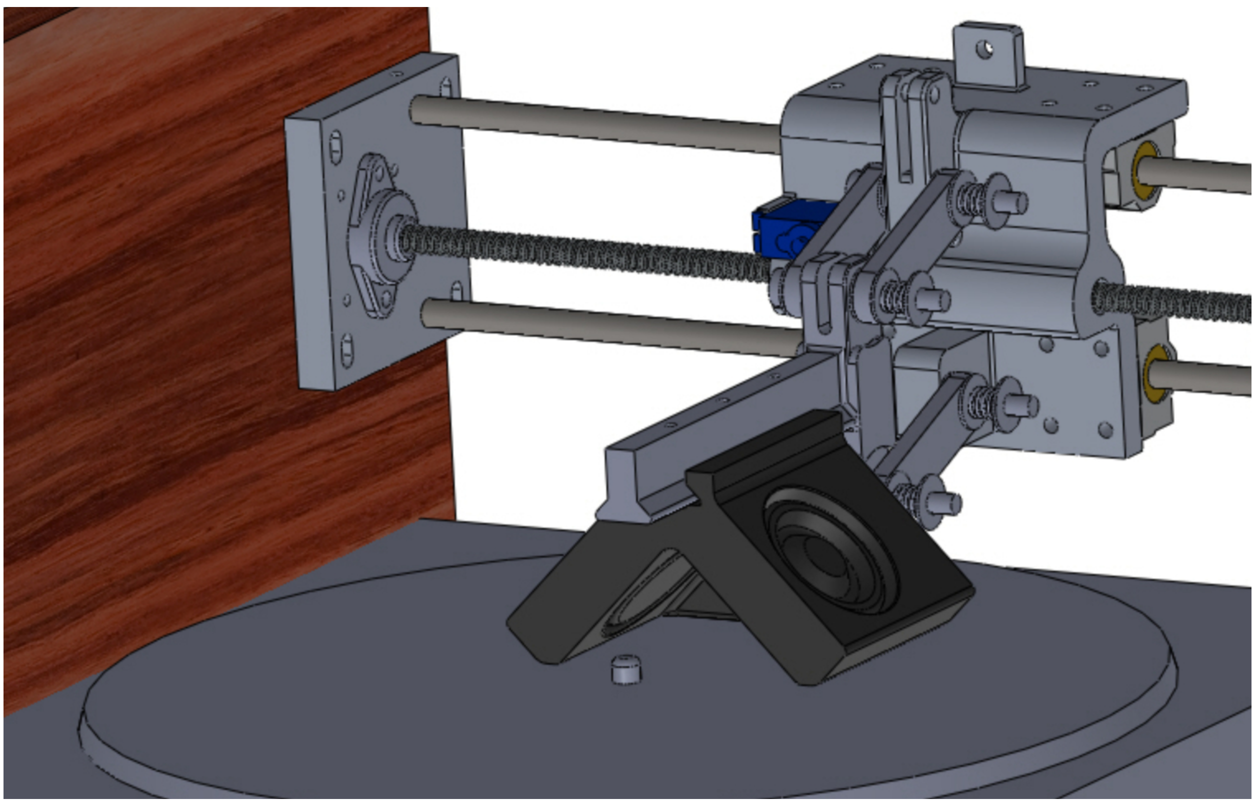
ViniGo, a stereo vinyl recorder



Revision	Data	Author	Modifications
R01	06 / 2021	Q.THEROND	Creation

1) Introduction

Sorry for my English!

Music has accompanied men across the time, and artists transmit messages or emotions through their music. Studies show that music gives us motivation and pleasure. Promotes memory and helps to make sports. Reduces stress, anxiety, and pain. An enjoyable support to listen to music is the vinyl. Because the object is real, it has defaults, and it gives us the possibility to arrange a space to oneself in our house. Handling a vinyl, it's a true moment of happiness.

The goal of this project is to refresh the gramophone concept to build a vinyl recorder, easier, more accessible, and affordable. Is made for artists, vinyl stores, recording studios, or music lovers. Lot of music bands mistakenly think that a custom vinyl is expensive or is only for big music productions. VinyGo project will show you that you can create your own vinyl easily for less than 3 dollars/vinyl.

More accessible ?

VinyGo is an open hardware, mechanic, and source project to build your own vinyl recorder with a precision of 106 micrometer between each groove (20min/side for a 12”).

Easier ?

VinyGo has an automatic and manual mode. In automatic mode, you just need to choose the vinyl size (7", 10", 12") and the time of your playlist. After that, it puts the engraving head depending on the vinyl size, it controls the raising and lowering and the acceleration of the motors during the cutting to create the start, middle, and end groove on the vinyl.

Affordable ?

VinyGo machine is an open hardware, mechanic and source project. It costs less than a commercial machine and works perfectly.

1.1) Overview of how a vinyl recorder works

Burn sound on a matrix (vinyl)

It is the engraving of the audio signal by microgrooves on a matrix. Sound recording is in real time. A diamond, connected to two speakers (for stereo), vibrates above the blank lacquer which turns at 33 or 45 turns. The vibration is made by the speaker when the audio signal is played. This means that a groove is the exact representation of the speaker membrane vibration.

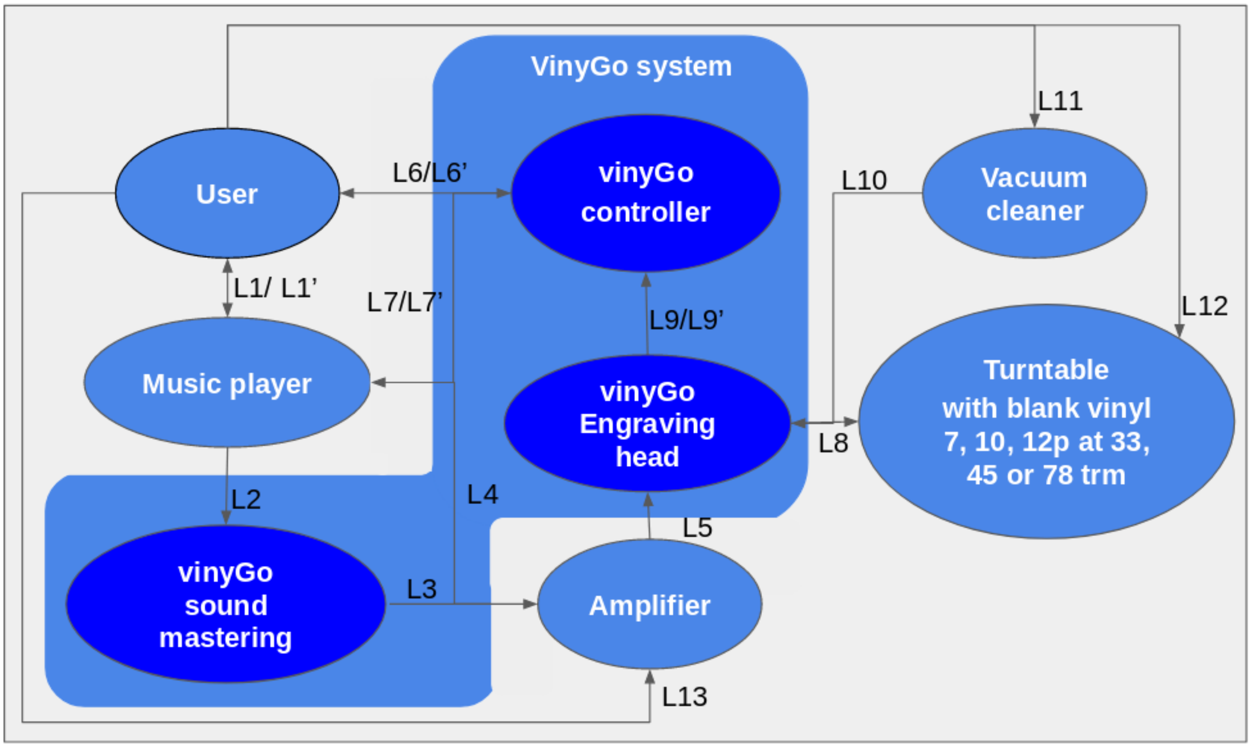
Mastering

Before burning the vinyl you have to apply some equalization like an iRIAA to the audio file.

Cutting

For the “cutting” you need to use a specific engraving diamond with an angle of 90 °

2) Sagittal diagram



2.1) Description of the links

" L.../L...' " is the input and output links between blocks.

Note: VinyGo sound mastering can be done by software or by an extended board. Use L4 link if you use sound mastering by software or L2/L3 if you use a VinyGo sound mastering board. In this project presentation we use sound mastering software.

2.1.1) User

L1/L1' :

- Select a playlist of music on your media player
- Configure the sound mastering
- Configure the MIDI commands of your media player for the start, middle, and end groove

L6/L6' :

- Input/output to use the test mode
- Input/output to use the calibration mode
- Input/output to use the configuration mode

- Input/output to use the update mode
- Input/output to use the manual mode for the cutting vinyl
- Input/output to use the automatic mode for the cutting vinyl

L11 :

- Power on/off the vacuum cleaner

L12 :

- Turntable configuration (33, 45, 78TRM)

L13 :

- Adjust the sound volume

2.1.2) Media player

L1/L1' :

- Inform the user of the playlist select
- Inform the user of the MIDI commands select
- Inform the configuration of the sound mastering

L2 :

- Useless (see note above)

L7/L7' :

- Allows to send MIDI commands to the vinyGo controller to automatically change parameters (like speed motor).

L4 :

- Sound signal with mastering

2.1.3) ViniGo system

2.1.3.1) ViniGo controller

L6/L6' :

- Inform the user of the current mode
- Inform the user of detected errors
- Depending on the mode, inform the user of the recorder time, position of the engraving head, diamond heating, state of the sensors, ...

L7/L7' :

- Send MIDI commands to the media player

L9/L9' :

- Get the information of the sensors
- Raising and lowering the head automatically

2.1.3.2) ViniGo sound mastering

L2 :

- Sound signal without mastering (useless, see note above)

L3 :

- Sound signal with mastering (useless, see note above).

2.1.3.3) ViniGo engraving head

L9/L9' :

- Sensors information

L5 :

- Amplified sound signal with mastering

L8 :

- Transformation of the sound signal in physical vibration.

L10 :

- Removes plastic cut by the diamond

2.1.4) Amplifier

L3 :

- Sound signal with viniGo mastering. (useless, see note above)

L4 :

- Sound signal with media player mastering.

