PRR

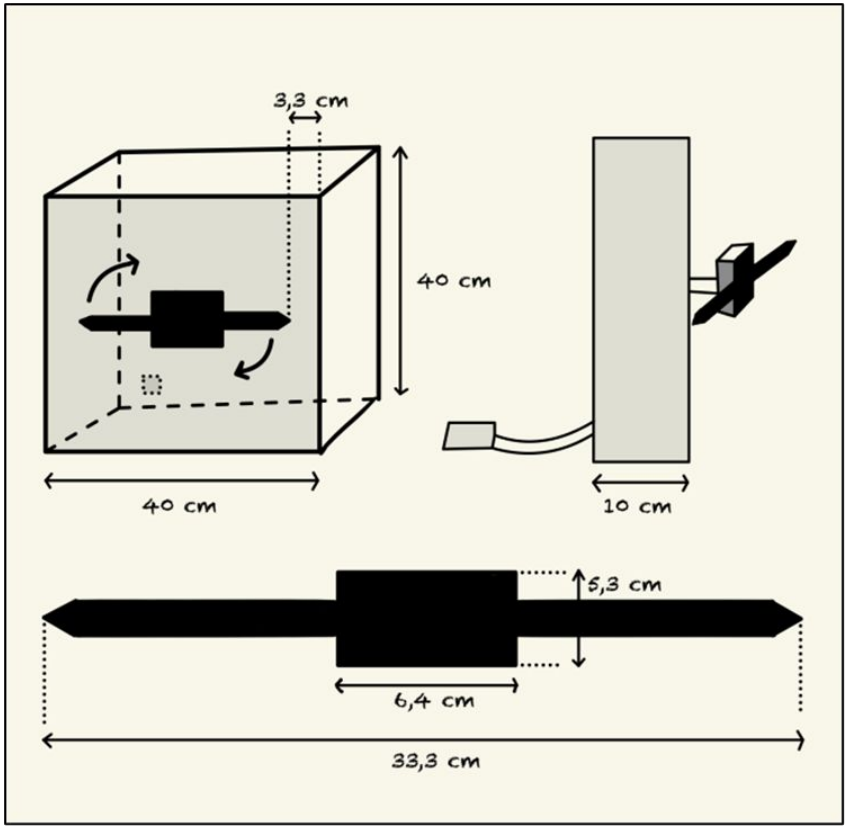
Holographic fan

The 30th of april 2025

Mustafa TOPBAS, Axel LEROY, Cédric DA CRUZ, Abigaïl BROCHARD

Introduction / quick presentation

- The purpose : To show an image
- For whom : GPSE speciality
- For what : Open house events



