - V_p}{1}$

$at + V_0 = 0$

$at = -V_0$

$t = \frac{V_0}{a} = \frac{V_p}{a} = \frac{V}{a}$

$V_2^2 - V_1^2 = 2ad \Rightarrow V_2^2 = 0$

$-V_1^2 = 2ad$

$d = \left| \frac{-V_1^2}{2a} \right|$

example

$V_p = 7\ ms^{-1}$ $F = 2$

$V_i = F \times 2.07 = 4,14$

$a = V_i - V_p = 4,14 - 7 = -2,86\ ms^{-2}$

if brake will brake :

$t = \frac{-4,14}{-2,86} = 1,44\ s$

Calculations

$V = -2,86 \cdot 1,44 + 4,14 \simeq 0$

$d = \left| \frac{-V_i^2}{2a} \right| = \frac{-(4,14)^2}{2 \cdot -2,86} = \frac{-4,14}{-5,72} = 2,99\ m$

Calculations

$x(1,44) = \frac{1}{2} -2,86 (1,44)^2 + 4,14 \cdot 1,44 + 0$

$= -1,43 \cdot 2.07 + 4,14 \cdot 1,44$

$= -2,9601 + 5,9616 \simeq 3\ m$

use round after each calculation when you convert from double to integer

double to int:

60,5 =
60 = 6050 mod 100

6 . 5 x 100 = 650.

6 = 650 mod 100
50 = 650 mod 100

DIY Speed Sensor

Physical grade

5 grade speed sensor
min speed: 1,4904 KM/h
increment 1,5 KM/h
0,45 ms^{-1}

100% correct speed measurements

$F = \frac{1}{T}$ each ON state generated by the sensor will trigger stopwatch stop and current speed calculation

for example

$T = 500\ ms$

$F = \frac{1}{0,5} = 2\ Hz$

$T = 50\ ms$

$F = \frac{1}{0,05} = \frac{1}{\frac{5}{100}} = \frac{100}{5}$

20 Hz ...

Solution 4 ms timer used to determine speed

Physical laws

$F = \frac{1}{T}$

$V_i = F \cdot 2,07 = \frac{1}{T} \cdot 2,07$

$dV = V_i - V_p = \left(\frac{1}{T} - \frac{1}{T_1}\right) \cdot 2,07$

$t_b = \left|\frac{V_i}{a}\right|$

$db = \left|\frac{-(V_i)^2}{a}\right|$

$OCR = \left(\left(Clk / Prescaler\right) * T_{ms}\right) - 1$

$T = OCR + 1 \qquad T = \frac{OCR1}{DC} = 0,0045$

⚠ Warning: if Timers do not run as expected change timing option TIMER0_COMPA_vect

T0 = 4 ms

T2 = 1 ms

$OCR2 = \left(\left(16\,000\,000 / 1024\right) * 0,001\right) - 1 = 15 = 0x0F$

Cost Estimation:

ATMEGA328	12500
Crystal	1460
Voltage Regulator LM7805	740
LED	700
Nokia 6100 LCD	5000
Nokia LCD connector	3000
Other Materials	3000
Estimated electrical cost	28 DT
Battery 2x BL-5J	
Mechanical Cost	
Repair	4 DT

available Budget

22 DT

Total Budget needed

40 DT

sys = False

Programmer Board

Float (Artificial float)

V_1 V_2

add:

~~$AV_2 + BV_2 = CV_1$~~

$CV_2 = (AV_2 + BV_2) \bmod 100$

$CV_1 = (AV_1 + BV_1) + (AV_2 + BV_2 / 100)$

example $A = 75,58$ $B = 156.72$

$CV_2 = 58 + 72 \bmod 100 = 130 \bmod 100 = 30$

$CV_1 = (75 + 156) + ((58+72)/100)$

$= 231 + (130/100) = 231 + 1 = 232$

$C = 232,30$

Multiply

~~$CV_2 = AV_2 \cdot BV_2 \% 100$~~

~~$CV_1 = AV$~~

long $x' = ((AV_1 \times 100) + AV_2) * ((BV_1 \times 100) + BV_2)$

$CV_1 = x' / 10000$

$CV_2 = (x' \bmod 10000) / 100$

$A = 75,58$ $B = 156.72$

$x' = ((75 \cdot 100) + 58) * ((156 \cdot 100) + 72) = 7558 * 15672$

DIVIDE

$x / y = 1.50$

$C_{V_1} = (x / y)$

$CV_2 = ((x \bmod y) \times 10) / y$

$CV_2 + ((x \bmod y \times 10) \bmod y \times 10) / y$

example

$CV_1 = 1000 / 665 = 1$

$CV_2 = ((1000 \bmod 665) \times 10) / 665 + ((1000 \bmod 665) \times 10 \bmod 665) / 665$

$= 3350 / 665 + (3350 \bmod 665) / 665$

$= 5 \times 10 + 250 / 665$

$= 50 + 0 = 50$

Test:

$AV_1 = 3$ $AV_2 = 45$ $BV_1 = 7$ $BV_2 = 45$

$300 + 45 * 700 + 45 = 345 \times 745 = 257025$

$CV1 = 257025 / 10000 = 25$

$CV2 = 257025 \bmod 10000 / 100 = 70$

Speed = 2570

Speed Counter Speed limits [KM/h]

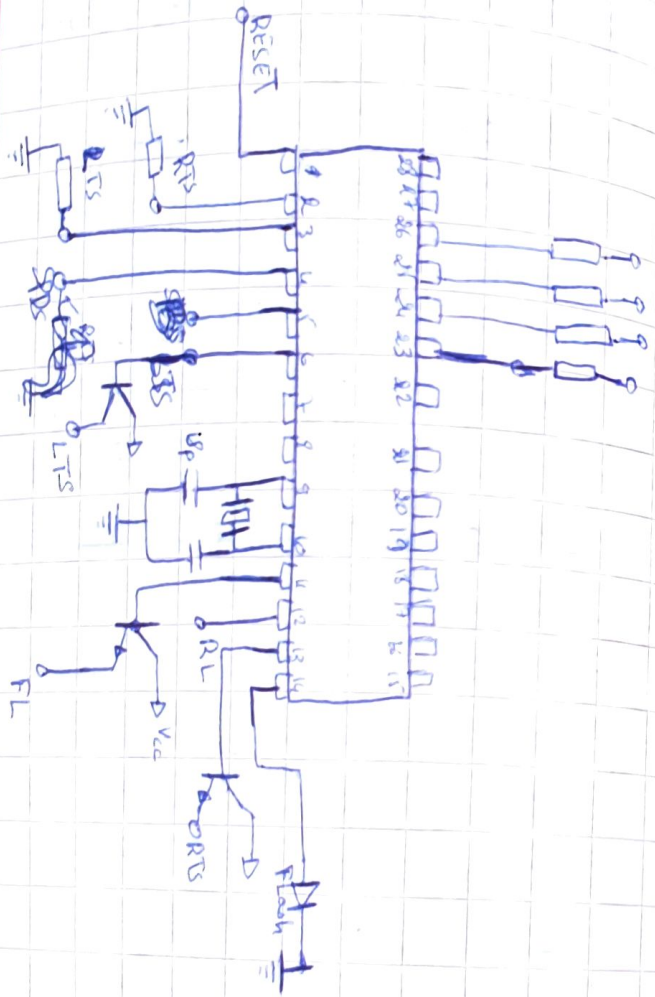
$3.81 \leqslant \text{Speed} \leqslant 0,74$

Wheel frequency

$42 \leqslant F \leqslant 0,1$

accuracy $\pm$ 2 KM/h ± 0.01 KM/h

Schem.



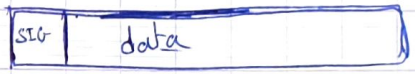
MFT

1/ .FMT Flydows Motor Text file
2/ .FMD Flydows Motor Data file
3/ .FMI Flydows Motor Image file
4/ ~~.FMS Flydows Motor Image file~~
5/ ~~.FMSys Flydows Motor Driver file~~
6/ .FMBoot Flydows Motor Boot file

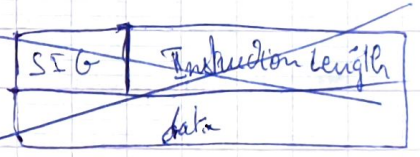
File Definition:

FMD

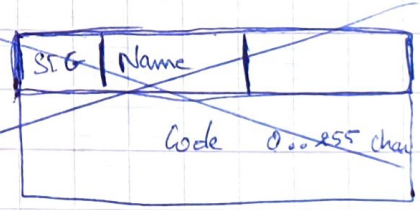
FMI



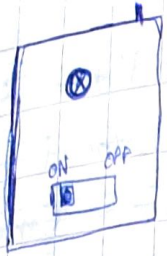
FMS



FMSys



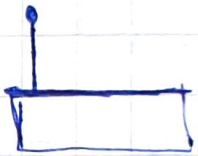
FMBoot



Use [Case based clearscreen]
[Update screen]