L5 :

- Amplified sound signal with mastering

L13 :

- Adjust the sound volume

2.1.5) Vacuum cleaner

L10 :

- Removes plastic cut by the diamond

L11 :

- Power on/off the vacuum cleaner

2.1.6) Turntable with blanc vinyl

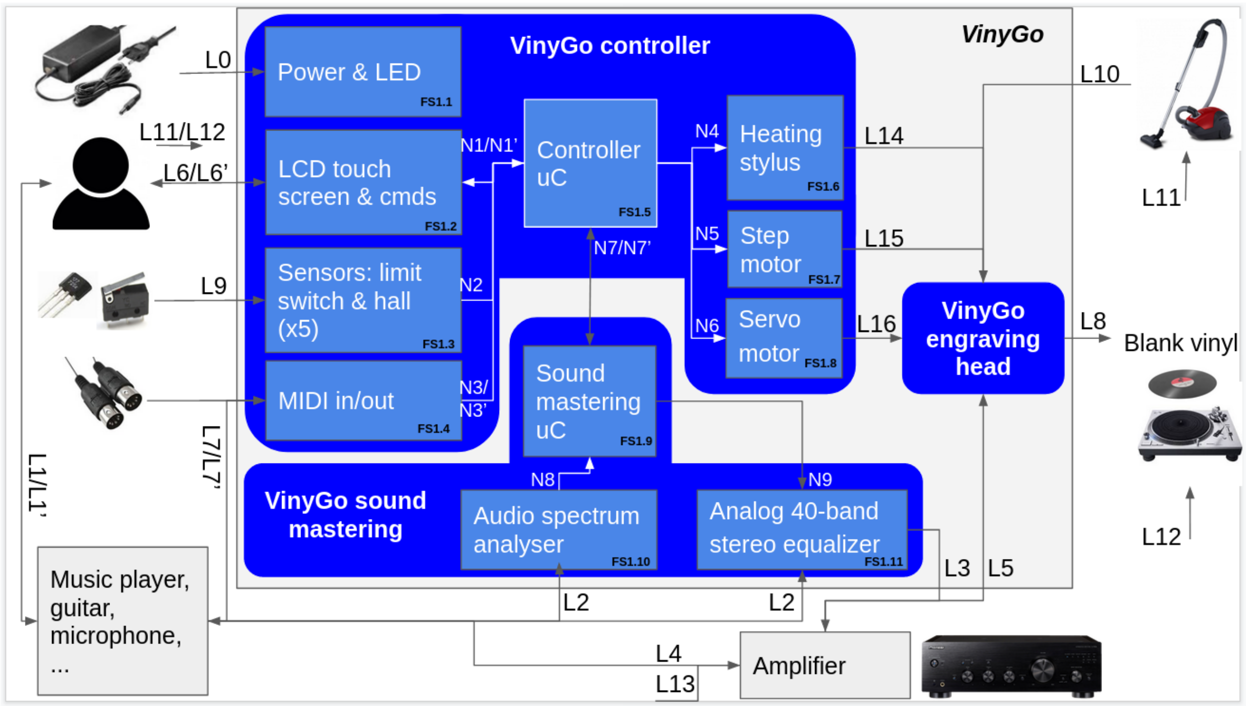
L8 :

- Transformation of the sound signal into physical vibration

L12 :

- Turntable configuration (33, 45, 78TRM)

3) Functional diagram



3.1) VinyGo controller

3.1.1) FS1.1: Power supply

The power function allows us to create: +12v, +5V, +3.3V, 0V.

Input(s):
L0: AC-DC power supply 12v 3a

Output(s):
+12v, +5V, +3.3V, GND

3.1.2) FS1.2: LCD touch screen

Display digital information for the user and make order acquisition by the microcontroller.

Input(s):
L6/L6': Information for the user
N1/N1': Digital signal from the microcontroller

Output(s):
L6/L6’: Configuration made by the user.
N1/N1’: Digital signal from the microcontroller

3.1.3) FS1.3: Sensors

Detection of engraving head positions.

Input(s):
L9: Physical movement.

Output(s):
N2: Digital signals for the microcontroller.

3.1.4) FS1.4: MIDI

Technical standard that describes a communications protocol, digital interface, and electrical connectors that connect a wide variety of electronic musical instruments, computers, and related audio devices for playing.

Input(s):
L7/L7’: Digital signal from the media player
N3/N3’: Digital signal from microcontroller

Output(s):
L7/L7’: Digital signal for the media player
N3/N3’: Digital signal conversion for microcontroller

3.1.5) FS1.5: uC

Ensures through a programmed treatment (software) the acquisition, processing and return of information. It communicates with the motors, sensors, and offers inputs / outputs to add additional functionality.

Input(s):
N1/N1’: Digital signal from the LCD touch information.
N2: Digital signals from the sensors.
N3: Digital signal from Musical Instrument Digital Interface (MIDI).
N7/N7’: Digital signal from VinyGo sound mastering board.
N4: Analog signal to heat the diamond.
N5: Digital signal for step motor order.
N6: Digital signal for servo motor order.

Output(s):
N1/N1’: Digital signal for the LCD
N3’: Digital signal for Musical Instrument Digital Interface (MIDI).
N7/N7’: Digital signal for VinyGo sound mastering board.

3.1.6) FS1.6: Heating stylus

Heat the diamond for a better cutting.

Input(s):
N4: Digital signals from the microcontroller

Output(s):
L14: Power current

3.1.7) FS1.7 Step motor

Move the engraving head on the X axis.

Input(s):
N5: Digital Signals for step motor control

Output(s):
L15: Physical movement of the engraving head on X axis

3.1.8) FS1.8 Servo motor

Move the engraving head on the Z axis.

Input(s):
N6: Digital Signals for step motor control

Output(s):
L16: Physical movement of the engraving head on Z axis

3.2) Engraving head

Lacquer cutting

Input(s):
L5: Filtered and amplified analog signal

Output(s):

L8: Physical movement of the sound

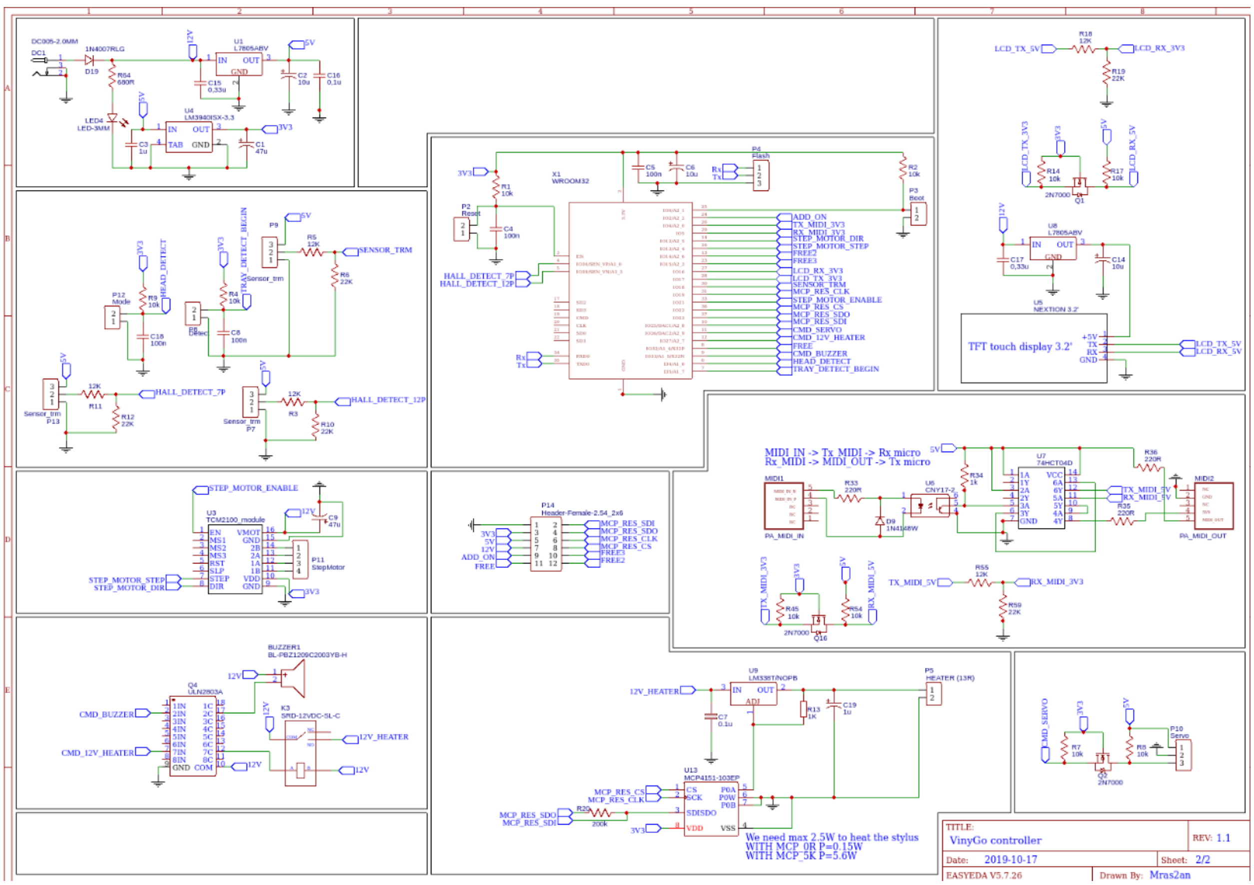
3.3) VinyGo sound mastering

For a price reduction of the project, we will use audio software instead of VinyGo sound mastering board. So this part will not be presented to the Hackaday contest.

5) Electronic

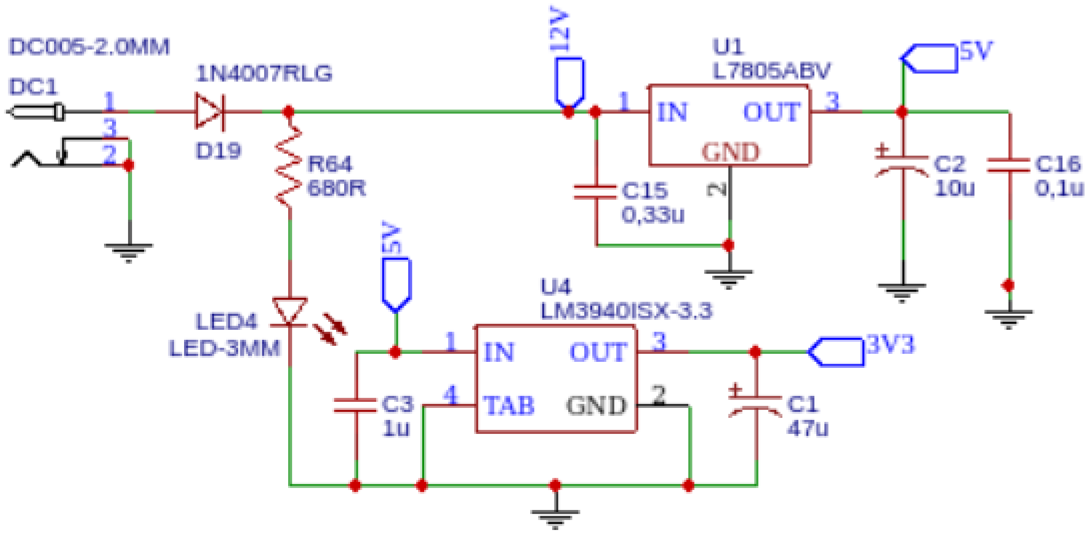
All schemas and PCB (gerber), can be downloaded on the VinyGo git project.
https://github.com/Mras2an/VinyGo/tree/master/02_Hardware

5.1) Structural diagram



5.1.1) FS1.1: Power supply

Create power for all features on VinyGo Board. Input voltage 12V 5A, output voltage, +12v, +5V, +3.3V, 0V.



DC1: 12V connector

D19: Protection diode.

R64, LED4: Bleu LED,information on the powered board.