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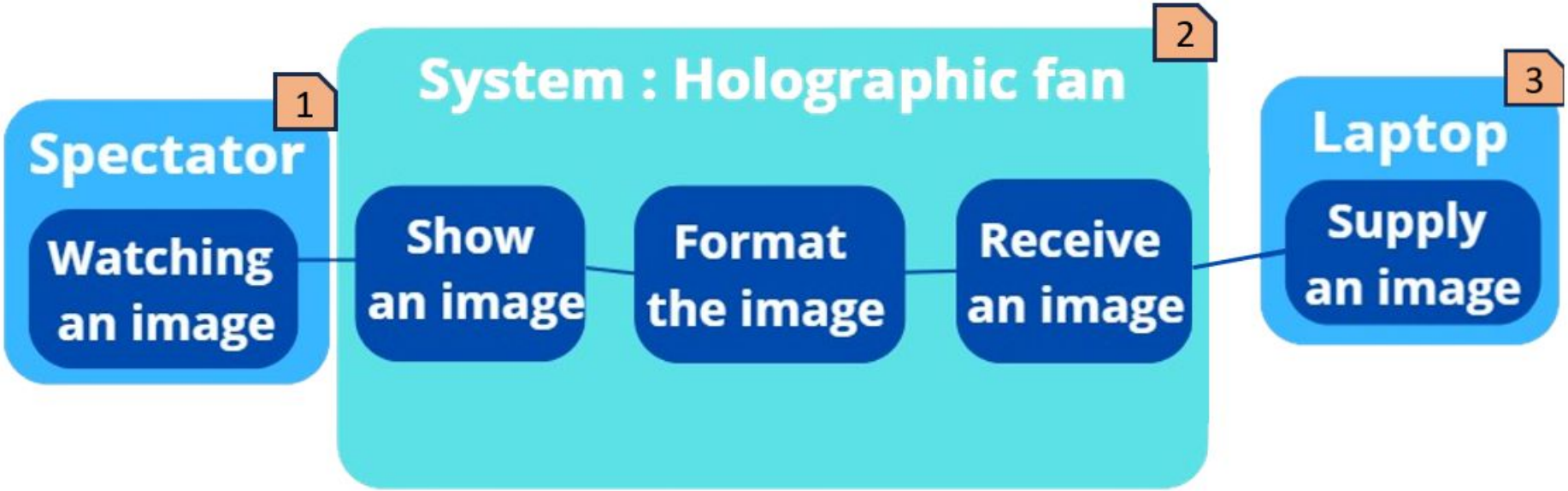
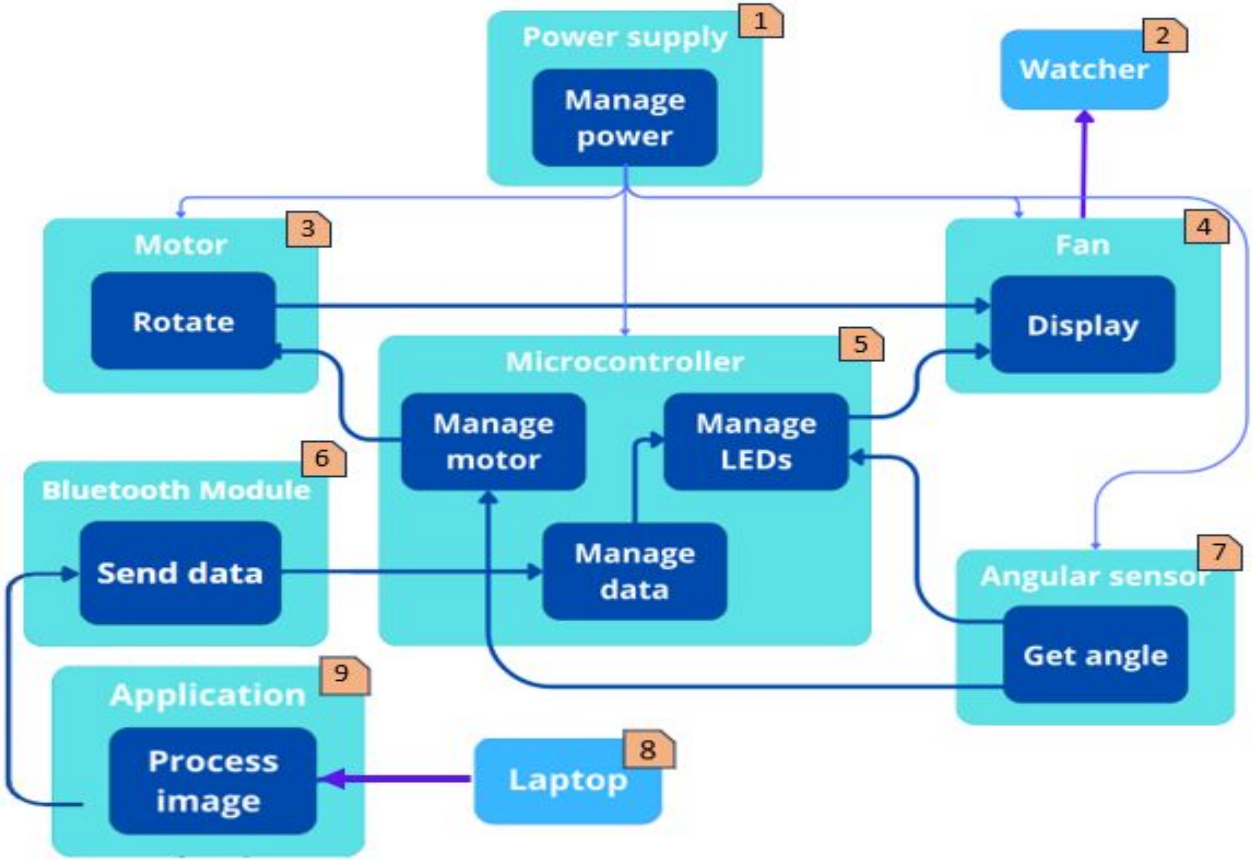
I. Use case

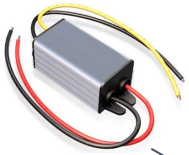

1
Spectator
Watching an image
2
System : Holographic fan
Show an image
Format the image
Receive an image
3
Laptop
Supply an image

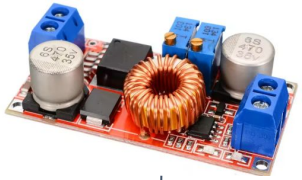
I. Functional analysis

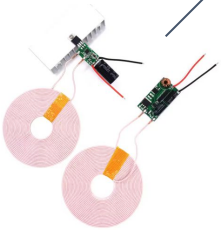


II-1 Power supply and blades

Mustafa :