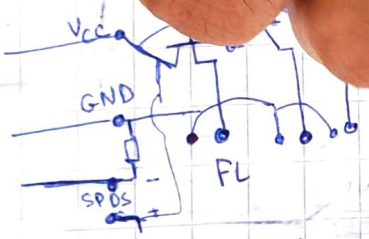
Contact sense
control LCD power

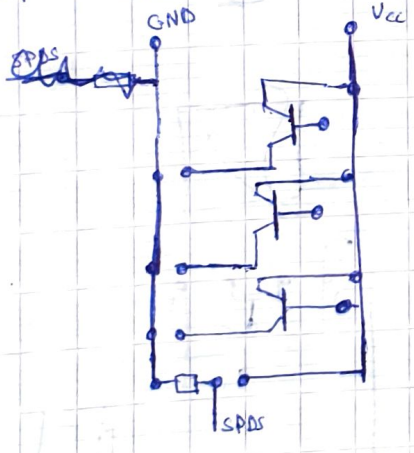
- Clear ~~Core~~ zones on screen
- check contact sensor
- pulse radio (Morse code)
- data logs
- ~~Buttons~~



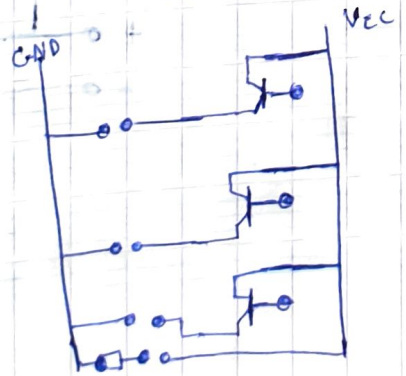
Vision: (Predicted)

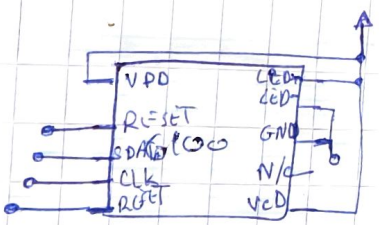
- Radar
- simple listener ✓
- AM Detector
-

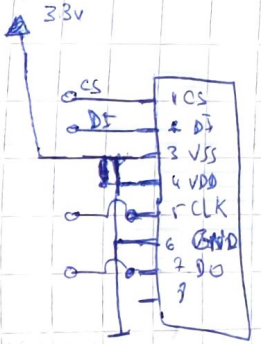


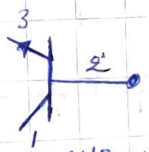


REARBoard



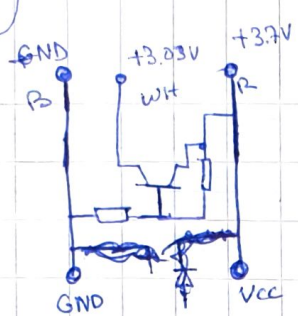






2N3904

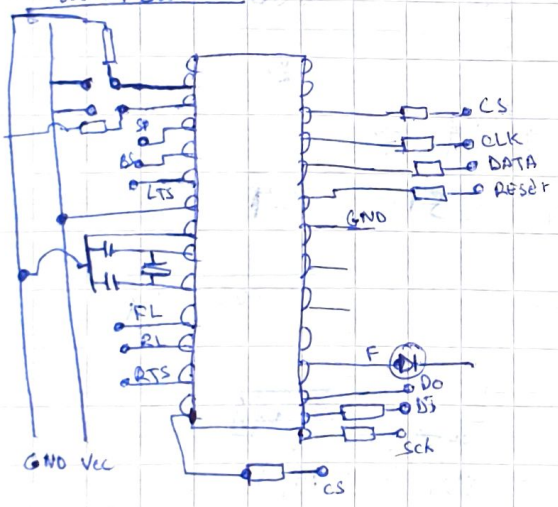
Power Board



Notes: use a low resistive Cable

Cover Board

Main Board



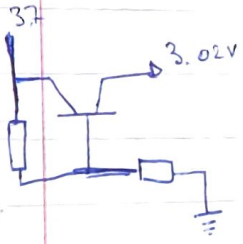
Power Board

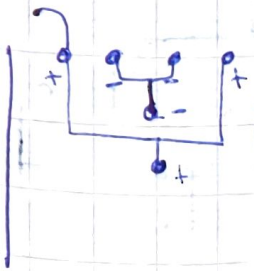
+B1

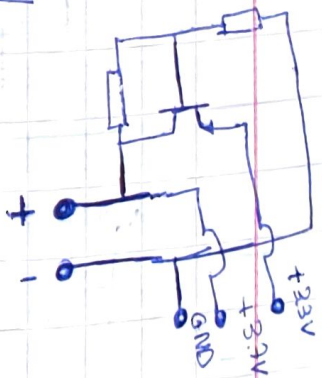
-B1

+B2

-B2







~~Paper~~

~~Main Screen~~ Logo

Arsslensoft

OS

FlyDows Motor

~~Motor~~

Main Screen

LTS BS RTS

& Km/h

a V

PBD= PBT=

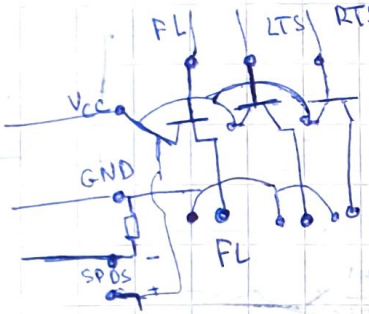
or

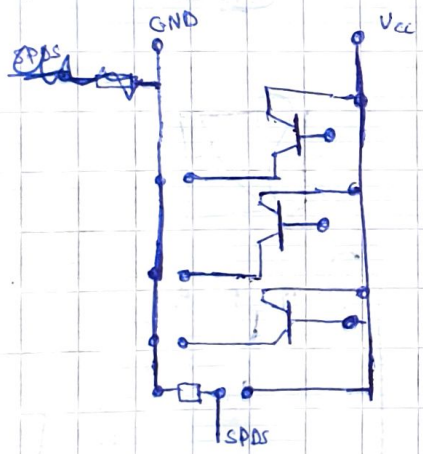
Suggestion

Assembly Notes:

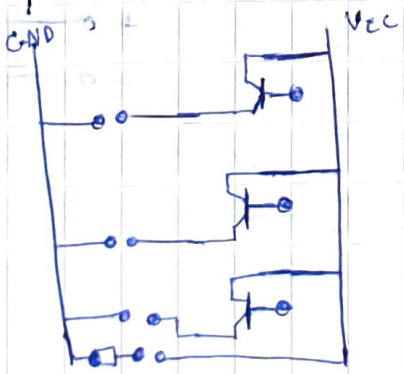
- check the Timers values
- ~~LTS and~~ TS and Update screen

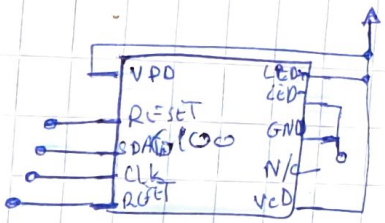
Front Board

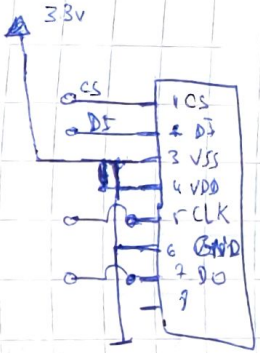


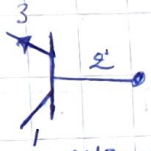


REARBoard









2N3904

Advanced Bike System
Cancelled

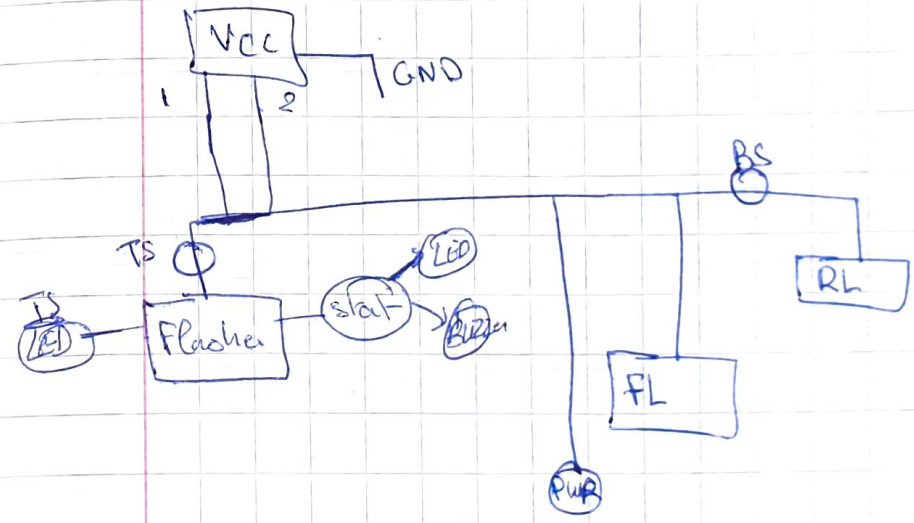
Reasons:
- No money:
  Unexpected costs
- Material problem
  PCB Production
- No Glossy paper
- Components unavailable

Replaced

BCS
Bicycle Control System

- Front light 6 LED ~~4~~ Necessary ~~2~~ booster
- Rear light ~~2~~ LED ~~2 RT~~ ~~[illegible]~~
- Turnsignal 4 LED 2 LTS 2 RTS
- Battery ~~2~~ ~~[illegible]~~ V, ~~[illegible]~~ supply
- Beeper on TS