C1, C2: Polarized chemical capacitors. They perform the filtering, and allow a decoupling in case of power supply

C2, C16, C3: Plastic capacitor, serves as an anti-parasite to suppress high frequencies (it is recommended in the technical documentation).

U1: 5V regulator, it allows to regulate the input voltage 12V DC in a voltage of 5V DC. According to the manufacturer's documentation of the 78XX, a minimum input voltage of the output voltage plus Vdrop (2V) or Ve = Vs + Vdrop = 5 + 2 = 7V minimum is required for proper operation.

U4: 3.3V LDO, it allows to regulate the input voltage 5V DC in a voltage of 3.3V DC.

5.1.1.1) Calculation of a radiator

Pmax = (Tj – Ta)/RTHja = (125-25)/65 = 1,5W

Supposition for 3V3 WROOM32: 90mA, other 50mA max
Isystem = 90+50 = 140mA
Putil(3.3V) = Isystéme*(Ve-Vs) = 140*10^-3*(12-3.3) = 1,218W
Putil<Pmax.

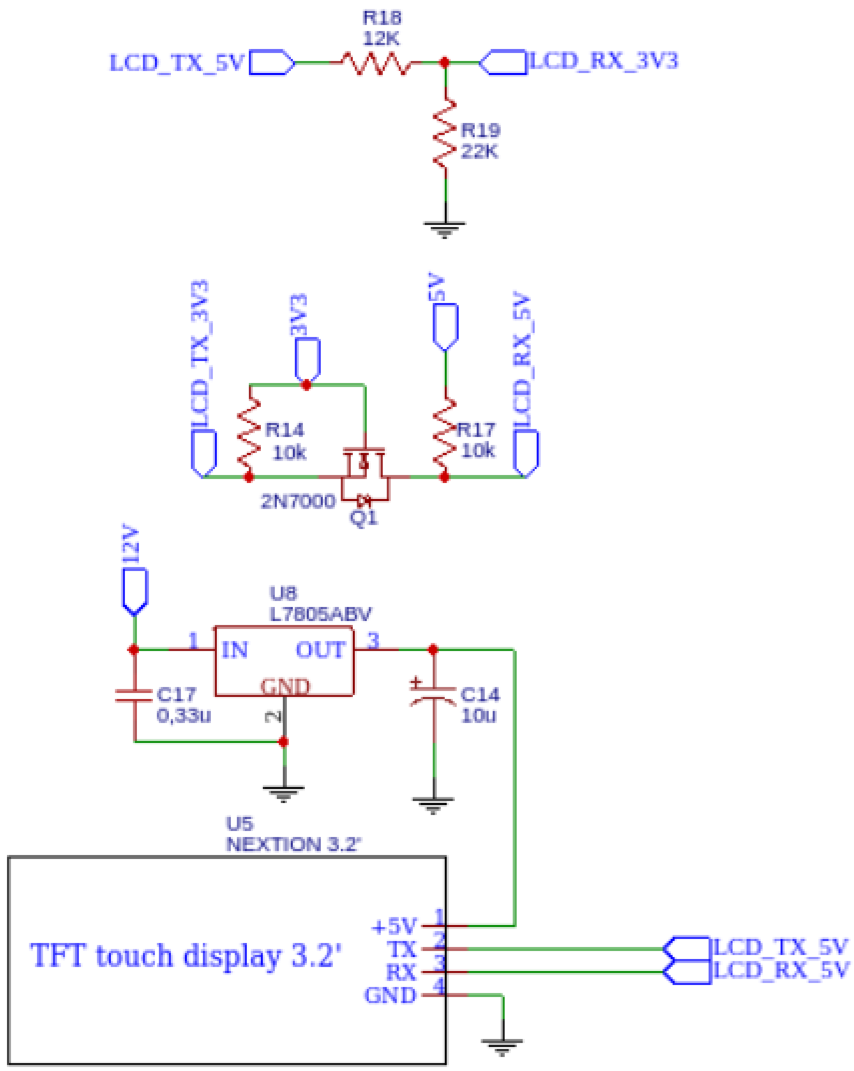
Supposition for 5V: Servo motor 120mA, Sensors 40mA, MIDI 10mA, other 60mA

Isystem = 120+40+10+60 = 230mA
Putil(5V) = Isystéme*(Ve-Vs) = 230*10^-3*(12-5) = 1,61W
Putil>Pmax.

The utility of a radiator for regulators 3V3 is not essential at room temperature.
But we need a radiator for 5v.

5.1.2) FS1.2: LCD touch screen

Display digital information for the user and make order acquisition by the microcontroller.



Q1, R14, R14: Convertor 3.3V to 5V

R18, R19: Convertor 5V to 3.3V

U5: Nextion HMI display connects to peripheral MCU via TTL Serial (5V, TX, RX, GND) to provide event notifications that peripheral MCU can act on, the peripheral MCU can easily update progress, and status back to Nextion display utilizing simple ASCII text-based instructions.

U8: 5V regulator, it allows to regulate the input voltage 12V DC in a voltage of 5V DC. According to the manufacturer's documentation of the 78XX, a minimum input voltage of the output voltage plus Vdrop (2V) or Ve = Vs + Vdrop = 5 + 2 = 7V minimum is required for proper operation.

5.1.2.1) Calculation of a radiator

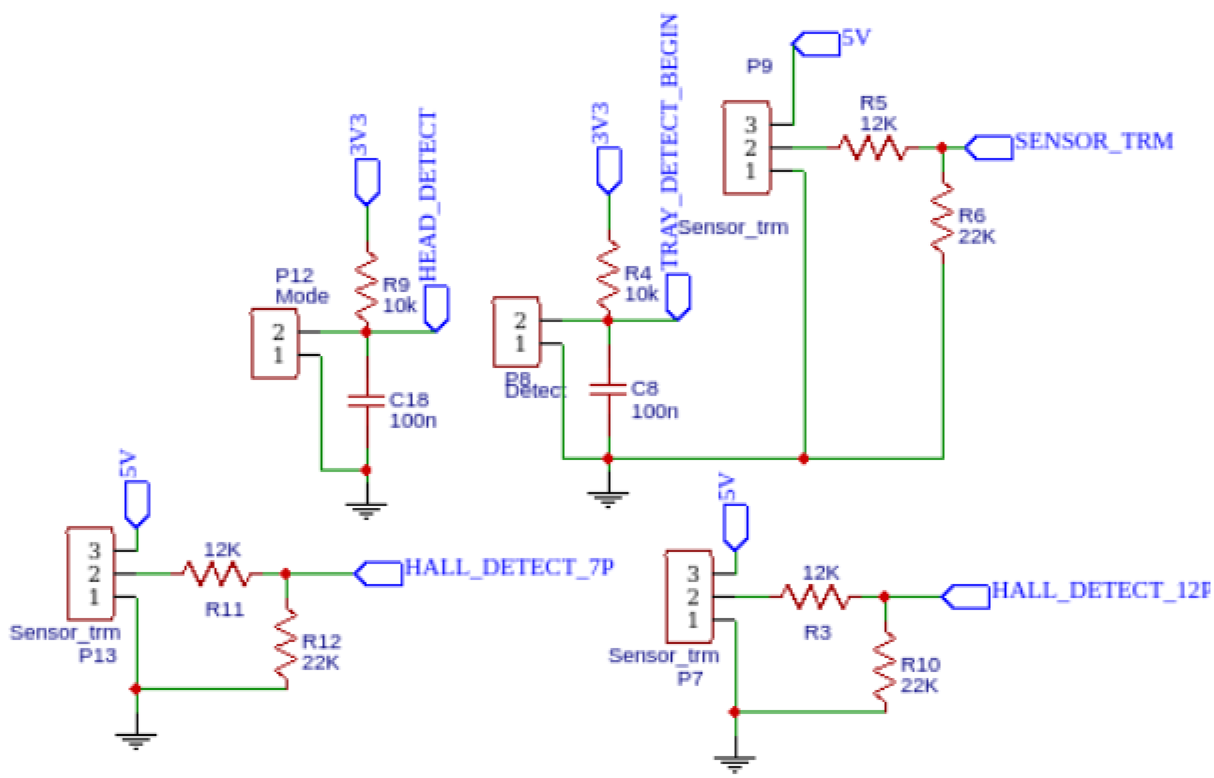
Pmax = (Tj – Ta)/RTHja = (125-25)/65 = 1,5W

Supposition for LCD 5v : 130mA max
Isystem = 130mA
Putil(5V) = Isystéme*(Ve-Vs) = 130*10^-3*(12-5) = 0,91W
Putil<Pmax.

The utility of a radiator for LCD is not essential at room temperature.

5.1.3) FS1.3: Sensors

Detection of engraving head positions.



P13, R11, R12: Connector for hall sensor to detect end of 7p vinyl.

P7, R3, R10: Connector for hall sensor to detect end of 12p vinyl.

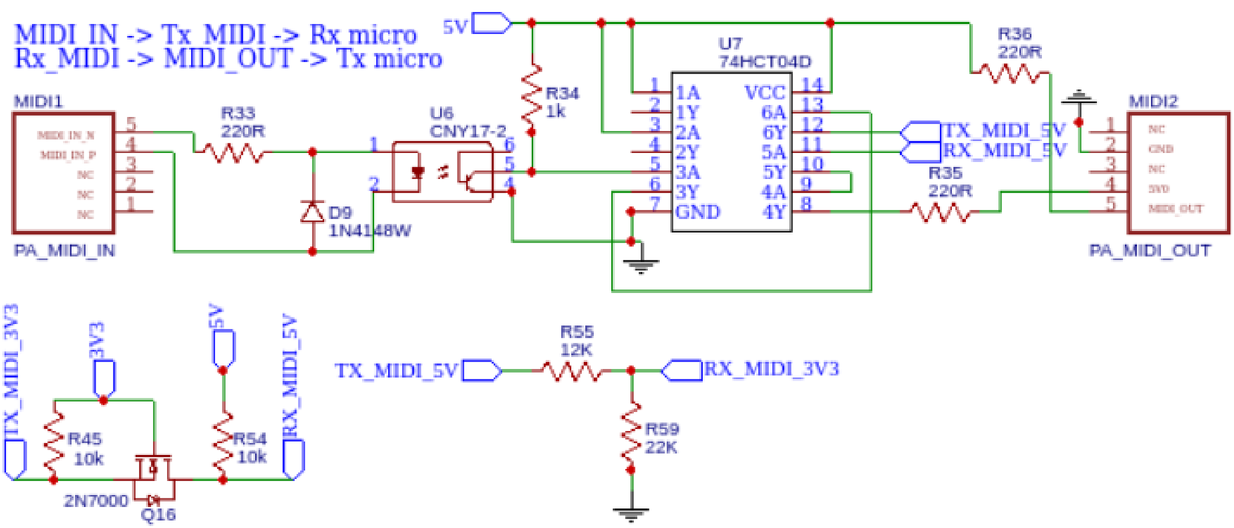
P12, R9, C18: Connector to detect if the engraving head is up or down

P8, R4, C8: Connector to detect if the tray is on begin position.

P9, R5, R6: NOT use

5.1.4) FS1.4: MIDI

Technical standard that describes a communications protocol, digital interface, and electrical connectors that connect a wide variety of electronic musical instruments, computers, and related audio devices for playing.