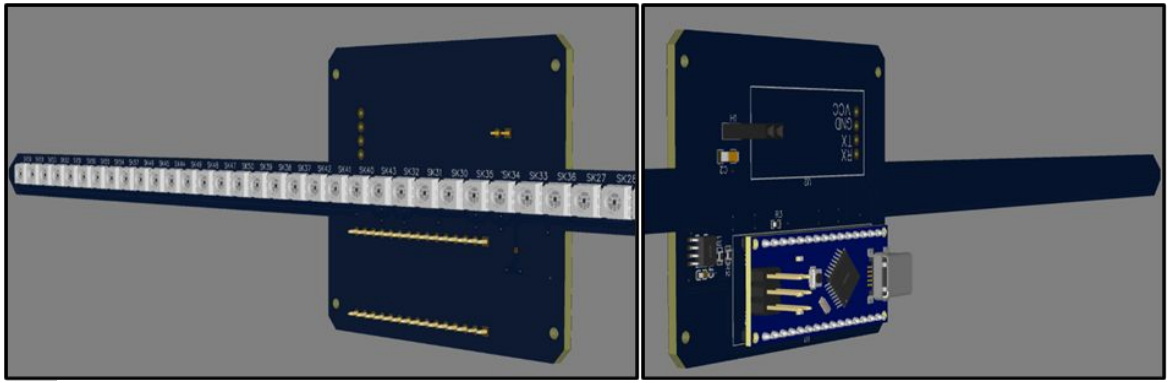




II-1 Power supply and blades

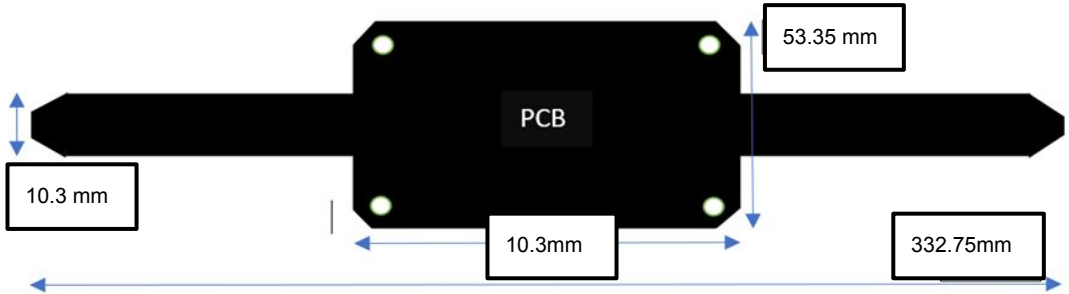
Mustafa :

Front side :
-50 leds
-Ground plan



EasyEDA

Back side :
-Arduino nano
-Module bluetooth
-Angular sensor
-PCB power supply input



J@LC JLCPCB

II-2 LEDs and sensors

Abigaïl:

Criterias	SK9822
Communication protocol	SPI: 2 wires (Data In + Clock In)
Max communication frequency	Up to 30 MHz
Frame structure	32 bits: 1 control byte (0b111xxxxx) + 3 bytes RGB
Power supply voltage	5.0 V ± 0.2 V
Max current per LED	RGB max (3 × 20 mA) = 60 mA per LED
Brightness (RGB white @ 100%)	~550–650 mcd
Operating temperature	-20°C to +70°C
Signal latency per LED	~0.4 µs per LED at 30 MHz (slightly faster)
Power consumption at 150 LEDs	150 × 60 mA = 45 W max (at 100% white)
Logic input voltage	Data/Clock HIGH ≥ 3.3V
High-speed stability	Very stable, but slight flicker may appear above 20 MHz

II-2 LEDs and sensors

Abigaïl:

Criterias	AS5600
Measurement type	Non-contact angular position
Measurement range	0° to 360° (without mechanical stop
Resolution	12 bits (4096 steps per revolution)
Communication interface	I^2C
Supply voltage	3.3V to 5V
Power consumption at 150 LEDs	~1. 5 mA in typical operation
Operating temperature	40°C to +125°C
Programmability	Yes (angle range, direction, etc.)
Latency	Typically 1-2 ms
Magnetic field sensitivity	Recommended magnet: 4 mT to 8 mT at 0.5 mm

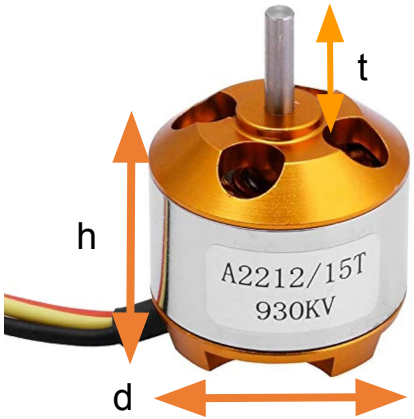
II-2 LEDs and sensors

Abigaïl:

Criterias	Arduino nano
Microcontroller	ATmega328P
Operating voltage	5V or 3.3V
Digital pins	14 (including 6 PWM)
Analog inputs	8
Available interfaces	UART / I^2C / SPI
Flash memory	32 KB
Clock frequency	16 MHz
Programming port	USB mini-B

II-3 Motor & motor management

Cédric: Components



Brushless motor

A2212/15T 930KV

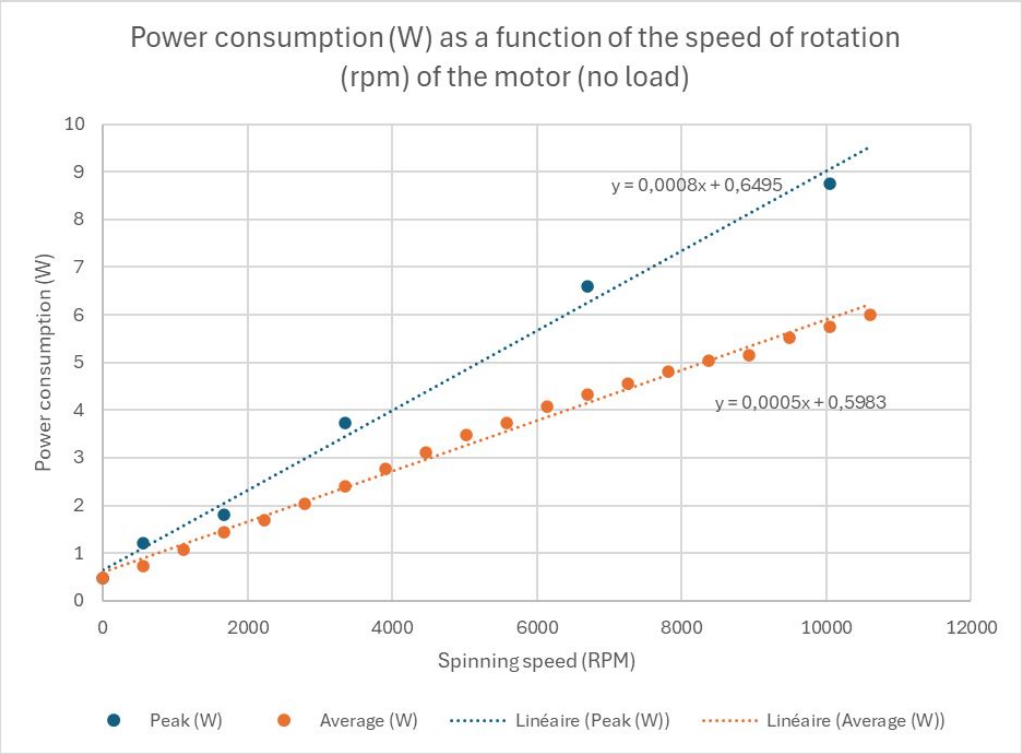
- 930 RPM/V
- h = 22mm
  t = 12mm
  d =22mm