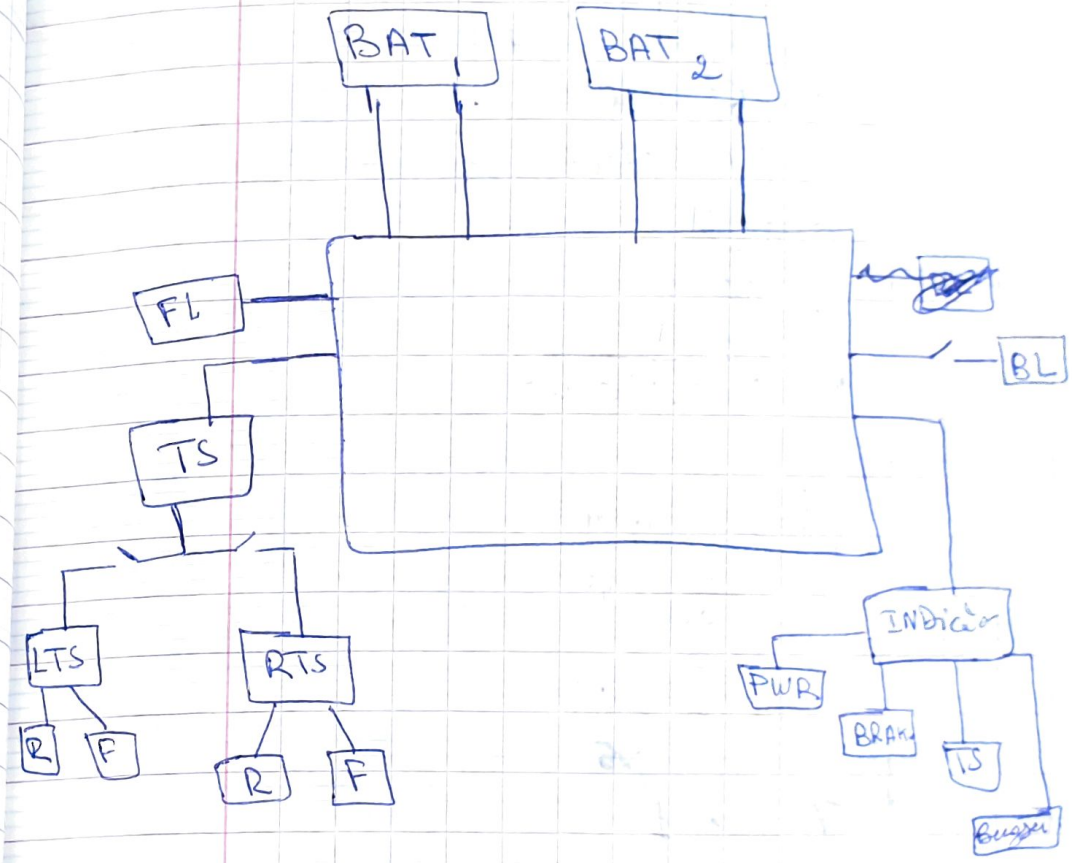
Design



Objectifs:

- Turnsignals
- Power indicator
- TS indicator
- Beepon Turn
- Signal LED
- Brake light
- ~~Brake light~~
- Bright front light

- Design



$f = \frac{0,721}{RC}$

$f = \frac{0,721}{5000 \cdot C} = 2$ Hz

$0,721 = 10000C$

$C = \frac{0,721}{10000}$

$f = \frac{0,721}{5000 \cdot 220 \cdot 10^{-6}} =$

$f = \frac{1}{T} = 0,64$

$T = \frac{1}{0,64} = 1,5$

$C_1 = \frac{T}{} = 0,75$

if $t_1^2 = 0,75$

$T = 2t = 1$

$f = 1$

$\frac{0,721}{R \cdot 220 \cdot 10^{-6}} = 1$

$0,721 = R \cdot 220 \cdot 10^{-6}$

$R = \frac{0,721}{220 \cdot 10^{-6}} = 3,3\,K$

0,000 1518

$f = \frac{1}{1,38RC} = \frac{0,721}{RC}$

$T = 1,38RC \qquad t = \frac{T}{2} = \frac{1,38RC}{2} = 0,69RC$

$t = 0,69RC \Rightarrow \boxed{R = \frac{t}{0,69C}}$

$\boxed{C = \frac{t}{0,69R}}$

(1) if $C = 220 \cdot 10^{-6}$ then $R = \frac{0,5}{0,69 \cdot 220 \cdot 10^{-6}} = 3,3$

$\approx 3,3\,K\Omega$

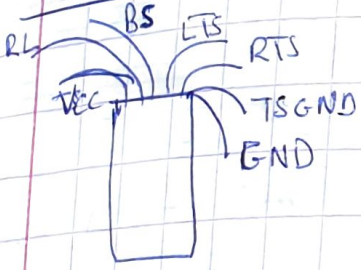
$f = \frac{0,721}{RC} \Leftrightarrow f = 1 \Leftrightarrow R = \frac{0,721}{220 \cdot 10^{-6}} = 3277\,\Omega$

$\approx 3,3 k\Omega$

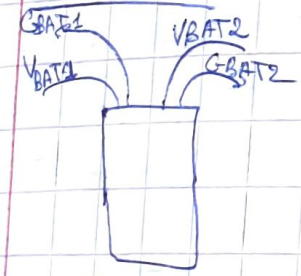
Cable Definitions

Front Cable :

Rear Cable

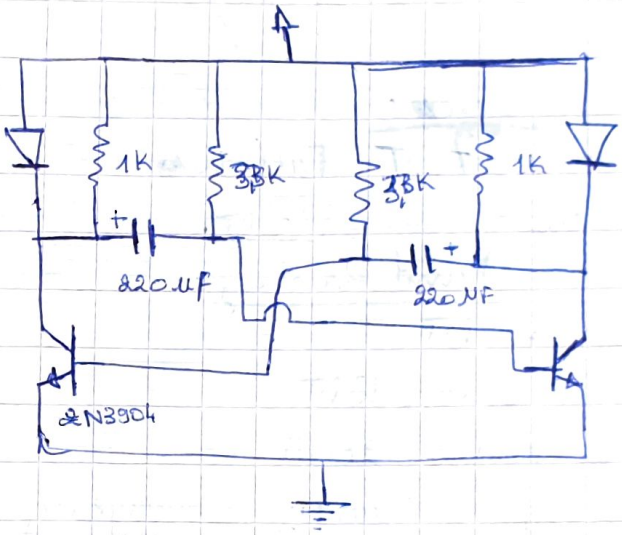


Power Cable

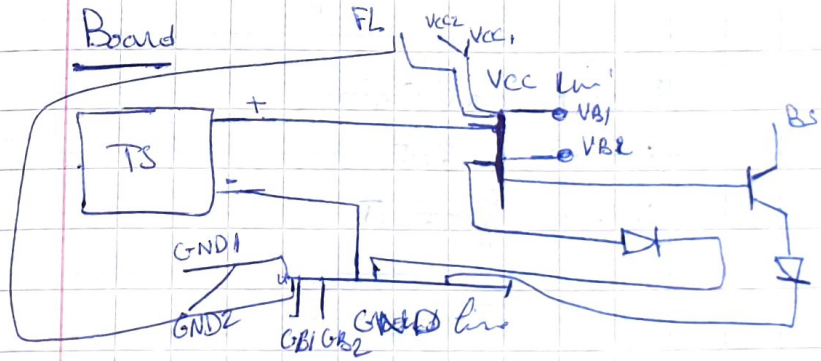


TS Cable :

TS Schematic



Board



Succeed or Nait
TRY

Costs:
37DT Full tarif
Prime Cost = 30DT

Fund Raising:
+5DT
Base: 13DT
Mother: 20DT
for security or emergency fund
10DT %50 of collection

Mechanical Costs
Brakes : 6DT
.Wheel fix: 5DT

$\frac{37}{37} = \frac{R1}{R2+R1} = 0,89$ if $R1 = 220$

3ms = 1/500 F

$\frac{3}{1} : \frac{T}{500}$

$T = 1500$

$0,89 = \frac{220}{R2+220}$

$0,89R2 + 196,21 = 220$

$0,89R2 = 23,79$

$R2 = 26,73$ ohms

$R_2 = \frac{R1}{0,89-1} = \frac{R1}{-0,11} =$

~~1000 = 8000000 / Prescaler * (TOP+1)~~

WGM13 WGM10 CS12

$1000 = \frac{8000000}{512 . T} \Rightarrow 512000T = 8000000$

$T = \frac{8000000}{512000}$

Prime Components

Components	5 DT
ATTIEGA 328	12,5 DT
LCD	5 DT
Matrix Board	2,5 DT
PCB Material	3 DT ⇒ 28 DT

$\frac{12,5 \times 12,5}{2} = 78,125$

$\frac{25}{2} = 12,5$

$V = 1,40 \quad a = -3$

$t = \frac{1,4}{3} = 0,05$

$V_2^2 - V_1^2 = 2ad$

$V_1^2 = 2ad$

$d = \frac{V^2}{2a}$

$x(t) = \frac{1}{2}(t)^2 + V_0 t + 0$

$= \frac{1}{2}(0,33)^2 + 1,4(0,33)$

DIVIDE(a, b)