Q16, R45, R54: Convertor 3.3V to 5V

R55, R59: Convertor 5V to 3.3V

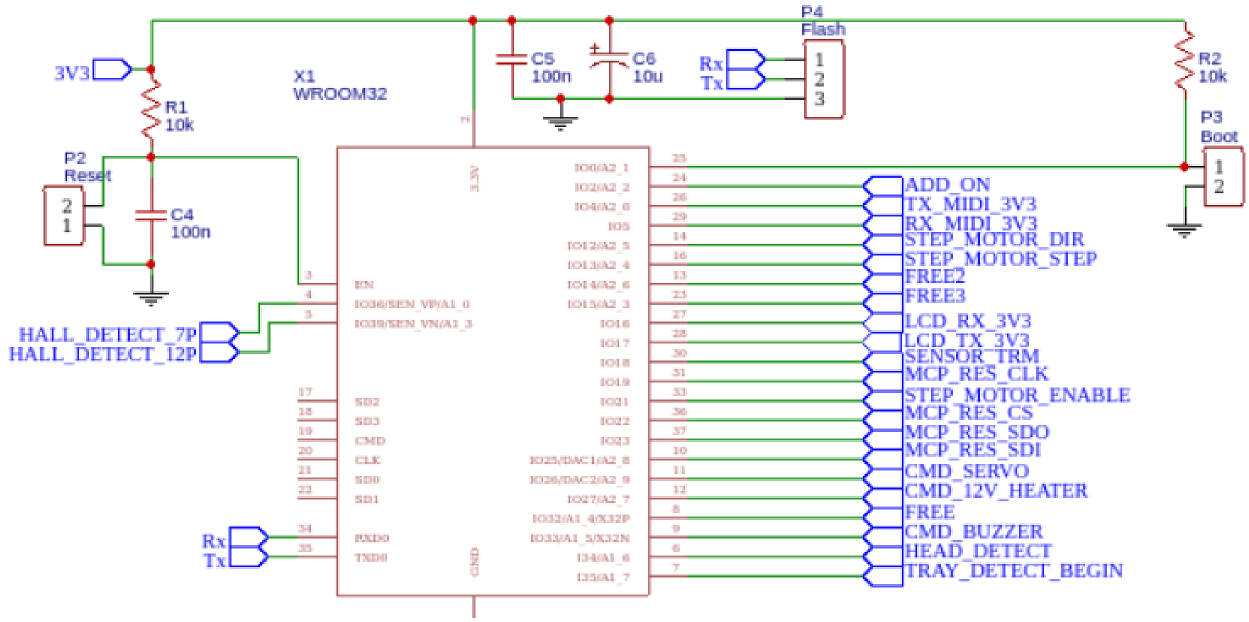
MIDI1, MIDI2, Connector In and Out for MIDI.

R33, D9, U6, U7: Convertor of MIDI to Rx UART.

R35, UT: Convertor of Tx UART to MIDI.

5.1.5) FS1.5: Uc

Ensures through a programmed treatment (software) the acquisition, processing and return of information. It communicates with the motors(PWM), sensors(GPIO), LCD(UART), MIDI commands(UART), and offers inputs / outputs to add additional functionality like VinyGo sound mastering.



R1, C4, P2: Allows a reset on the wroom32.

C5, C6: Used to filter high and low frequencies.

P4: Allows programming the wroom32 via a UART.

P3: Set wroom32 to programming mode.

5.1.5.1) Definition of the inputs, outputs of the microcontroller.

5.1.5.1.1) Inputs

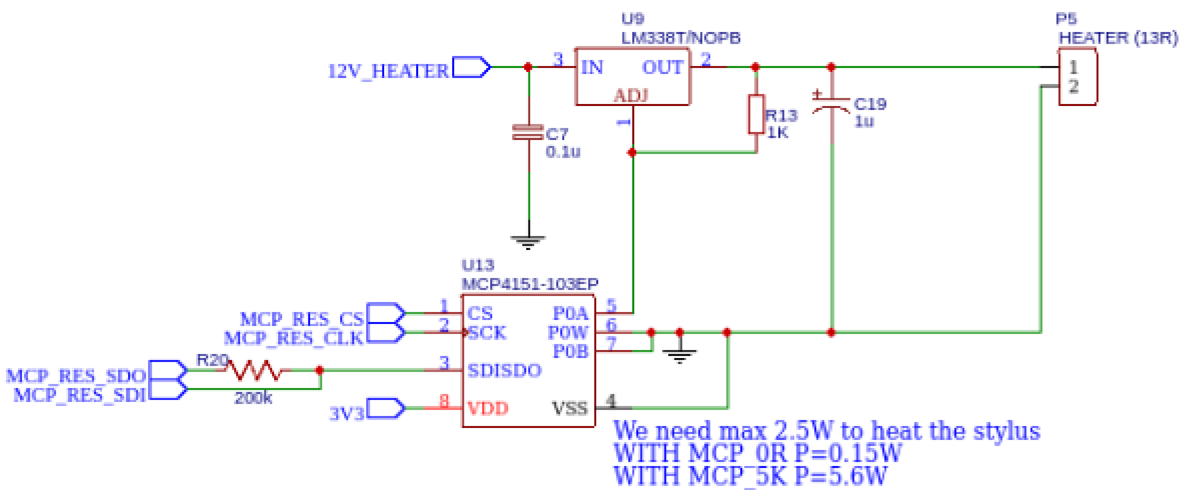
Boot: Set the WROOM32 to programming mode.
Reset: Allows a reset on the WROOM32.
Flash: Send binarie to the wroom32 memory.
HALL_DETECT_7P: Detects end of 7p vinyl.
HALL_DETECT_12P: Detects end of 12p vinyl.
RX_MIDI_3V3: UART signal for MIDI protocol.
LCD_RX_3V3: UART signal for LCD protocol.
SENSOR_TRM: NOT use.
MCP_RES_SDO: SPI data from Digital POT.
HEAD_DETECT: Detect if the engraving head is UP or DOWN.
TRAY_DETECT_BEGIN: Detects if the tray is at the initial position.

5.1.5.1.2) Output

TX_MIDI_3V3: UART signal for MIDI protocol.
STEP_MOTOR_DIR: Select the motor direction.
STEP_MOTOR_STEP: PWM signal.
LCD_TX_3V3: UART signal for LCD protocol.
MCP_RES_CLK: SPI clock for Digital POT.
STEP_MOTOR_ENABLE: Enable step motor driver
MCP_RES_CS: SPI select for Digital POT.
MCP_RES_SDI: SPI data for Digital POT.
CMD_SERVO: PWM signal
CMD_12V_HEATER: Enable heating
CDM_BUZZER: Buzzer signal.

5.1.6) FS1.6: Heating stylus

Heat the diamond for a better cutting. Max 500mA for 5v, see diamond specification for more details.



U13, R20: SPI Digital POT

U9, R13, U13: Adjustable linear voltage regulators, capable of delivering more than 5 A at an output voltage between 1.25 and 32 V.

C7: Polarized chemical capacitors. They perform the filtering, and allow a decoupling in case of power supply

C19: Plastic capacitor, serves as an anti-parasite to suppress high frequencies (it is recommended in the technical documentation).

5.1.6.1) Calculation of a radiator

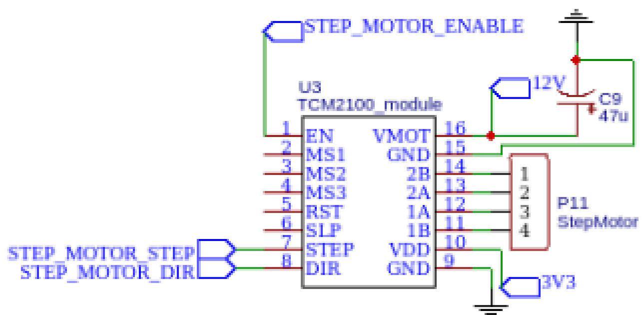
Pmax = (Tj – Ta)/RTHja = (125-25)/65 = 1,5W

Supposition for 5V heating: 500mA
Isystem = 500mA
Putil(5V) = Isystéme*(Ve-Vs) = 500*10^-3*(12-5) = 3,5W
Putil>Pmax.

We need a radiator for heating regulators.

5.1.7) FS1.7: Step motor

Move the engraving head on the X axis.



U3: Provides an integrated motor driver solution for 3D-Printing, Cameras, Scanners and other automated equipment applications. The device has an integrated microstepping indexer, the completely noiseless current control mode StealthChop™ and is intended to drive a bipolar stepper motor.

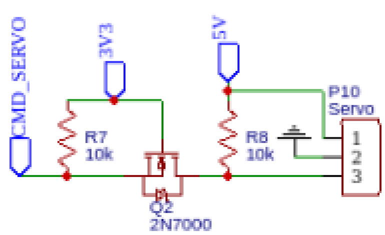
P11: Step motor connector.

C9: Polarized chemical capacitors. They perform the filtering, and allow a decoupling in case of power supply (it is recommended in the technical documentation).

CFG2	CFG1	Steps	Interpolation	Mode
GND	GND	1	-	spreadCycle
GND	VIO	½	-	spreadCycle
GND	OPEN	½	1/256	spreadCycle
VIO	GND	¼	-	spreadCycle
VIO	VIO	1/16	-	spreadCycle
VIO	OPEN	¼	1/256	spreadCycle
OPEN	GND	1/16	1/256	spreadCycle
OPEN	VIO	¼	1/256	stealthChop
OPEN	OPEN	1/16	1/256	stealthChop

5.1.8) FS1.8 Servo motor

Move the engraving head on the Z axis.



Q2, R7, R8 Convertor 3.3V to 5V for servo motor PWM signal.