Electronic Speed Controller

- 30A maximum
- 2-12 V
- PWM communication
- Controlled by µ-processor

II-3 Motor & motor management

Cédric: Test



II-3 Motor & motor management

Cédric: Make the motor spin at the requested speed

Calibration Code

Library “Servo.h”

Initialisation process

Loop for speed increment (0 -> 11600 RPM)
- Width expansion of PWM impulse(1000->2000)

Spinning Code

Library “Servo.h”

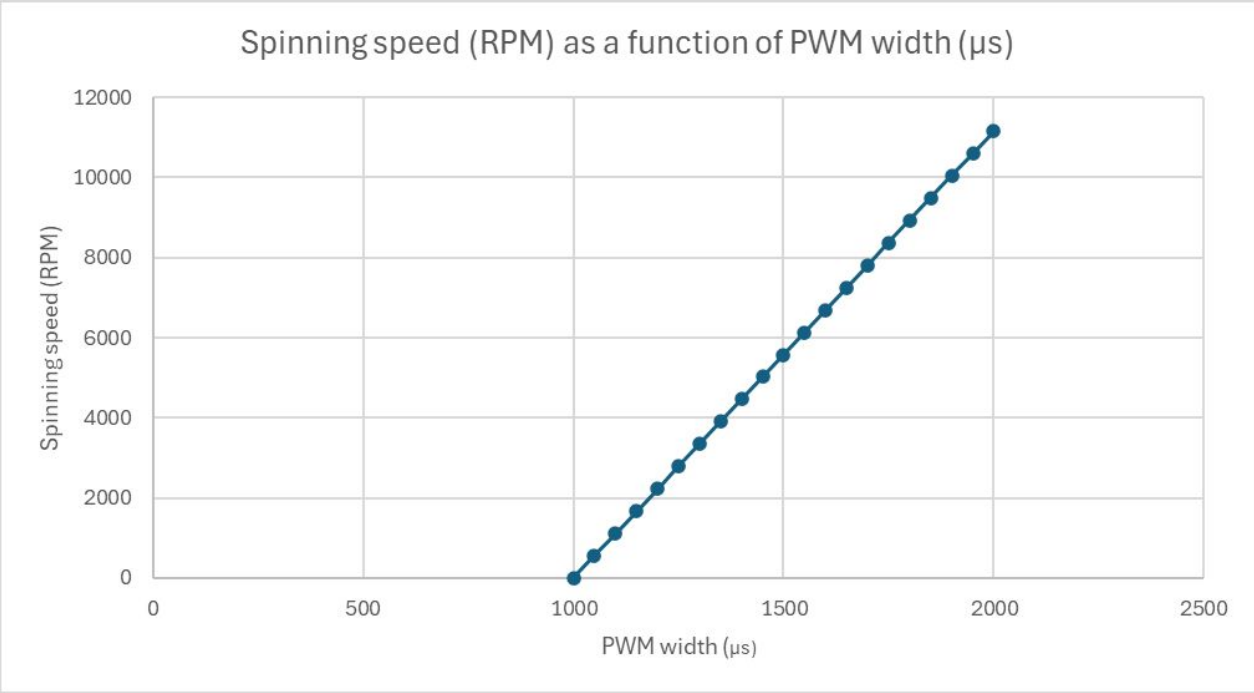
Initialisation process

Fix speed (PWM width 1063⇔ 700 RPM)

Link to the Github :
https://github.com/cedric-da-cruz/HoloFan

II-3 Motor & motor management

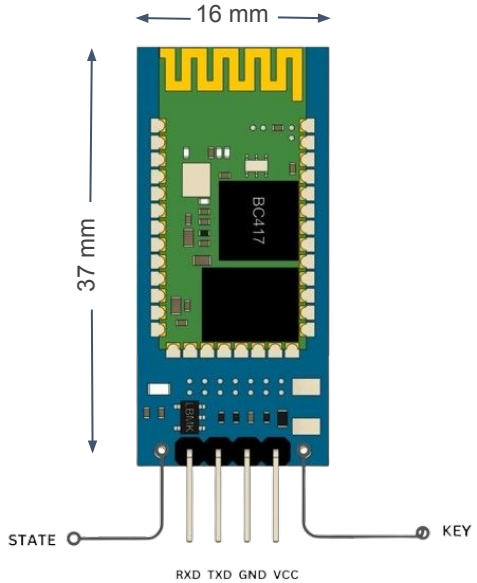
Cédric: Test



II-4 App and data

Axel:

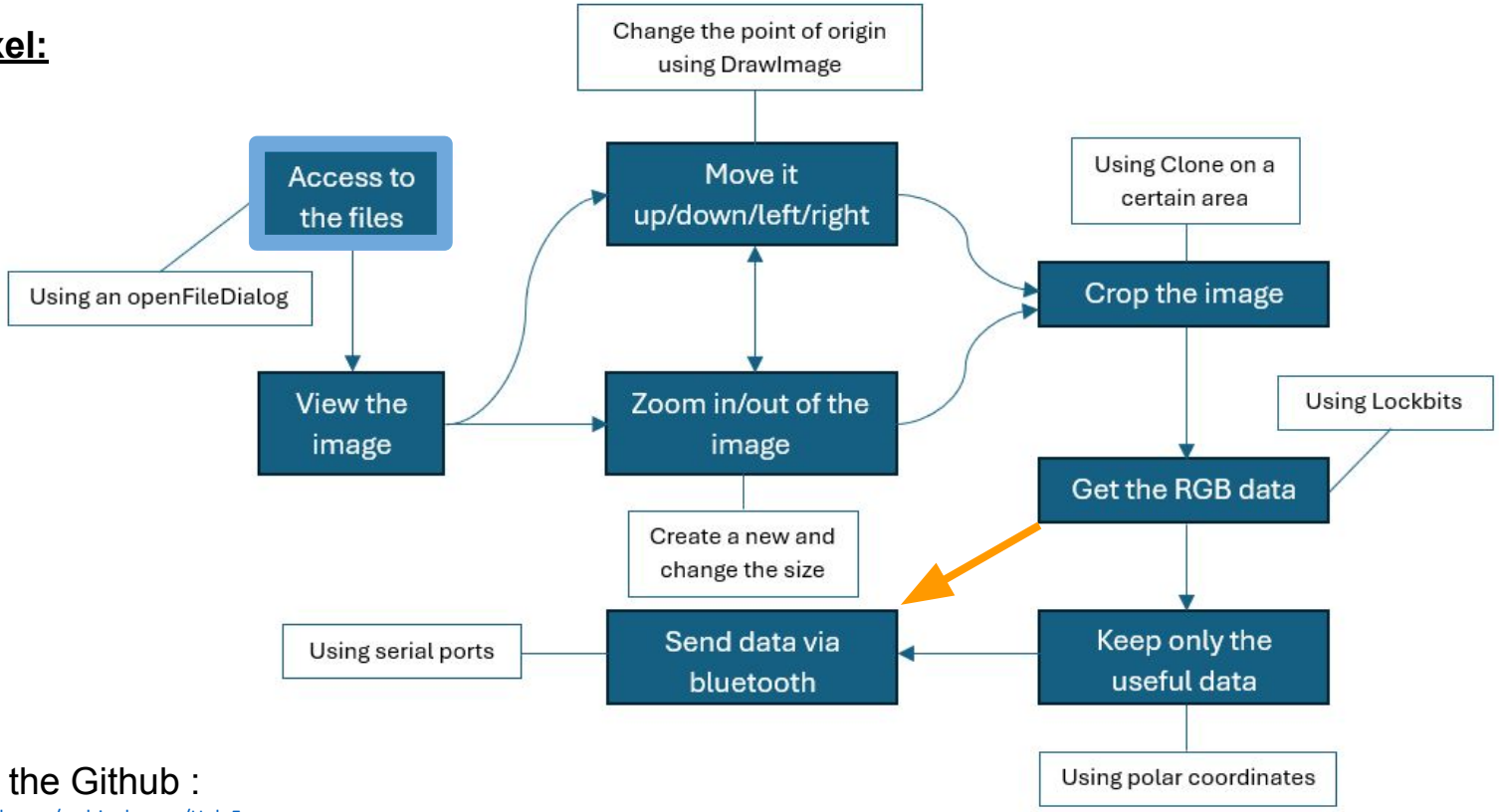
HC-06



HC-06	
Bluetooth version	Bluetooth 2.0
Frequency	2,4 GHz
Max data transfer rate	2,1 Mb/s
Communication protocol	UART
Power supply	5V
Dimensions	16X37mm

II-4 App and data

Axel:



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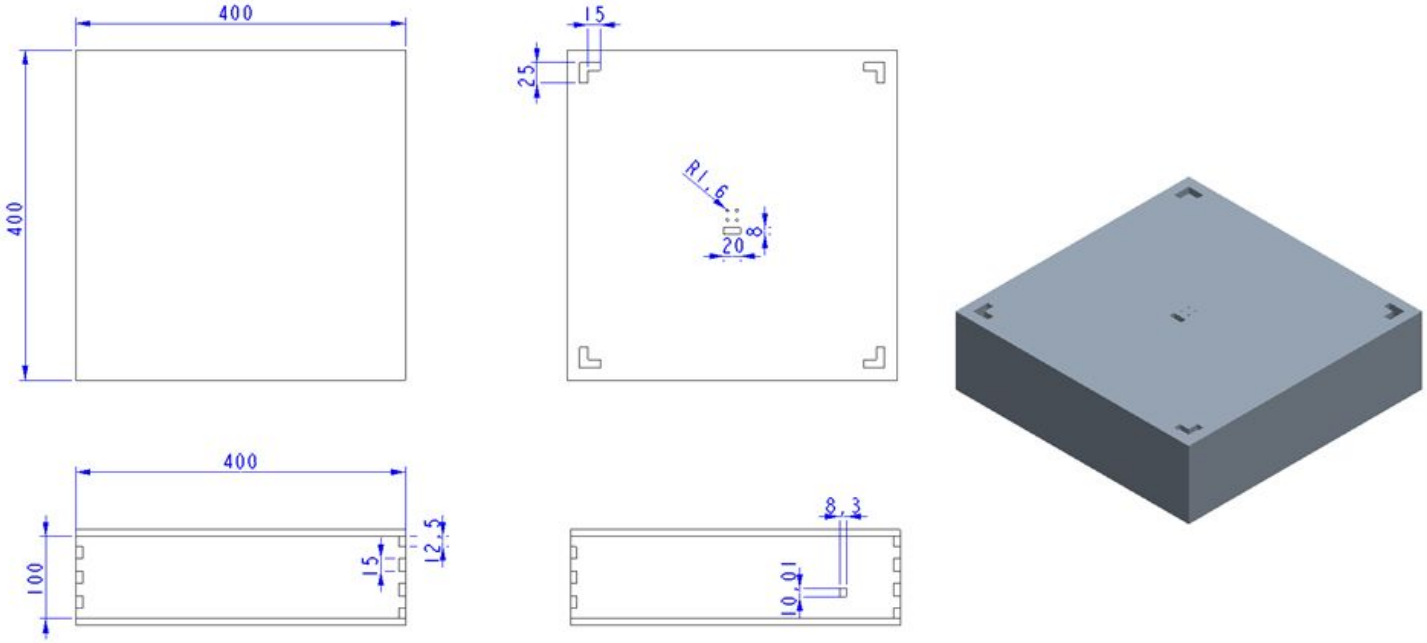
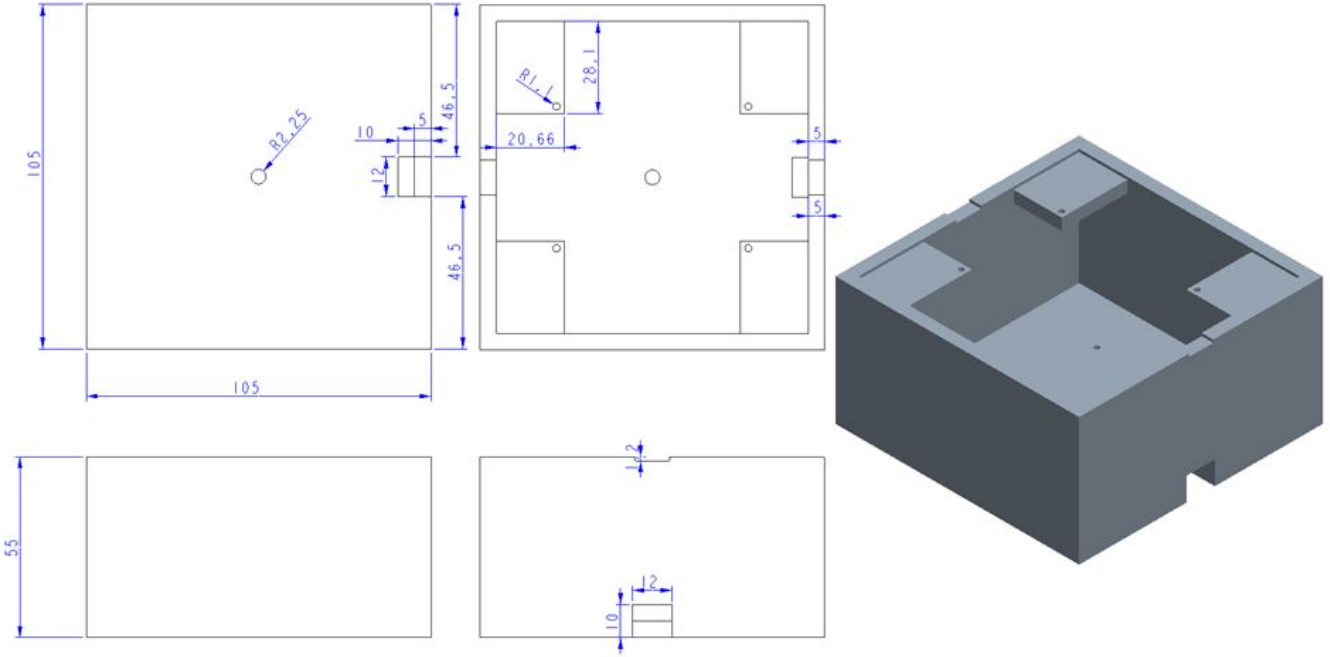


Cédric:



III-1 Work distribution

	Mustafa	Axel	Cédric	Abigail
Tasks completed				
Electrical Schematic for PCB	40	0	0	60
Power Electrical Schematic	70	0	30	0
Building the Base	0	0	85	15
PCB Design	90	5	5	0
LED Soldering	80	0	0	20
Component Soldering	25	0	0	75
PCB Housing Creation	0	0	100	0
Component Testing	10	0	90	0
Building the Base	5	0	95	0
CSR	0	0	0	100
CANVA Business Model	33	33	0	33
Report and Slides	25	25	25	25
GitHub	20	0	80	0
Component Ordering	0	0	10	90
Software Program	0	100	0	0
Task distribution table	55	15	15	15

Second semester

IV- Skills and learning : Mustafa

- Design an electronic board (schematic + PCB)
- Tests on the prototype (test the soldered board)
- Select the scientific instrumentation (general system power supply)
- Plan a development project (organization, deliverables and milestones)
- Manage a development project with a systems approach
- Write a datasheet

IV- Skills and learning : Cédric

- Assemble various analogue and digital components
- Implement existing code or libraries
- Selecting technological building blocks
- Study and write a datasheet
- CAO Software
- Manufacturing machines

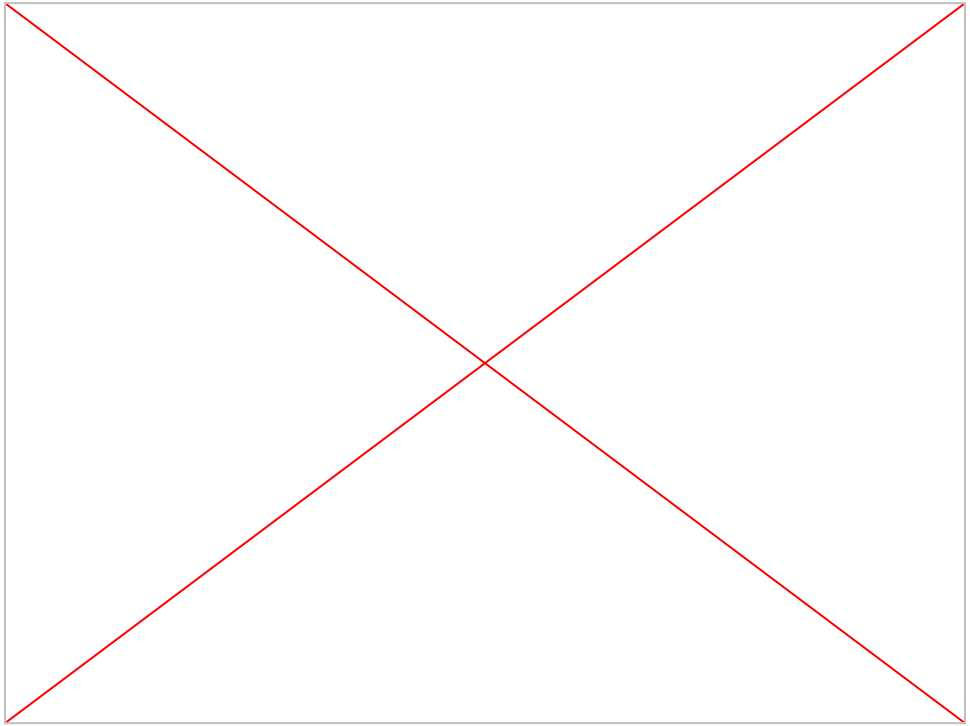
IV- Skills and learning : Abigaïl

- Designing an electric diagram (EASYEDA)
- Assemble various analog and digital components
- Selecting technological building blocks
- Study and write a datasheet

IV- Skills and learning : Axel

- Assemble various analogue and digital components
- Implement existing code or libraries
- Develop code or libraries
- Design a Human Machine Interface
- Select interaction / communication modes
- Develop a processing strategy in a constrained context
- Write a progress report

Demonstration video for LEDs



Conclusions

Power and blade :

- The second blade manufactured (Everything is welded: approximately 330 welds) and tested: non-functional
- The power supply is working, the PCB circuit is distributing the power poorly.

Conclusions

Motor & Motor management :

- It worked as it should
- ESC ceased to function yesterday

Conclusions

LED and angular sensor:

- LEDs and angular sensor are soldered
- LEDs light up
- The angular sensor could not be tested because the PCB was not working.

Conclusions

App and Bluetooth :

- The HC-06 is soldered and tested
- The application can get an image, resize it, move it, get the RGB data and send data via Bluetooth
- The integrity of the RGB data has been tested in the code by re-displaying the image from the RGB data
- The use of polar coordinates doesn’t work

Conclusions

Manufacture :

- Lack of protection
- Slightly unstable when spinning

Perspectives

Power and blade :

- Repeat tests thoroughly to determine the malfunction
- Create a 3rd PCB with the corrections made

Perspectives

Motor & Motor management :

- Buy new ESC
- Protection against big variation of amps

Perspectives

LED and angular sensor:

- Retest the LED with a new PCB
- Connect application, sensor, arduino and LED

Perspectives

Application :

- Use polar coordinates
- Make it easier to use
- Create another one for other devices

Perspectives

Manufacture :

- 3rd Version of the PLA PCB case (narrower & circular -> lighter)
- Plexiglass shield (protection)
- 2nd fixation for the upper part of the wooden box (better stability)
- ON/OFF switch

4A Project – Holographic fan

Annex:

First semester

	Mustafa	Axel	Cédric	Abigail
Tasks completed				
Use case	25	25	25	25
Life cycle	25	25	25	25
FAST diagram	25	25	25	25
Specifications table	25	25	25	25
Risks table	5	5	90	0
Corporate social responsibility	5	5	0	90
Capella	30	65	5	0
Application + Image data manager	0	100	0	0
Engine + Engine management	0	0	100	0
Led management + angular sensor	0	10	0	90
Power Supply + Fan	80	0	20	0
Gantt	100	0	0	0
Analysis of received propellers	20	0	80	0
Report and slides	40	20	20	20
Prototype	35	45	20	0
Task distribution table	95	0	5	0

4A Project – Holographic fan

Annex :

	Catastrophic (5)	Considerable (4)	Medium (3)	Low (2)	Negligible (1)
Certain (5)	25	20	15	10	5
Probable (4)	20	16	12	8	4
Occasional (3)	15	12	9	6	3
Rare (2)	10	8	6	4	2
Unlikely (1)	5	4	3	2	1

Annex: Risk analysis

Identified Risk	Probability of occurring	Impact on the project	Risk score	Proposed solution to reduce the risk
~~HOLO3DLED company that does not send the promised package~~	~~Probable~~	~~Negligible~~	~~4~~	~~Not be dependent on the study of a functional fan~~
Injury caused by the fan while spinning	Unlikely	Catastrophic	5	Make the fan untouchable during its rotation
Application/Site unable to handle traffic	Rare	Catastrophic	10	Make the app/site independent of traffic
Too high ambient light (indoors)	Rare	Medium	6	Ensure a brightness equivalent to the indoor lighting standard
Fan that flies away	Rare	Catastrophic	10	Ensure sufficient weight of the base
Blades that detach	Rare	Catastrophic	10	Keep the blades fixed and prevent unscrewing via vibration
Fan that pitches	Occasional	Considerable	12	Light fan/Stable Base (Big Block?) and Stable Axis of Rotation
System Short Circuit	Occasional	Considerable	12	Spare part and test point (circuit breaker?)
No compatibility with any system (IOS, Android, Windows, etc)	Probable	Medium	12	Used a Cross-System Programming Tool
Image processing problem	Rare	Considerable	8	Pre-Display Confirmation Step/ Simple Image
Fan connection problem	Unlikely	Catastrophic	5	Keeping the distance reduced as possible and without obstacle

Annex: Corporate Social Responsibility

Environmental

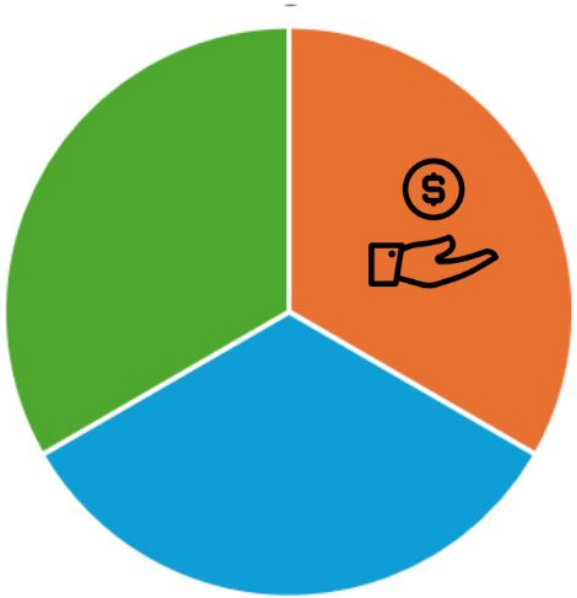
Economic

Societal

Annex: Corporate Social Responsibility

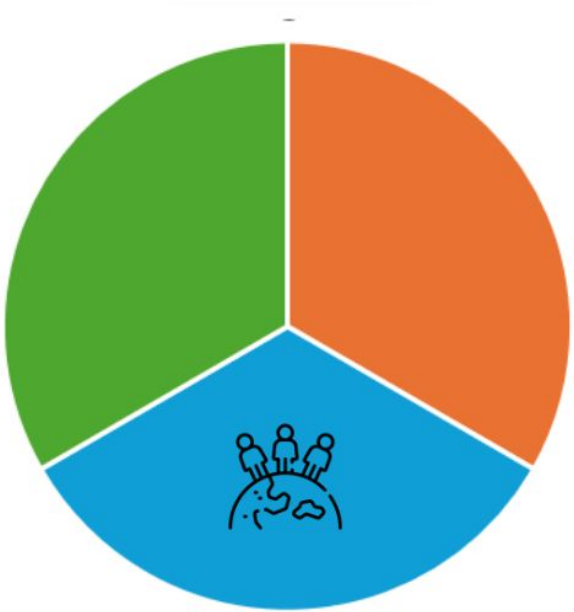
- **Easy to reproduce**

- **Being able to make it accessible to everyone**
  - Make a user manual
  - Kit project



Annex: Corporate Social Responsibility

- **Representation tool for the specialty**
- **Attracting young people to technology**



Annex: Corporate Social Responsibility

Main objectives :

- **Selection of materials with the least environmental impact**
- **Optimization of product's lifespan**

To go further :

- **Reduction in the quantity of materials**
- **Reduce the environmental impact of the use phase**
- **Optimization of the end of life of the system**