$c = (a.v_1 \times 100 + a.v_2 \;/\; b.v_1 \times 100 + b.v_2)$

DV1 = C

DV2

$(4)^2 + 8 \times 4 = -16 + 32 = 16$

$+\frac{7}{2}(0,0)^2 + 0,4 \times 0,05 = 1,5$

$+0,0008 +$

$\frac{1,06}{2}(4)^2 + 2,4 \cdot 4$

$-0,3 \cdot 16 + 2,4 \cdot 4 = -4,8 + 9,6 = +4,8$

100^e

$Vt - \frac{a \cdot t^2}{2} \Big| \frac{1}{t} = x$

$20 \cdot 100 - \frac{a2}{2} \cdot 10000 = 2000 - 1000 = 1000 = 1$

$\left(\frac{N_i}{} \cdot V_i \right.$

FM_Flo

5000

2000

10

$\left((50 \times 10) + 0 \right) \times 200 \times 100 + 0$

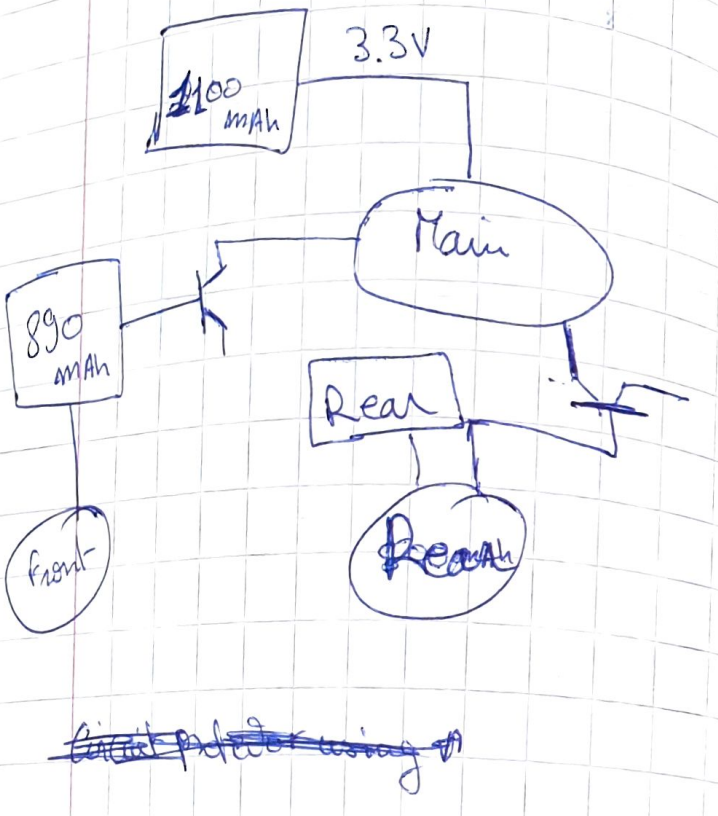
$500 \times 200 =$

$4000 \mid 4$

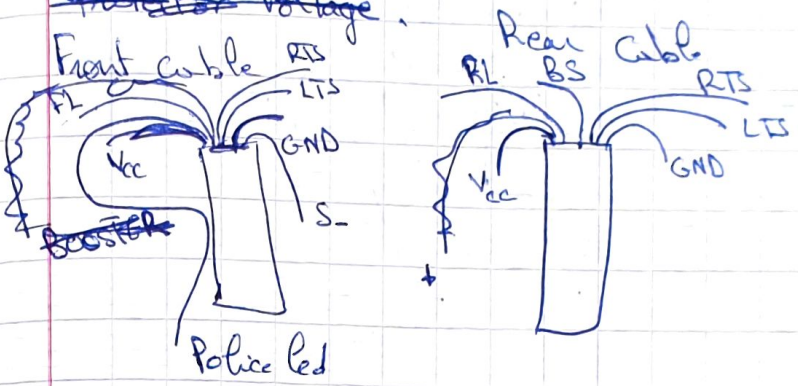
$V = F \cdot 2,07$

$100 \qquad V \cdot V = F \cdot 2,07 \cdot F \cdot 2,07$

- each circuit will have it's own
- ~~the m~~

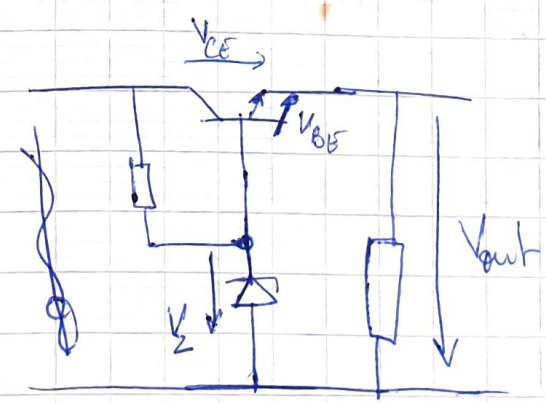


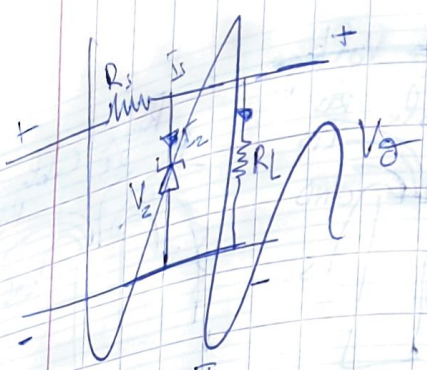
~~Battery voltage~~



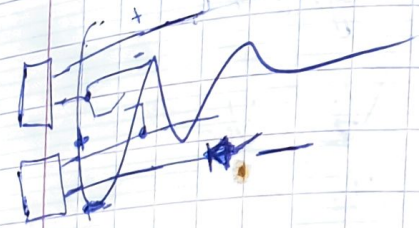
Voltage regulator

$V_{out} = V_{in} - V_{BE}$



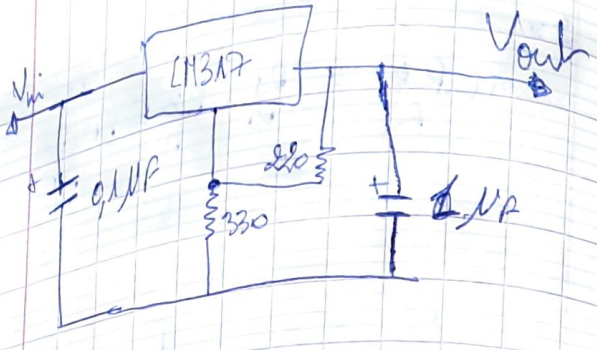


$I_s = I_{z_{min}} + I_{L_{max}}$



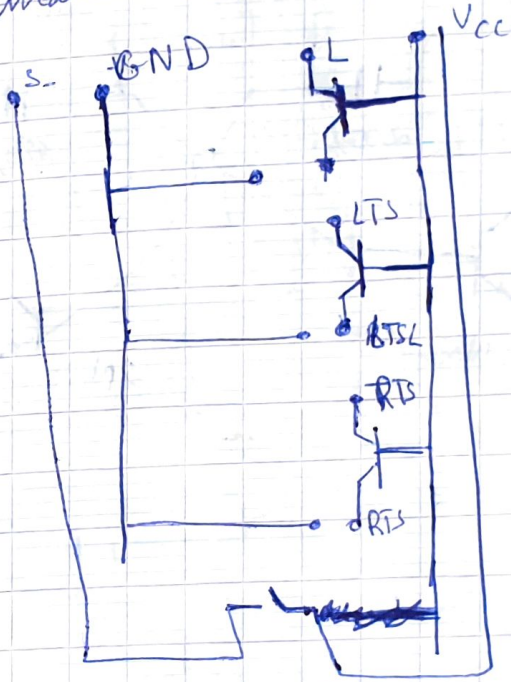
2x

$$1 + \frac{R_2}{R_1} = \frac{R_1}{R_1} + \frac{R_2}{R_1} = \frac{R_1 + R_2}{R_1}$$