5.2) The PCB

The PCB does not have any particular constraint except to respect the "hardware design" proposed by expressif to have the best radio performances. *“make sure that the module is not covered by any metal shell. The antenna area of the module and the area 15 mm outside the antenna should be kept clean”.*

5.2.1) PCB components list

Name	Designator	Footprint	Quantity	Manufacture	Manufacturer	Supplier	Supplier Part	Price Uni	Price
WROOM32	X1	WROOM32	1	?				4,4	4,4
L7805ABV	U1,U8	TO-220(TO-2	2	L7805ABV	STMicroelect	LCSC	C16807	0,9	1,8
TCM2100_module	U3	A4988 STEP	1	?				8	8
LM3940ISX-3.3	U4	TO-263-3	1	LM3940ISX-	TI	LCSC	C18910	0,55	0,55
47u	C1,C9	CAP-D5.0XR	2	?				0,2	0,4
10u	C2,C6,C14	CAP-D5.0XR	3	?				0,2	0,6
1u	C3	RAD-0.2	1	?				0,2	0,2
10k	R1,R2,R4,R7	AXIAL-0.4	10	?				0,2	2
100n	C4,C5,C8,C1	RAD-0.2	4	?				0,2	0,8
Reset	P2	HDR-1X2/2.5	1	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,2	0,2
Boot	P3	HDR-1X2/2.5	1	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,2	0,2
Flash	P4	HDR-3X1/2.5	1	Header2.54r	BOOMELE	LCSC	C49257	0,2	0,2
Detect	P8	HDR-1X2/2.5	1	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,75	0,75
Sensor_trm	P13	HDR-3X1/2.5	3	Header2.54r	BOOMELE	LCSC	C49257	0,2	0,6
Sensor_trm	P9,P7,P13	HDR-3X1/2.5	3	Header2.54r	BOOMELE	LCSC	C49257	1,8	5,4
12K	R5,R55,R3,R	AXIAL-0.4	5	?				0,2	1
22K	R6,R59,R10	AXIAL-0.4	5	?				0,2	1
2N7000	Q2,Q16,Q1	TO-92(TO-92	3	2N7000	CJ	LCSC	C9114	0,2	0,6
Servo	P10	HDR-3X1/2.5	1	Header2.54r	BOOMELE	LCSC	C49257	10	10
StepMotor	P11	HDR-4X1/2.5	1	Header-Fem	ReliaPro	LCSC	C124413	7,4	7,4
0,33u	C15,C17	RAD-0.2	2	?				0,2	0,4
0,1u	C16	RAD-0.2	1	?				0,2	0,2
CNY17-2	U6	DIP-6	1	CNY17-2	LITEON	LCSC	C10807	1,67	1,67
74HCT04D	U7	DIP-14	1	74HCT04D	PHILIPS	LCSC	C5958	1	1
PA_MIDI_IN	MIDI1	PA_DIN_5_F	1	?				2,98	2,98
PA_MIDI_OUT	MIDI2	PA_DIN_5_F	1	?				2,98	2,98
220R	R33,R35,R3	AXIAL-0.4	3	?				0,2	0,6
1N4148W	D9	DO-41	1	1N4148W	SEMTECH	LCSC	C81598	0,25	0,25
1k	R34	AXIAL-0.4	1	?				0,2	0,2
680R	R64	AXIAL-0.4	1	?				0,2	0,2
LED-3MM	LED4	LED-3MM/2.	1	204-10SURD	EVERLIGHT	LCSC	C99772	0,2	0,2
Alim 12v 2A			1					8,2	8,2
DC005-2.0MM	DC1	DC-5020	1	DC005-2.0M	SOFNG	LCSC	C111567	0,58	0,58
1N4007RLG	D19	DO-41	1	1N4007RLG	ON	LCSC	C53568	0,2	0,2
NEXTION 3.2'	U5	NEXTION 3.	1	NEXTION 3.2'				32	32
Mode	P12	HDR-1X2/2.5	1	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,75	0,75
LM338T/NOPB	U9	TO-220(TO-2	1	LM338T/NO	TI	LCSC	C53303	2	2
1K	R13	AXIAL-0.4	1	?				0,2	0,2
0.1u	C7	RAD-0.2	1	?				0,2	0,2
MCP4151-103EP	U13	DIP8	1	?				1	1
1u	C19	CAP-D5.0XR	1	?				0,2	0,2
HEATER (13R)	P5	HDR-1X2/2.5	1	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,2	0,2
Header-Female-2.54_2x2	H2	DIP-2X2.54M	1	DS1023-2*2	CONNFLY	LCSC	C92273	0	0
ULN2803A	Q4	DIP-18	1	ULN2803A	STMicroelect	LCSC	C73936	2	2
Deco pull up	P1,P6	HDR-1X2/2.5	2	2.54-1*2PFe	BOOMELE	LCSC	C49661	0,2	0,4
GND_LCD	P17	HDR-1X1/2.5	1	Header-Male	ReliaPro	LCSC	C81276	0	0
200k	R20	AXIAL-0.4	1	?				0,2	0,2
SRD-12VDC-SL-C	K3	SONGLE RB	1	Songle			undefined	2	2
BL-PBZ1209C2003YB-H	BUZZER1	BUZZER-R6.	1	BL-PBZ1209	Dongguan B	LCSC	C187885	0,35	0,35
Header-Female-2.54_2x6	P14	HDR-6X2/2.5	1	Header-Fem	BOOMELE	LCSC	C36191	0,2	0,2
PCB			1					2	2
radiateur			3					0,215	0,645
cable midi			2					2,92	5,84
nappe cable			15					0,095	1,425
									117,37

6) Mechanic

In this part, I will introduce two 3D printing mechanics for the VinyGo project. The first mechanic works well, it is a proof of concept but we have a lot of 3D pieces to print. The second mechanic is in the testing phase, it is optimized to reduce the number of 3D parts. With these both solution we have a good sound quality and a precision about 0,1 mm minimum
between each groove (20min/side for a 12” at 33trm).
All these STL files can be downloaded on the VinyGo git project.
https://github.com/Mras2an/VinyGo/tree/master/01_3D%20Modeling

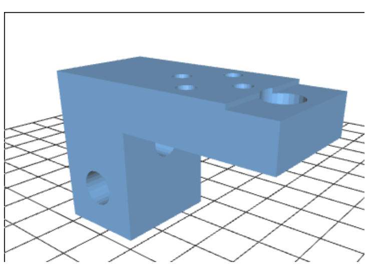
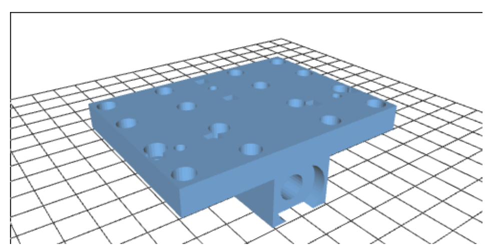
6.1) Structure

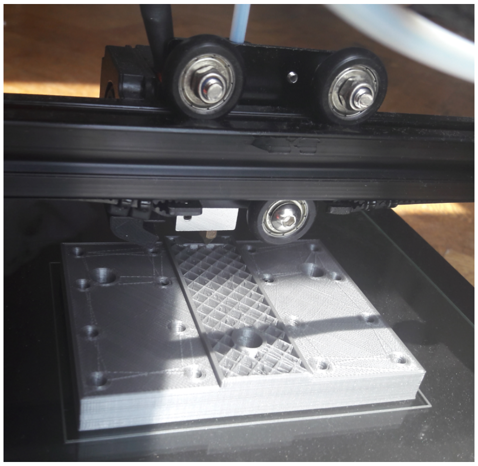
6.1.1) Standard mechanical pieces

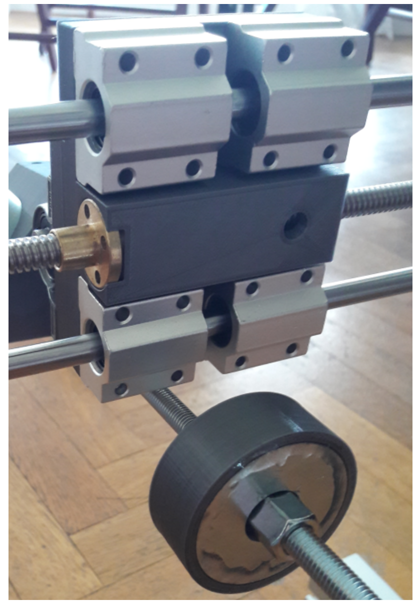
Standard pieces for the structure can be purchased on the internet, here is the list:

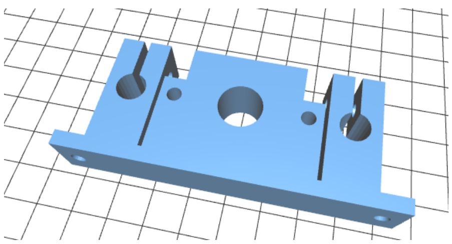
- Profiled aluminum 40x4cm
- Worm screw 50cm, (diameter : 8mm)
- Ball bearings
- Steel rod 50cm, (diameter : 8mm)
- Worm (M4)

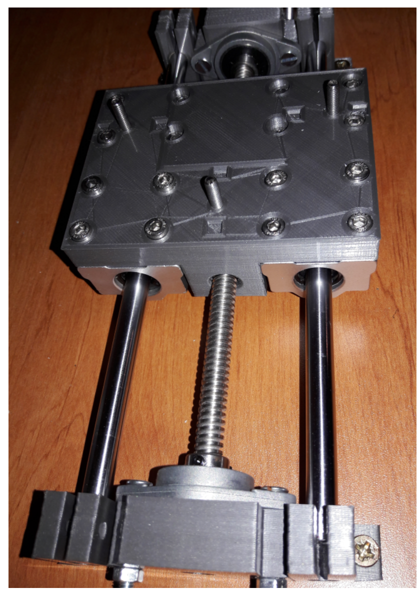
6.1.2) 3D pieces

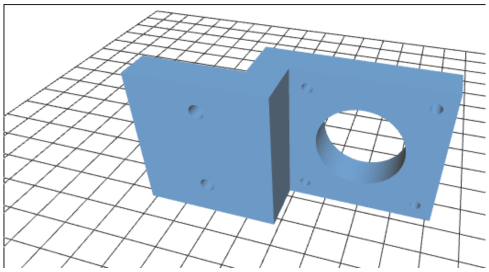
	

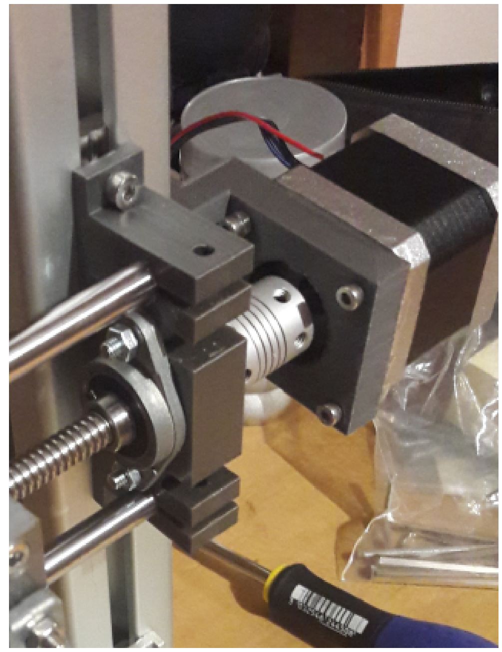












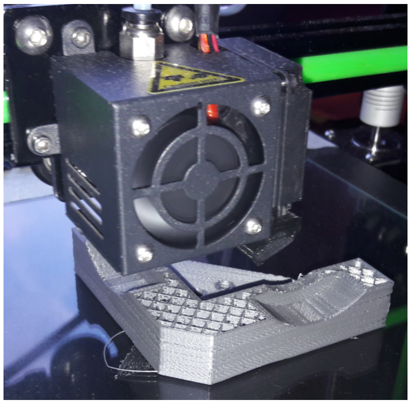
6.2) Head

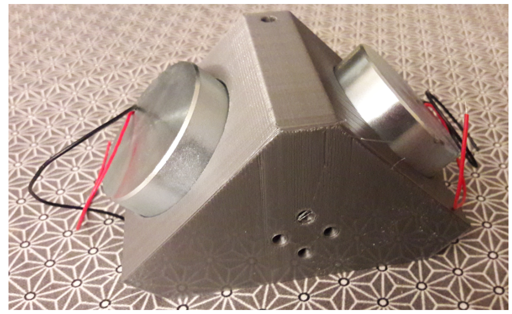
6.2.1) Standard mechanical pieces

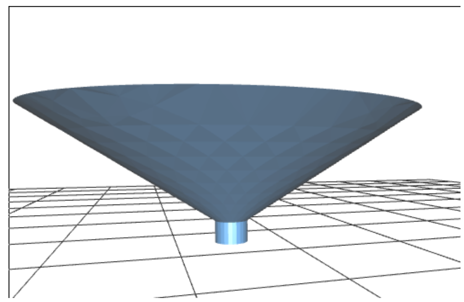
Standard pieces for the head can be purchased on the internet, here is the list:

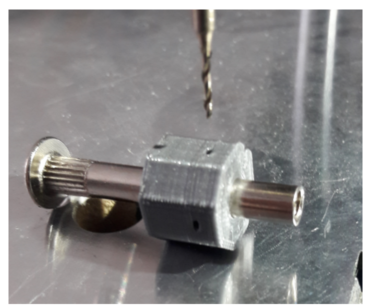
- Worm chicago (5mm)
- Worm (M4)
- Tweeter 120 Watt minimum
- Strong glue (epoxy)
- Lacquer cutting diamond
- Spring

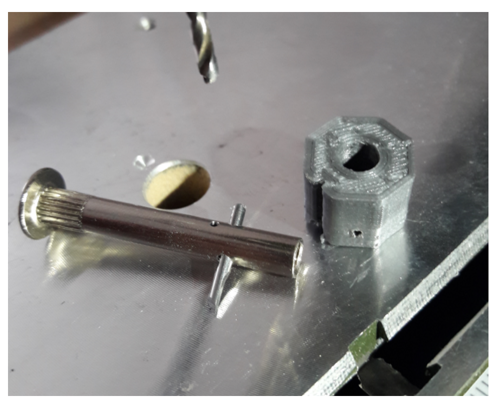
6.2.2) 3D pieces

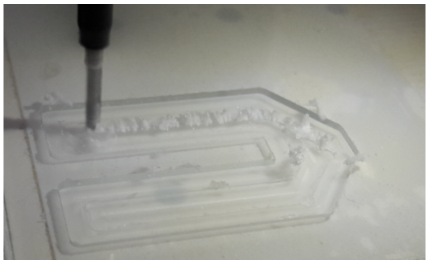








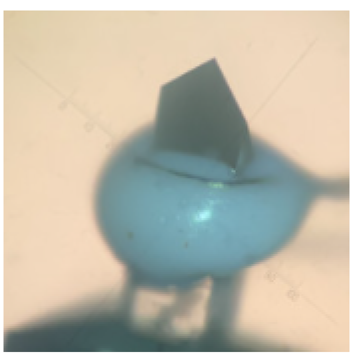


6.3) Stylus

This is the most expensive part, because we need a cutting “diamond”. It can be purchased on the internet for more than 100$. For a cost reduction, some people use Roland blades, around 5$ but it is not the same sound quality.

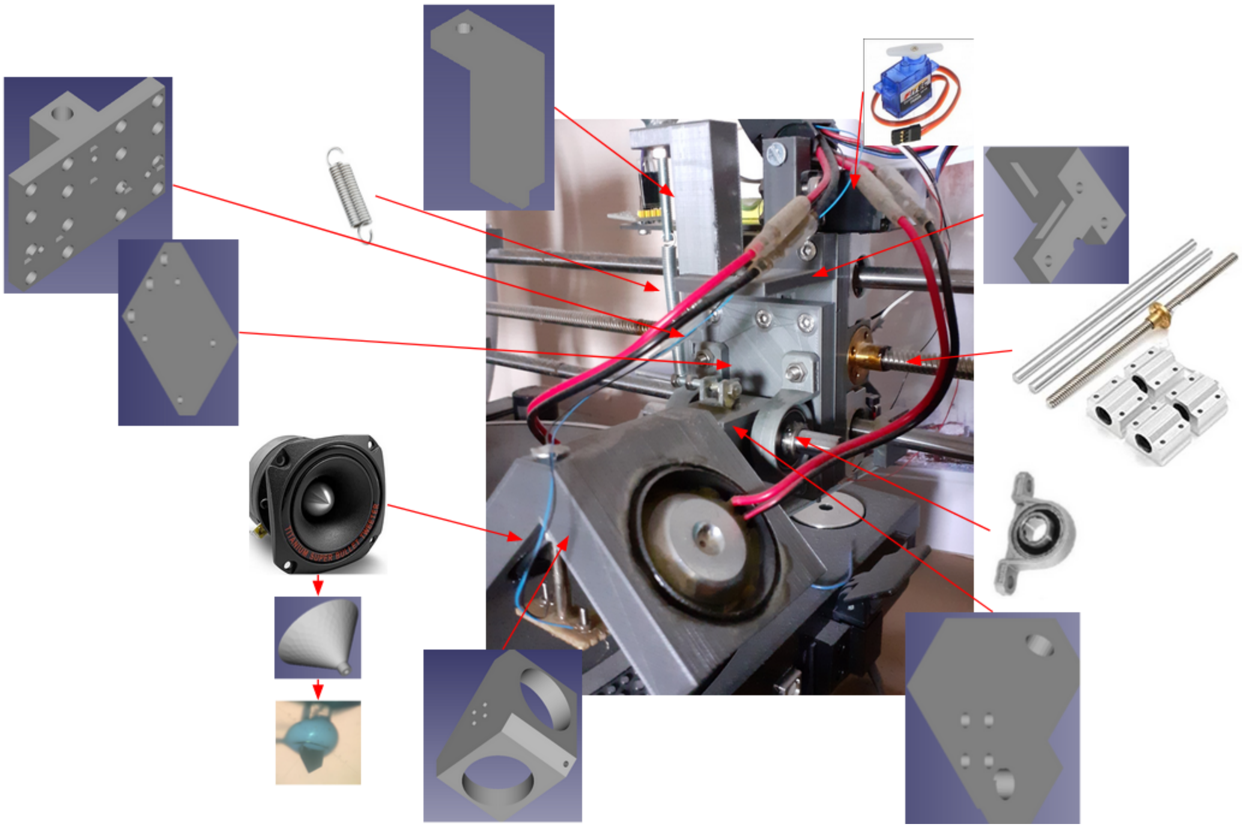
Diamond



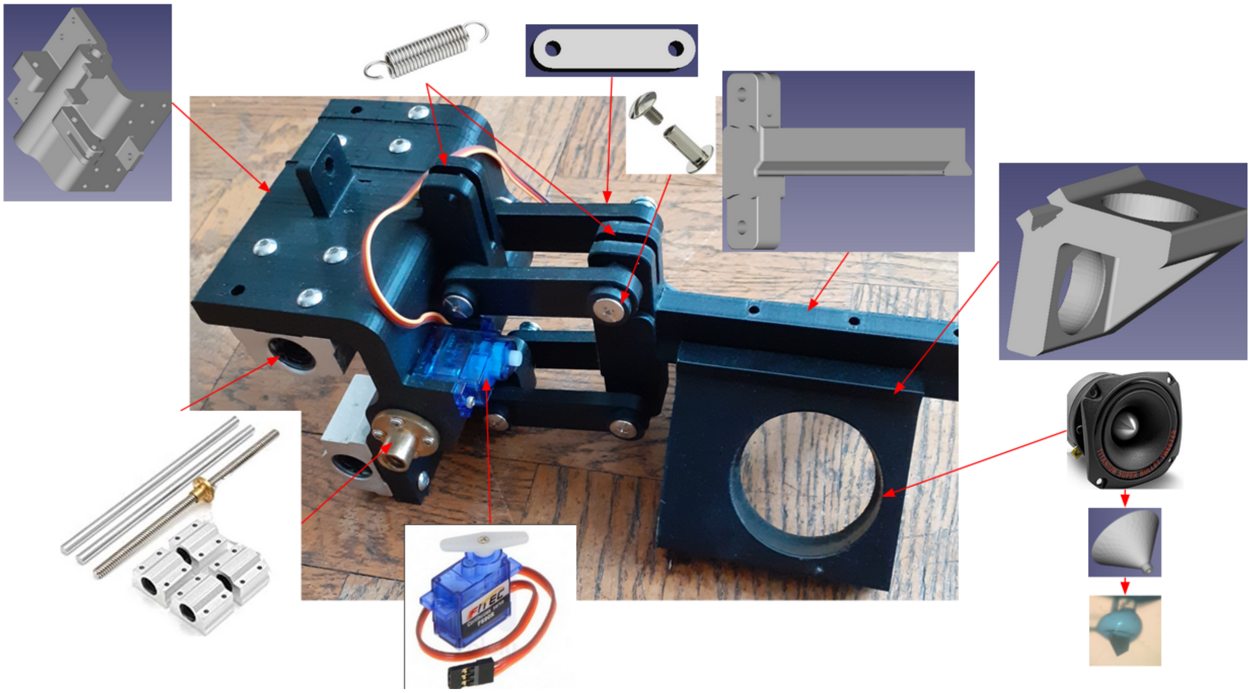
Roland blade

6.4) Assembly

6.4.1) For V1



6.4.2) For V2



6) Softwares

There are two microcontrollers on VinyGo. The master uses an ESP32, and the slave uses a stm32 for the HMI on the LCD touchpad. Both communicate via an UART protocol.
It can be downloaded on the VinyGo git project.
https://github.com/Mras2an/VinyGo/tree/master/03_Software

6.1) UART protocol

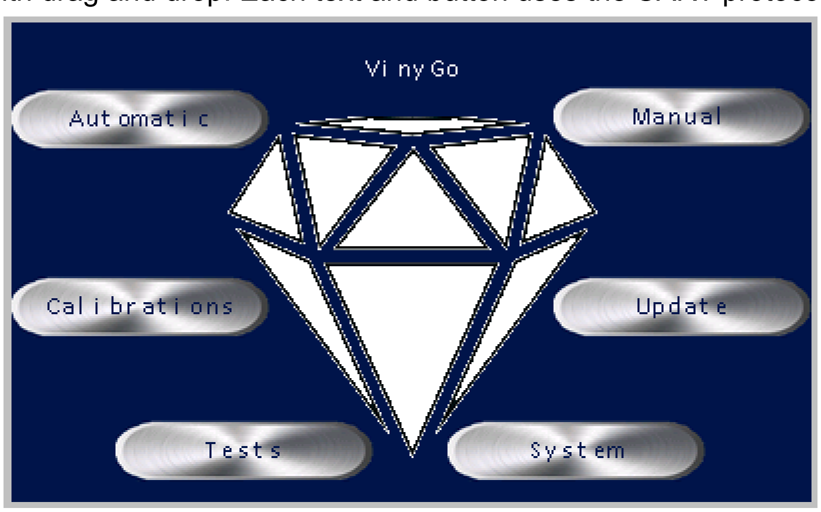
I created an UART protocol for the slave and master communication. Each frame is made as follows:

Frame example to enter in system mode: *0x55 42 53 06 53 79 73 74 65 6d 54*

Start byte	**Header byte**	**Command Byte**	**Data size**	**Data**	**End byte**
0x55	0x42	0x53	0x06	0x53 0x79 0x73 0x74 0x65 0x6d	0x54

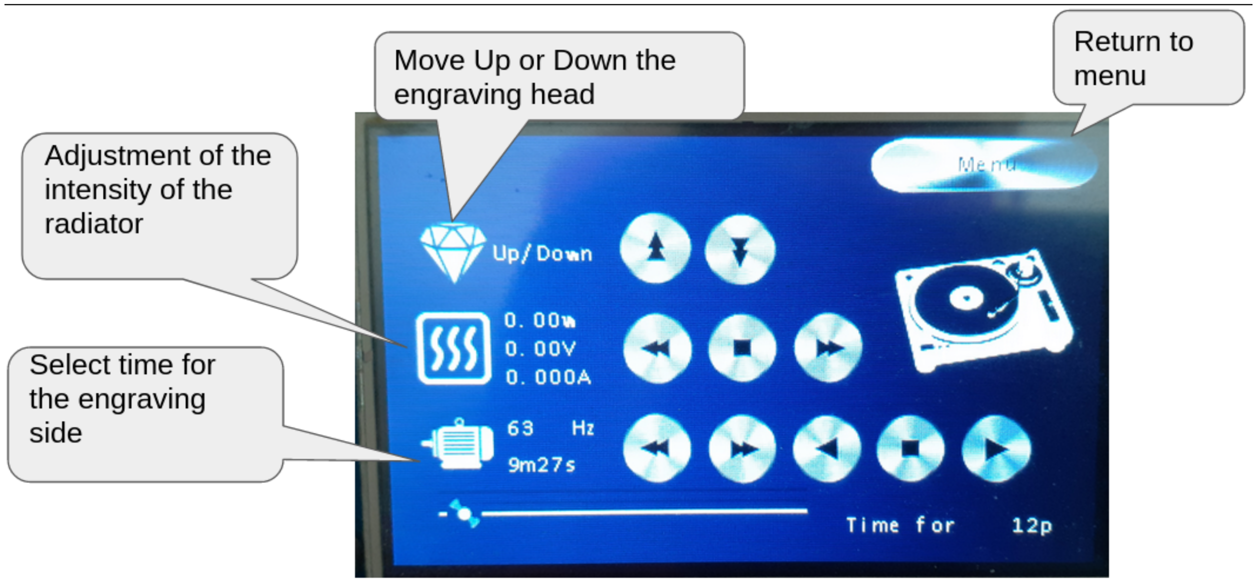
6.2) IHM on LCD touchpad

I chose a Nextion LCD touchpad and nextion editor v0.53. With this LCD screen, we can design an HMI simply with drag and drop. Each text and button uses the UART protocol seen above.



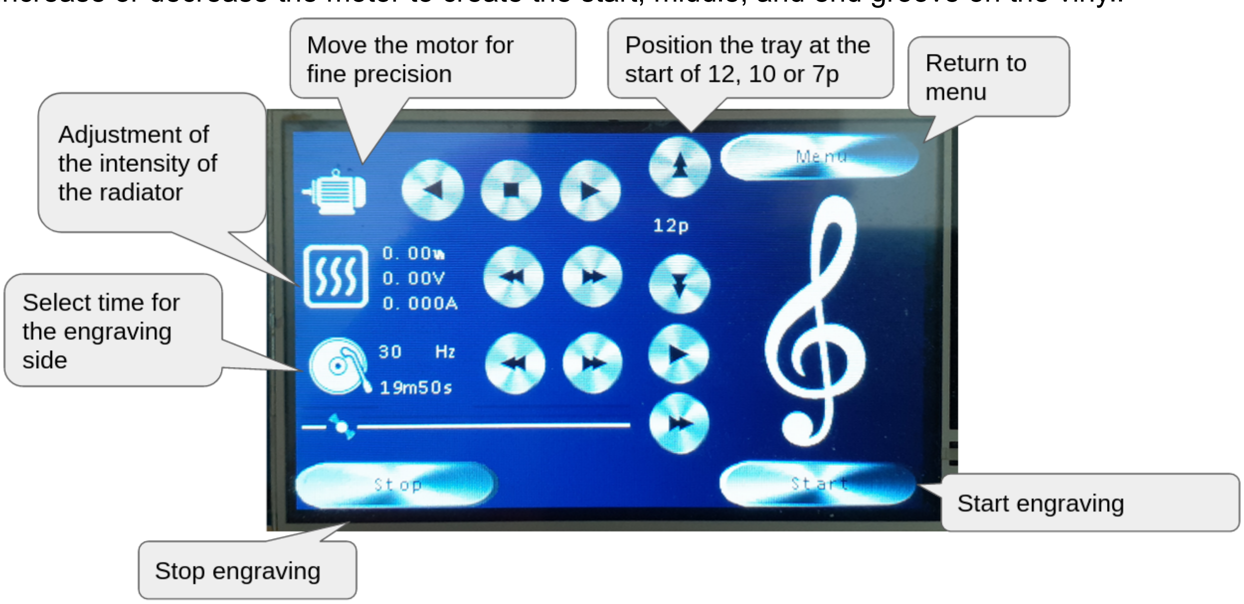
6.2.1) Manual mode

With the manual mode we can adjust all the parameters of the burner one by one, like motor speed, stylus heating.



6.2.2) Automatic mode

With the automatic mode we just need to choose the vinyl size (7", 10", 12") and the time of your playlist. After that all is made automatically. The MIDI commands received in this mode increase or decrease the motor to create the start, middle, and end groove on the vinyl.



6.2.3) Test mode

If you have operating issues this mode is for you. You can test all sensors and commands.

6.2.4) Update mode

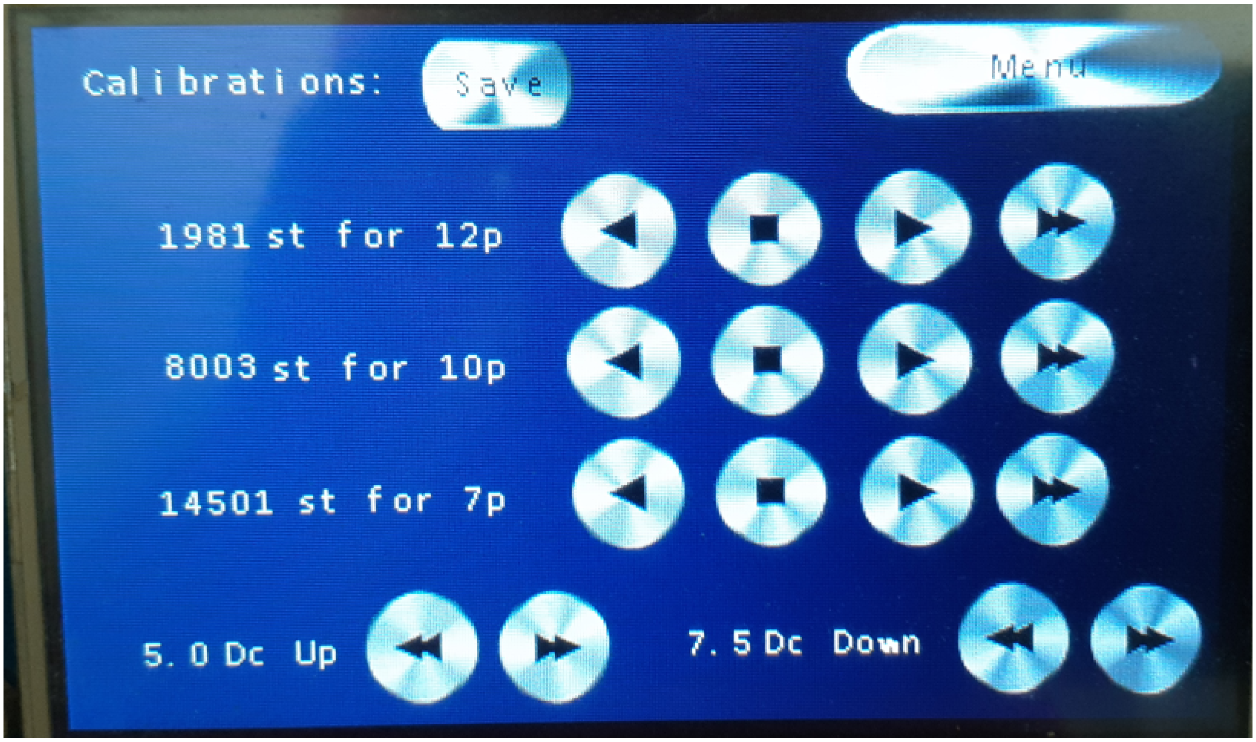
Very useful to send an update on VinyGo by OTA. VinyGo create its own AP, once connected to it you can send new software with a python tool (https://github.com/Mras2an/VinyGo/tree/master/03_Software/Utils)

6.2.5) System mode

System information like RAM, AP, ...

6.2.6) Calibration mode

VinyGo board is designed for several mechanics, so if you have your own mechanic you can use this mode to define the start of a 12, 10 or 7p vinyl.



6.3) Master

6.3.1) WROOM-32 module

I chose the Wi-fi WROOM-32 module because this module has a nice memory capacity, a simple and complete SDK with a lot of examples. It is also very practical to update the binary by OTA to avoid having to connect wires during the development phase.

6.3.2) SDK-IDF

I chose SDK-IDF on the v3.1 branch. The SDK-IDF has a lot of contributors. It is available on github: https://github.com/espressif/esp-idf.git

6.3.3) Flash partition

To allow the update of the system via the wifi we need more partitions. Espressif proposes the possibility to create a cvs file to define the addresses. Here is the one of the VinyGo:

```
# Name, Type, SubType, Offset, Size, Flags
otadata,data,ota,0xd000,8K,
phy_init,data,phy,0xf000,4K,
factory,app,factory,0x10000,1M,
ota_0,app,ota_0,0x110000,1M,
ota_1,app,ota_1,0x210000,1M,
```

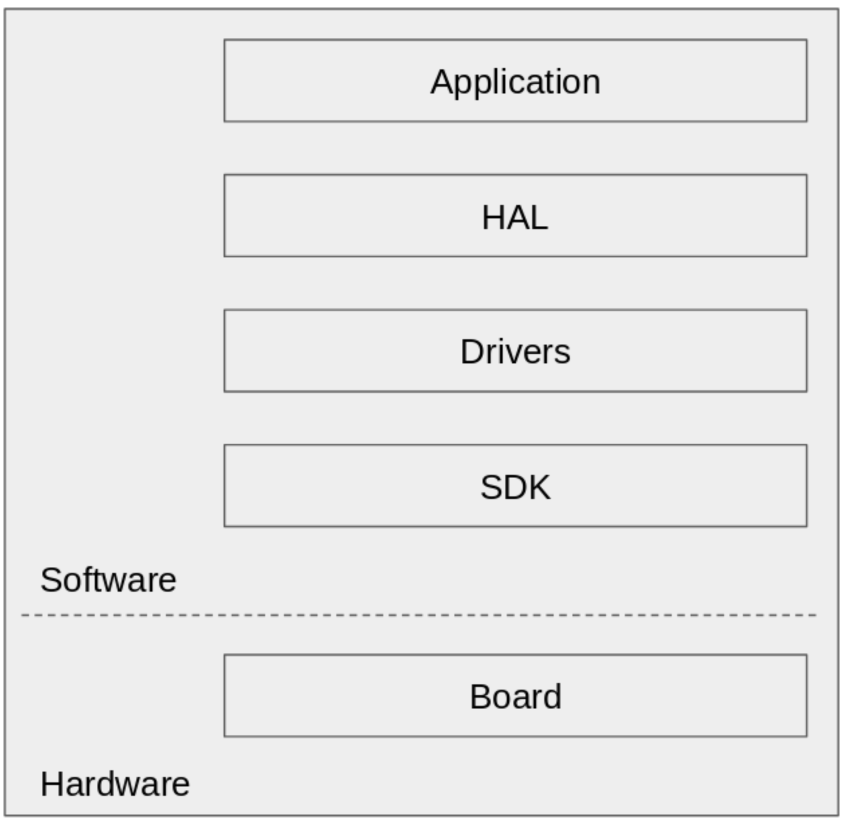
```
nvs,data,nvs,0x315000,500K,
```

So we have a partitioned memory as follows:

```
|   Addr       |   Binaries
 -------------------------------------
| 0x001000 |  Bootloader.bin
| 0x008000 |  Partitions.bin
| 0x010000 |  Factory.bin
| 0x110000 |  OTA_0.bin
| 0x210000 |  OTA_1.bin
| 0x315000 |  NVS (500Ko)
| 0x3F0000 |  Free
```

6.3.4) The architecture

The software is architectured as follows:



6.3.4.1) The espressif SDK

The SDK used is the SDK-IDF on the v3.1 branch available on github at (https://github.com/espressif/esp-idf). This is the official development system of the ESP32 chip.