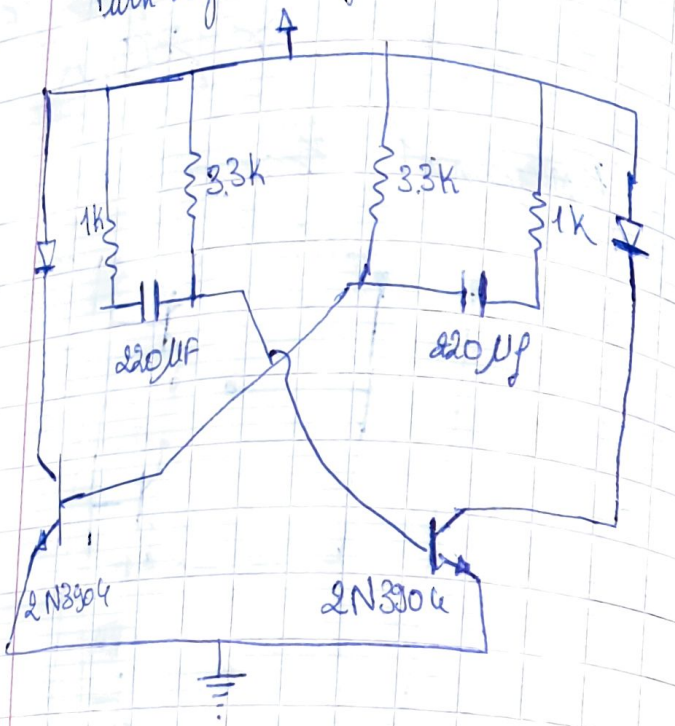


Basic Bike System

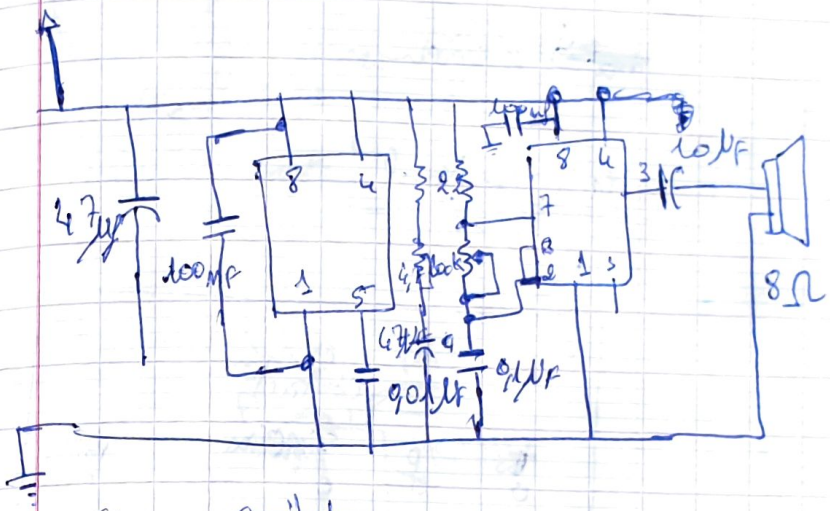
External Board



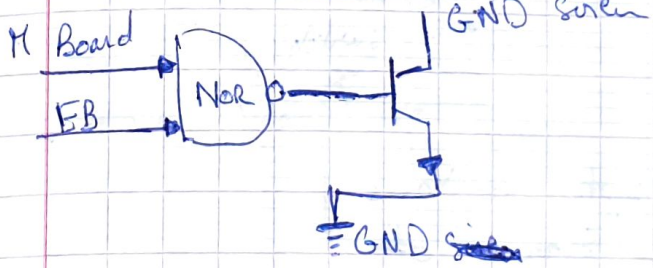
Turn Signal System



Siren Circuit



Siren Switch

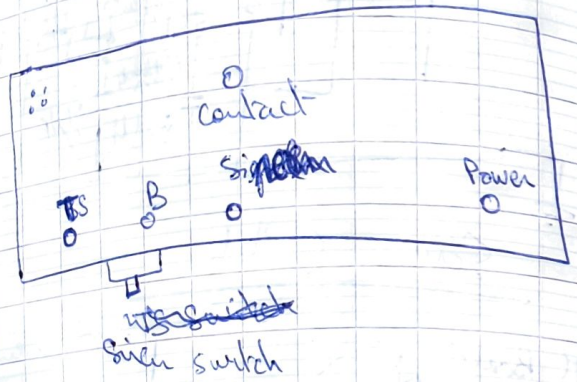


Buzzer

ERROR detection:

~~Front~~ / siren

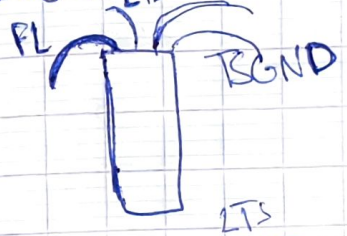
Main Control



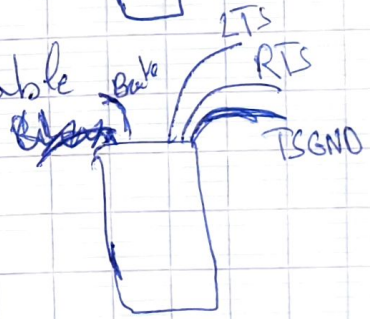
System contains
- Siren
- arlarm circuit

- fading shutdown
→ power on
→ Front light / Rear light
- fading startup
- Alarm system fake

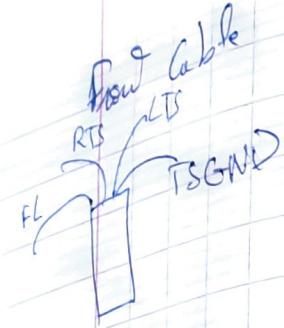
Front Cable



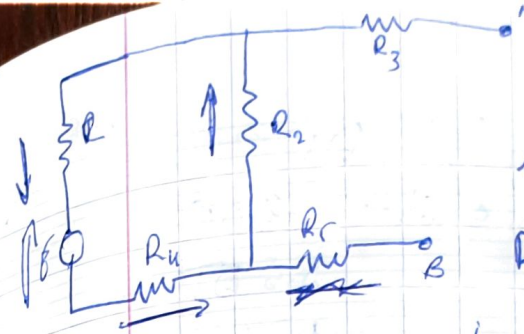
Rear Cable



Main Circuits



FL Red
RTS Green
LTS White
TSGND Black



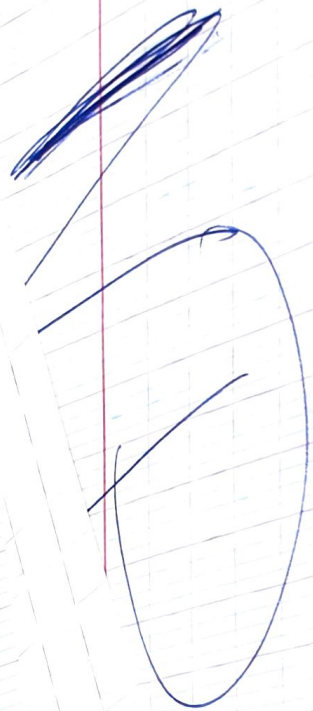
$$U_{R_1} + U_{R_2} + U_{R_4} = E$$

$$R_1 \cdot i + R_2 i + R_4 \cdot i = E$$

$$i = \frac{E_a}{R_1 + R_2 + R_4}$$

$$U_{R_2} = \frac{R_2 \cdot E}{R_1 + R_2 + R_4}$$

Coeur 3,5 DT
Gain + Brake Cables 2 DT
chain 3,5 DT
Repair 4 DT → 3DT
Total 12 → 13 DT



Developer Studio and Social services

t system
ference
eation
system
plugin

→ chemics
→ Maths
→ Programming

x
ric identification (Facial)
ction
communication protocol over TCP
account creation
icense file.

Long
me Writer

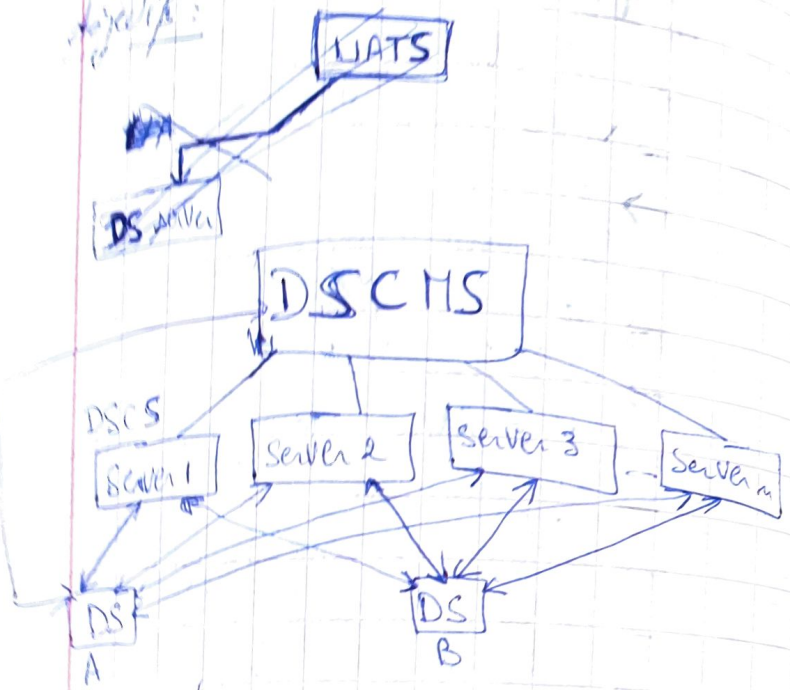
Gear 2
Gain + Brake
chain
Repair
Total

Developer Studio and Social Services

- IDE
- Im chat system
- Video conference
- Room creation
- Educational system
  - chemics
  - Maths
  - Programming
- Language plugin
- Safe box
- Biometric identification (Facial)
- self protection
- secure communication protocol over TCP
- online account creation
- user license file.
- UATS advancing
- Algorithms Writer

Protocol

Developer Studio Communication protocol [DSCP] over TCP

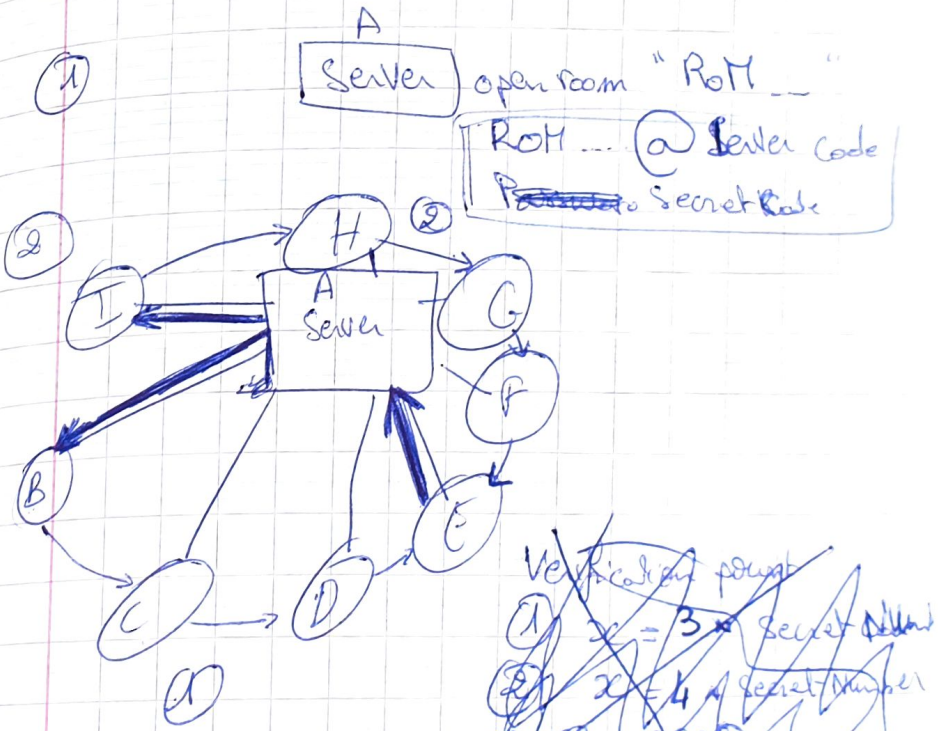


DSCMS: (Developer Studio Communication Main Server) responsible on servers addressing and localisation.

DSCS: (Developer Studio Communication server) responsible on client addres storing and activity fetch, User database.

objectifs:

- Transport text (chat)
- Transport algorithms
- Transport code
- Code window real-time presentation (right.)
- Security
- Encryption
- P2P data Transmission
-



VP = Random chosen by the server

1) Server create the room
2) users connect to this room while it's unlocked
3) Server VP and gives it a secret code
4)
- when VP want's to send the server i
VP
- when clients sends message to all

1 (2 = 1+1 = 2x1 ·
2 (3 = 2+1 = 2x1+1 = 1x2+1
2 (5 = 2x1+3 = 3x1+2 = 2x2+1
2 (7 = 5x1+2 = 3x2+1 = 3x2+1
4 (11 = 5x2+1
2 (13 = 5x2+3
4 (17 = 7x2+3
2 (19 = 7x2+5
4 (23 = 11x2+1
6 (29 = 13x2+3
2 (31 = 13x2+5
6 (37 = 17x2+3
4 (41 = 19x2+3
2 (43 = 19x2+5
4 (47 = 23x2+1
6 (53 = 23x2+7 = 29x2-5
6 (59 = 29x2+1 = 31x2-3
2 (61 = 29x2+3 = 31x2-1
6 (67 = 31x2+5 = 33x2+1
4 (71 = 33x2+5 = 37x2-3
2 (73 = 33x2+7 = 37x2-1
6 (79 = 37x2+5 = 41x2-3
4 (83 = 41x2+1
6 (89 = 43x2+3

1+x2 = 3

13x2+1 = 27
5x2+1 = 11
6x2+1 = 13

$2^2 = 4$ 3^2 5^2 6^2 7^2 8^2

4 — 9 — 16 — 25 — 36 — 49 — 64
5 — 7 — (9) — 11 — 13 — (15) — 17

81 — 100 — 121 — 144 — 169 — 196
19 — (21) — 23 — (25) — (27) — 29

225 — 256 — 289 — 324 — 361
21 — 31 — 16 — 33 — 17 — (35) — 18 — 37 — 19 — (39)

400 — 441 — 484 — 529 — 576
20 — 41 — 21 — 43 — 22 — (45) — 23 — 47 — 24 — (49)

625 — 676 — 729 — 784 — 841
25 — (51) — 26 — 53 — 27 — (55) — 28 — (57) — 29 — 59

900 — 961 — 1024 — 1089 — 1156
30 — 61 — 31 — (63) — 32 — (65) — 33 — 67 — 34

TCC +5,5

ECC 15

DCC 6

Discount +10

Total 36,5

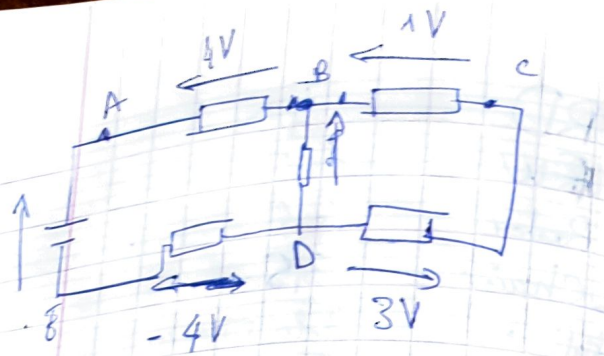
RD 4,5

FW 4,5

Rotor 7,5

Chain 3,5

Total : 20 DT



$U_{AE} + U_{ED} = U_{AB} + U_{BC} + U_{DC}$

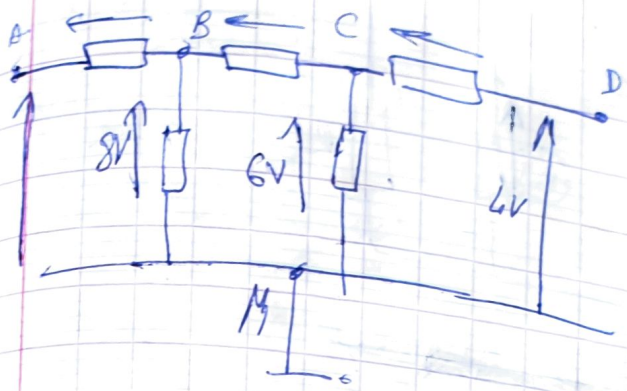
$U_{AB} - 4 = 4 + 1 + 3 = 8\,V$

$U_{AB} = 4\,V$

$U_{BD} = U_{BC} + U_{CD} = 1 + 3 = 4V$

$U_{AE} + U_{ED} = U_{AB} + U_{BD} + U_{DE}$

$U_{AE} - 4 = 4 + 4 + 1 + 3 = 12\,V$



$U_{AM} = U_{AB} + U_{BM} \Rightarrow U_{AB} = U_{AM} - U_{BM} = 4V$

$U_{AM} = V_A - V_M = 12 \Leftrightarrow V_M = 0$

$\boxed{V_A = 12V}$

$U_{AB} = V_A - V_B = 12 - V_B = 4$

$\boxed{V_B = 8\,V}$

$U_{BM} = U_{BC} + U_{CM} \Rightarrow 8 = U_{BC} + 6$

$\boxed{U_{BC} = 2V}$

$U_{BC} = V_B - V_C = 8V - V_C = 2V$

$\boxed{V_C = 2V}$

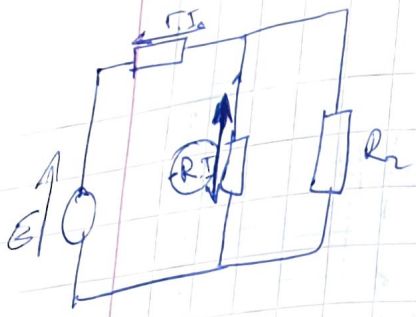
$U_{CM} = U_{CD} + U_{DM}$

$6V = U_{CD} + 4$

$U_{CD} = 2V$

$U_{CD} = V_C - V_D$

$2 = 2V - V_D$



$$I_1 = \frac{R_1}{R_1 + r} \cdot \varepsilon \Rightarrow$$

$$\frac{1}{R_{eq}} = \frac{1}{r} + \frac{1}{R_1} \Rightarrow \frac{1}{R_{eq}} = \frac{R_1 + r}{R_1 \cdot r}$$

$$\boxed{R_{eq} = \frac{R_1 \cdot r}{R_1 + r}}$$

$$I_2 = \frac{R_2}{R_2 + R_{eq}} \cdot \varepsilon = \frac{R_2 \cdot \frac{R_1 \cdot \varepsilon}{R_1 + r}}{R_2 + \frac{R_1 \cdot r}{R_1 + r}}$$

$$f(x) = \frac{x^2 - x + 1}{x - 2}$$

1) $\lim_{+\infty} f(x) = \lim_{+\infty} \frac{x^2}{x} = +\infty$

$\lim_{-\infty} f(x) = \lim_{-\infty} \frac{x^2}{x} = -\infty$

$\lim_{2^-} f(x) = \lim \frac{3}{0^-} = -\infty$

$\lim_{2^+} f(x) = +\infty$

- $x^2 - x + 1 = 0$

$\Delta = (-1)^2 - 4 = 1 - 4 = -3$

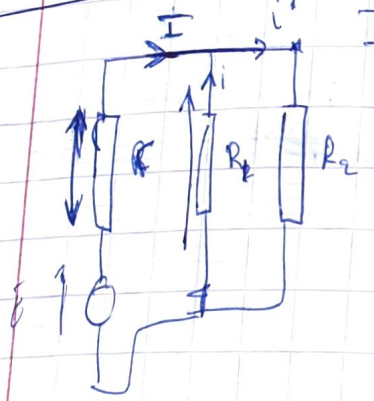
$\mathbb{R} = \emptyset$

cost

Coeur 7 DT

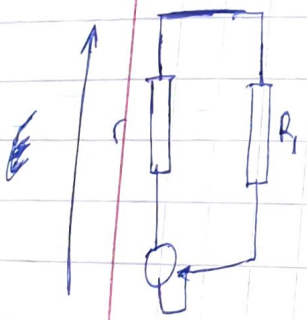
Pompe Retouche 5 DT.
gain Rad Cable 2 DT
chaine 3,5 DT

estimated cost 20 DT
or 15 DT if bombe retouche



$I = \frac{E}{r}$

$i' = I + i$



$U_{R_1} = U_{AB} =$

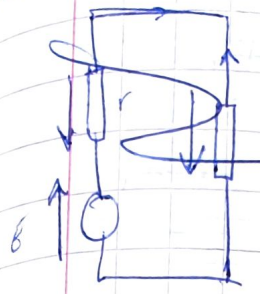
$U_{R_1} = -R_1 \cdot i$

$U_{R_1} = -R_1 \cdot (i' - I)$

$= -R_1 \cdot i' - \frac{E}{r}$

$= -R_1 i' + \frac{E R_1}{r}$

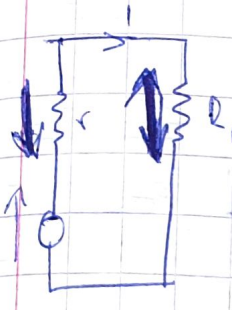
$= \frac{-r \cdot R_1 \cdot i' - E R_1}{r} = 1$



$E = U_r + U_{R_1}$

$E = r \cdot i + R_1 \cdot i$

$i = R_1 - \frac{E}{I}$



$E = U_r + U_{R_1} = r \cdot i + R_1 \cdot i$

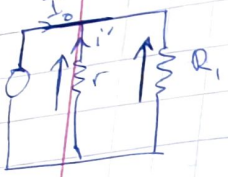
$E = i (r + R$

$i = \frac{E}{r+R}$

$U_{R_1} = \frac{R_1 \cdot E}{r + R_1}$

$R_0 = \frac{1}{r} + \frac{1}{R_1} = \frac{R_1 \cdot r}{R_1 + r}$

loi des noeuds



$i = I_0 + i'$

$r \cdot i' = R_1 \cdot i$

$\Leftrightarrow \boxed{i' = \frac{R_1 \cdot i}{r}}$

~~$U_{R_1} = R_1 \cdot i = r \cdot R_1$~~

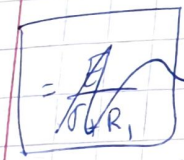
$i = I_0 + \frac{R_1}{r} \cdot i$

$I_0 = i + \frac{R_1}{r} \cdot i$

$I_0 = i\left(1 + \frac{R_1}{r}\right)$

$I_0 = \frac{E}{r}$ $\quad i\left(1 + \frac{R_1}{r}\right) = \frac{E}{r}$

$i = \frac{\frac{E}{r}}{1 + \frac{R_1}{r}} = \frac{\frac{E}{r}}{\frac{r + R_1}{r}}$

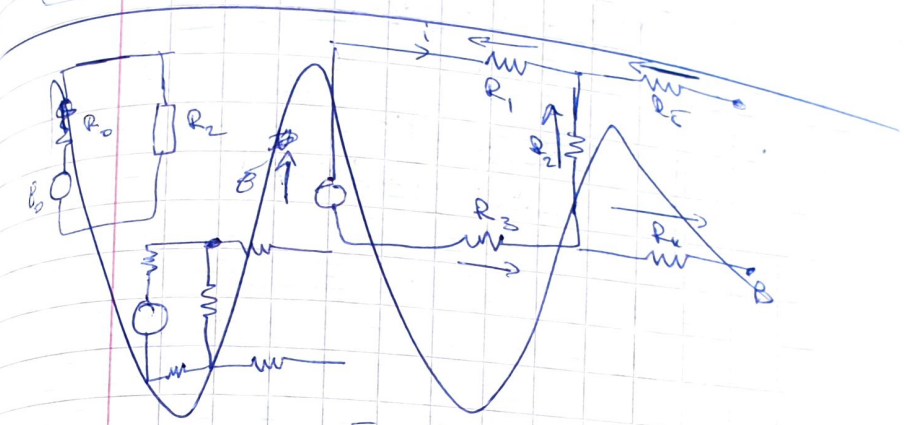


$i = \frac{r \cdot \frac{E}{r}}{R_1 + r}$

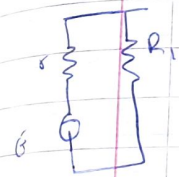
$\boxed{i = \frac{E}{R_1 + r}}$

$\boxed{U_{R_1} = R_1 \cdot i = \frac{R_1 \cdot E}{R_1 + r}}$

$\boxed{U_{R_1} = \frac{R_1 \cdot r \cdot I_0}{R_1 + r}}$

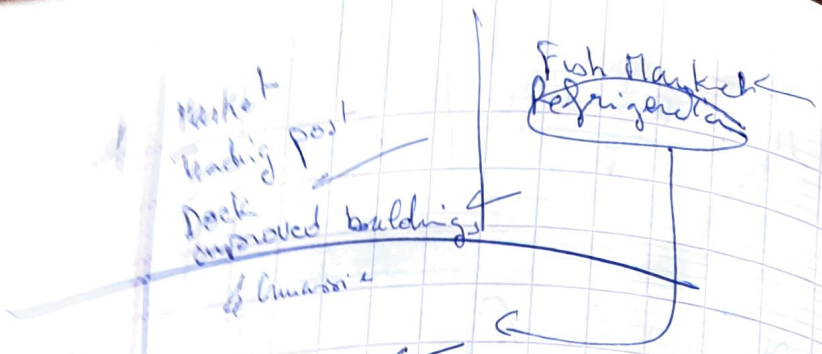


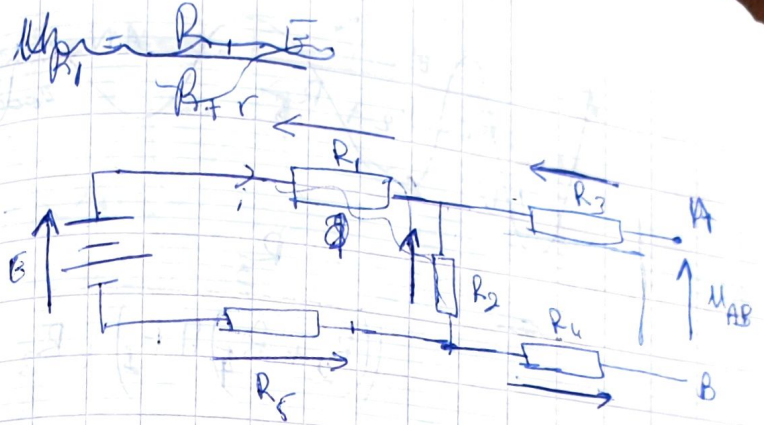
$E = U_{R_1} + U_{R_2} + U_{R_3} + U_{R_4} + U_{R_5}$



pour r et R_1 en parallèle on a

$E_0 = \frac{R_1 \cdot E}{r + R_1}$





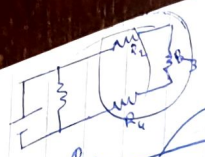
$$E_0 = \frac{R_2}{R_1+R_2} \cdot E \quad AN = \frac{4000}{7000} \cdot E = 5{,}71\,V$$

$$\frac{1}{R_0} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{R_2+R_1}{R_2 R_1} \Rightarrow R_0 = \frac{R_2 R_1}{R_1+R_2}$$

$$R_{0_{eq}} = 1714{,}28\,\Omega$$

$$E_1 = \frac{R_3}{R_0+R_3} \cdot E_0 = AN \cdot \frac{3000}{1714{,}28+3000} = \frac{3000}{4714{,}28} = 3{,}4$$

$$R_{1_{eq}} = \frac{R_3 R_0}{R_3+R_0} = 1090{,}9\,\Omega$$



$\frac{1}{R_1} + \frac{1}{R}$ $\quad R_0 = \frac{R_1 \cdot R}{R_1 + R}$

$A.N = \frac{4000}{4000+4000+400} \cdot 14$

$= 4V$

$E_0 = \frac{R_2}{R_1 + R_2 + R_3} \cdot E$

$E_0 = \frac{R_3}{\left((R_2 + R_4) \,||\, R_5\right) + R_3} \cdot E$

$= \frac{R_3}{\left(\frac{1}{R_2+R_4} + \frac{1}{R_5}\right)^{-1} + R_3} \cdot E$

$= \frac{R_3}{\frac{R_1 \cdot (R_2+R_4)}{R_2+R_4+R_1} + R_3} \cdot E$

$= \frac{R_3}{\frac{R_1 \cdot (R_2+R_4) + R_3(R_2+R_4+R_1)}{R_2+R_4+R_1}} \cdot E =$

$= \frac{R_3}{R'} \cdot E =$

$R' = \frac{1000 \cdot (3000 + 2000) + 7000\,(6000)}{6000}$

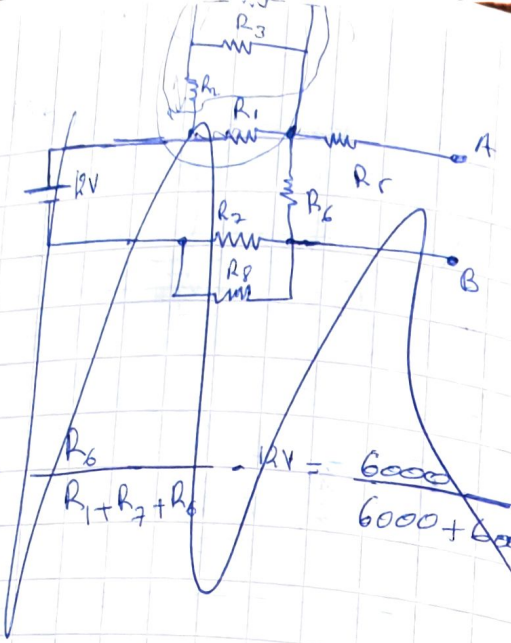
$= 7833{,}33\,\Omega$

$E_0 = \frac{7000}{783333}$

$V_{TH_1} = \frac{R_2}{R_1 + R_2} \cdot E = 7V$

$V_{TH} = \frac{R_5}{R_3 + R_5 + R_4} \cdot V_{TH_1} = \frac{1}{7} V_{TH}$

$E_0 = \frac{R_3}{R_1 + R_2 + R_4} =$



$$\frac{R_6}{R_1+R_7+R_6} \cdot 12V = \frac{6000}{6000+6000+6000} = \frac{1}{3}$$

$= 4V$

$$R_{TH} = \left(\left(R_1 + R_5\right) \| R_2\right) + R_3 + R_4$$

$$= \left(\frac{1}{R_1+R_5} + \frac{1}{R_2}\right)^{-1} + R_3 + R_4$$

$$= \left(\frac{R_1+R_5+R_2}{(R_1+R_5)\,R_2}\right)^{-1} + R_3 + R_4$$

$$\frac{(R_1+R_5)\,R_2}{R_1+R_5+R_2} + R_3 + R_4 =$$

$$R_{TH} = \left(\left(\left(R_1 + R_5\right) \| R_6\right) \| R_2\right) + R_3 + R_4$$

$$= \left(\left(\frac{(R_1+R_5)\,R_6}{R_1+R_5+R_6}\right) \| R_2\right) + R_3 + R_4$$

$$= \left(833{,}33 \| R_2\right) + R_3 + R_4$$

$$= \frac{R_0 \cdot R_2}{R_0+R_2} + R_3 + R_4 = 744{,}67 + R_3 + R_4$$

$=$

$$R_{TH} = (R_1 \parallel R_2) + ((R_3 + R_4) \parallel (R_5)) =$$

$$\frac{R_1 \cdot R_2}{R_1 + R_2} + \frac{(R_3 + R_4) R_5}{R_3 + R_4 + R_5} =$$

$2916,66 + 857,14 = 3773,80$

$$R_{TH} = \frac{(R_1 + R_4) \parallel R_2}{R_1 + R_2 + R_4} + R_3 = \frac{(R_1 + R_4) \cdot R_2}{R_1 + R_2 + R_4} + R_3 = 2400 + 3000$$

$= 5400\,\Omega$

$$R_{TH_1} = \left((R_3 \parallel R_4) + R_2\right) \parallel R_1$$

$$R_{TH_2} = (R_7 \parallel R_8) = \frac{R_7 R_8}{R_7 + R_8} = 3000\,\Omega$$

$$R_{TH} = \left((R_{TH_1} + R_{TH_2}) \parallel R_6\right) + R_5$$

$$R_{TH_1} = \left(\frac{R_3 R_4}{R_3 + R_4} + R_2\right) \parallel R_1 = 6000 \parallel R_1 = \frac{6000 R_1}{6000 + R_1}$$

$= 3000$

$$\frac{(R_{TH_1} + R_{TH_2}) R_6}{R_{TH_1} + R_{TH_2} + R_6} + R_5 = \frac{6000 R_6}{6000 + R_6} + R_5$$

$= 6742\,\Omega$

$$\left(\left(R_1 + R_5\right) \parallel R_2\right) + R_3 + R_4$$

$$R_{TH} = \frac{R_2 (R_1 + R_5)}{R_1 + R_2 + R_5} + R_3 + R_4 = 2666,67 + 6000 = 8666,67$$

$$V_{TH} = \frac{R_2}{R_1 + R_2 + R_5} = \frac{4}{4+4+4} \cdot 12 = 4V$$

$$V_{TH} = \frac{R_2}{R_1 + R_2 + R_5} = \frac{7}{12} \cdot 12 = 7V$$

$$V_{TH} = R_1 + \left(\left(R_3 + R_4\right) \parallel R_5\right) \parallel R_2$$

$$= R_1 + \left(\left(\frac{(R_3 + R_4) R_5}{R_3 + R_4 + R_5}\right) \parallel R_2\right) = R_1 +$$

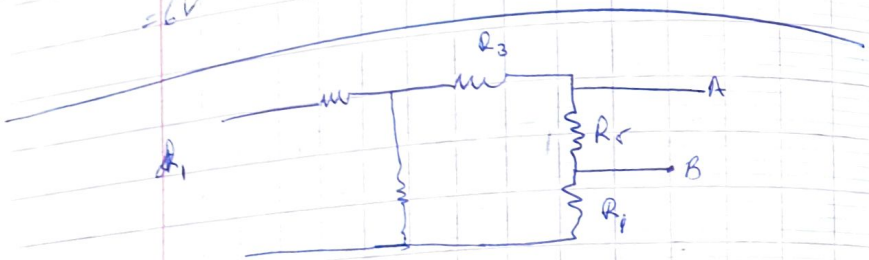
$$\frac{R_2}{R_1 + R_2} \cdot 12V = \frac{7}{12} \cdot 12 = 7V$$

$$V_{TH} = \frac{4}{10} \cdot 10 = 4V$$

$$V_{TH} = \frac{R_6}{R_{K_1} + R_{K_2} + R_6} \cdot V$$

$$R_{K_1} = 3 \;/\!/\; R_{K_2} = 3 \iff V_{TH} = \frac{6}{3+3+6} = \frac{6}{12} \cdot V$$

$= 6V$



$$V_{R_2} = \frac{R_2}{R_1 + R_2} \cdot V = \boxed{7V}$$

$$i = \frac{12}{5000} = 2,4\ mA$$

$$i_1 = 1\ mA$$

$$1,4\ mA$$

$$V_{R_3} = R_3 \cdot 1,4 = 4,2V$$

$$\frac{R_5}{R_3 + R_5} = \frac{3}{4} \cdot 7 = 5,25V$$

$$V_{R_5} = 5,25V$$

$$\frac{R_4}{R_4 + R_5} = \frac{3}{4} \cdot 5,25 = 3,93$$

$$\frac{R_4}{R_4 + R_2} = \frac{3}{10} \cdot 3,93 =$$

$$\frac{R_1}{} = \frac{5}{12} \cdot 12 = 5V \Rightarrow 3$$

$$\frac{R_3}{R_3 + R_5 + R_4} = 2,4$$

$$\frac{R_4}{R_4 + R_2} = \frac{7}{13}$$

$v_0 = 2.10^7\ ms^{-1}$ $d = 2cm = 0{,}02\ m$

$U = 140V$ $m_e = 9{,}1.10^{-31}$

$\|\vec{P}\| = m\|\vec{g}\|$

calculons le poids de l'électron

$\|\vec{P}\| = 9{,}1.10^{-30}\ N$

calculons l'intensité de la force

$\|\vec{F_e}\| = |q|\|\vec{E}\|$

AN $\|\vec{F_e}\| = 1{,}6.10^{-19} \times \frac{140}{2.10^{-2}} = 1{,}16.10^{-14}$

$\frac{\|\vec{F_e}\|}{\|\vec{P}\|} = \frac{1{,}16.10^{-14}}{9{,}1.10^{-30}} = 1{,}2.10^{16}$

le poids de l'électron est négligeable devant la force électrique

1/b

détermination $\vec{a}$ de l'électron entre les deux plaques

Référentiel : terrestre (galiléen)

Système : électron

BF : $\vec{F_e}$

deuxième loi de newton

$\vec{F_e} = m.\vec{a}$

$|q|\|\vec{E}\| = m.\vec{a}$

$-1{,}6.10^{-19}\ \frac{140}{0{,}02} = m\vec{a}$

$-1{,}6.10^{-19} \times 7000 = 9{,}1.10^{-31}.\vec{a}$

$\vec{a} = \frac{-1{,}6.10^{-19} \times 7.10^3}{9{,}1.10^{-31}}$

$\vec{a}\begin{cases} a_x = -\frac{e}{m} E_x = 0 \\ a_y = -\frac{e}{m} E_y = \frac{e}{m}\|\vec{E}\| \end{cases}$

$\vec{a}\begin{cases} a_x = 0 \\ a_y = \frac{e.U}{m.d} \end{cases}$

$\vec{V}\begin{cases} V_x = V_{0x} = V_0 \\ V_y = \frac{e.U}{m.d}.t + V_{0y} = \frac{e.U}{m.d}t \end{cases}$

$x\begin{cases} x = V_0 t + x_0 = V_0 t \\ y = \frac{e.U}{2m.d}t^2 + y_0 = \frac{e.U}{2m.d}t^2 \end{cases}$

b-2 $t = \frac{x}{V_0}$

$y = \frac{e.U}{2m.d}\left(\frac{x}{V_0}\right)^2$ $\quad y_s = \frac{e.U}{2m.d}\left(\frac{L}{V_0}\right)^2$

c) $OC = \frac{L}{2}$

$y_s = 1{,}6$ $\quad \boxed{y_s = \frac{e.U}{2.m.d}\left(\frac{L}{V_0}\right)^2}$

d) $\frac{y_s}{y} = \frac{OC}{D}$

$y_s.D = y.OC$