6.3.4.2) The drivers

Used for different hardware interactions such as motors, or the functionality of the WROOM32 module (Gpio, wifi, OTA, UART, PWM, ...).

6.3.4.3) The HAL and OSAL

HAL and OSAL allow simple porting of VinyGo to another SDK, OS, or hardware platform.

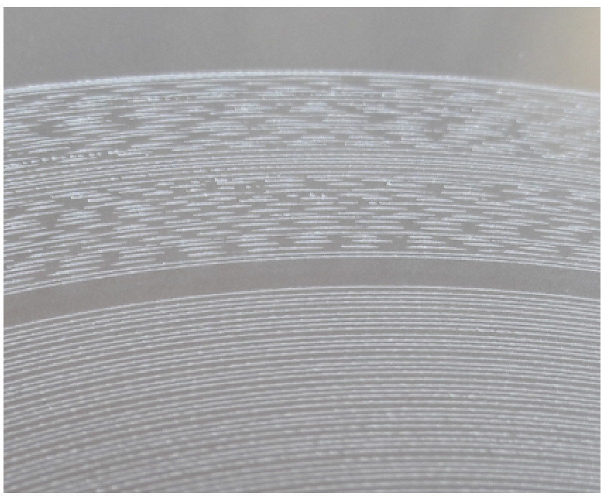
6.3.4.4) The application

This is the VinyGo application. We found six modes, manual, automatic, test, update, system, and calibration accessible by the LCD. For more detail of these modes, see “IHM on LCD touchpad” chapter.

6.4) Mastering music

For mastering the music you have several possibilities, use Pro software like Cubase, use Free software like Audacity. Whatever software you use, the principle is the same. We need to filter the sound before. For that we need an iRIAA equalization. RIAA equalization is a specification for the recording and playback of phonograph records, established by the Recording Industry Association of America (RIAA). The purposes of the equalization are to permit greater recording times (by decreasing the mean width of each groove), to improve sound quality, and to reduce the groove damage that would otherwise arise during playback (If this chapter interests you, you can read more about RIAA on the internet).

Here is an example of a record without iRIAA and with iRIAA. We have too much bass, the head jumps. We can see the issue on the photo below:

	**Bad mastering (too much bass)** **Good mastering**

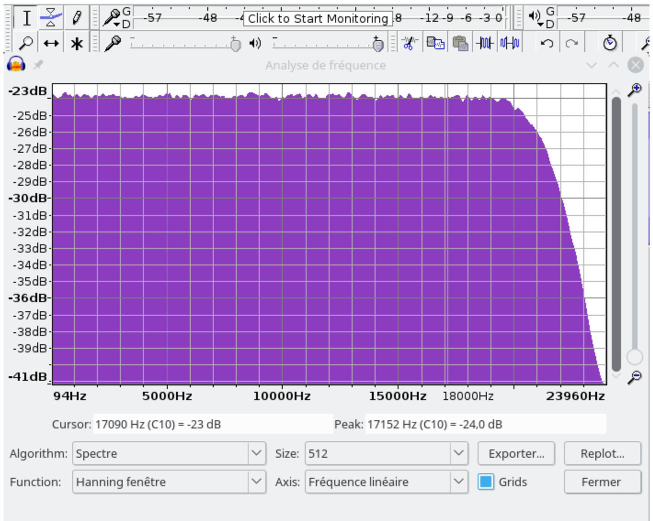
6.4.1) Create calibration filters for mastering

If you burn a vinyl without mastering, you will see that the spectrum of the original music is not the same that your music engraved. To have the same audio spectrum you need to create filters with iRiaa and an equalisation.

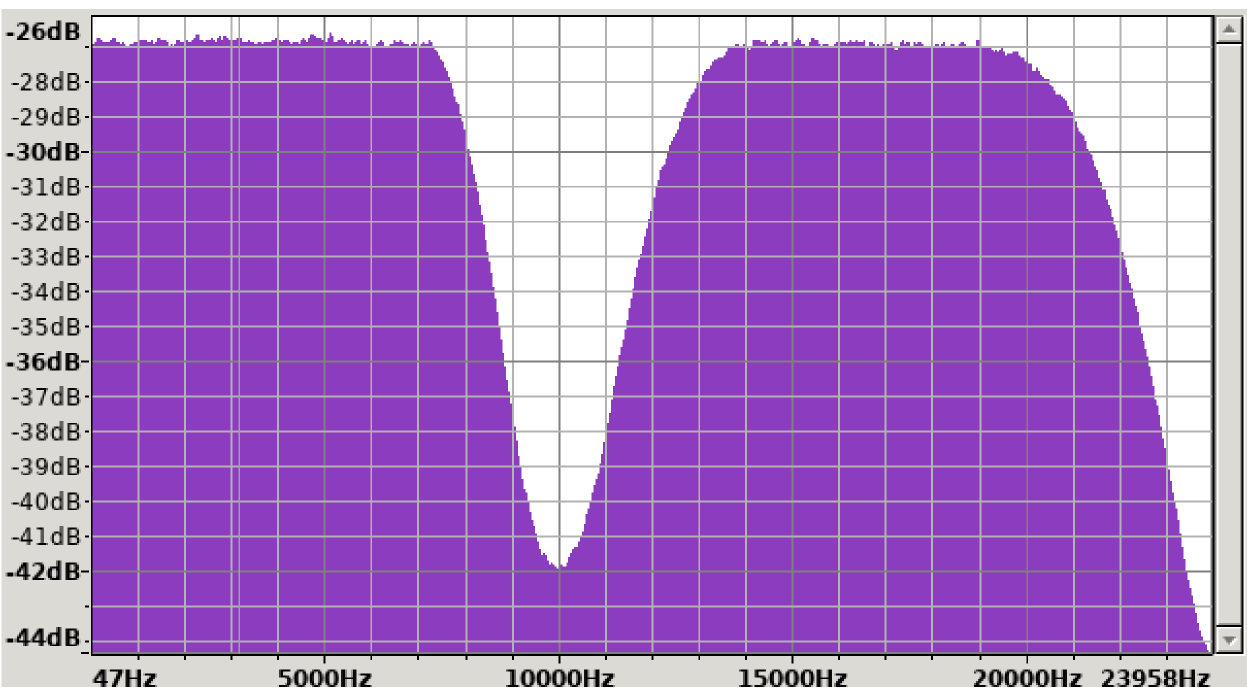
To create these filters you need to burn white noise (White noise is a random signal having equal intensity at different frequencies, giving it a constant power spectral density) (download it in VinyGo/utils git). After the engraving, it must be re-recorded and you need to compare the spectrum between the original signal and the engraved one. If there are some differences in spectrum on a frequency (example 10 KHz below) then the equalizer must be used to increase or decrease the intensity of the original signal on the frequency. That is the mastering! Repeat the operation to get the same spectrum between both original and burn signal. When it is OK you can save your filter. Use the filter on your playlist before each burn. If you use Audacity software these steps are manual, with Pro software like Cubase and fabFilter, the equalisation will be calibrated automatically.

Note: Increase or decrease the amplificator sound to get a sound at 0dB on your vinyl

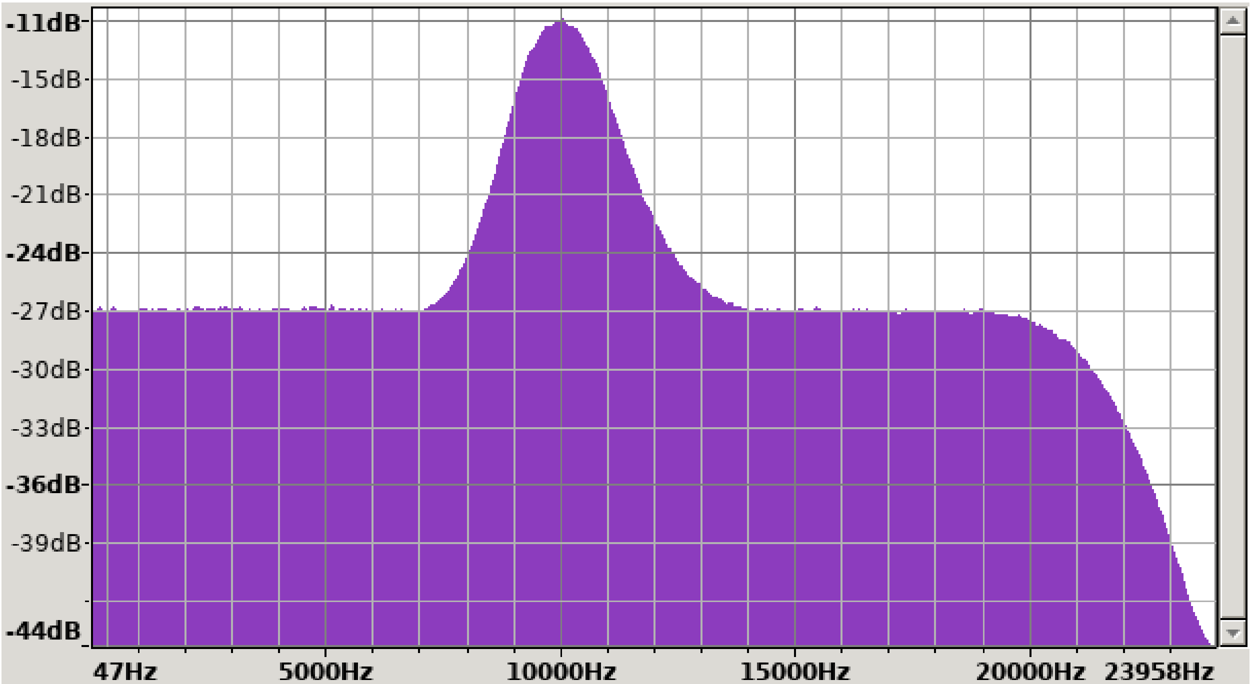
Spectral representation of original white noise:



Example of signal attenuation on vinyl after white noise engraving (On 10KHz).



Example of original white noise equalization to increase the signal intensity (On 10KHz).



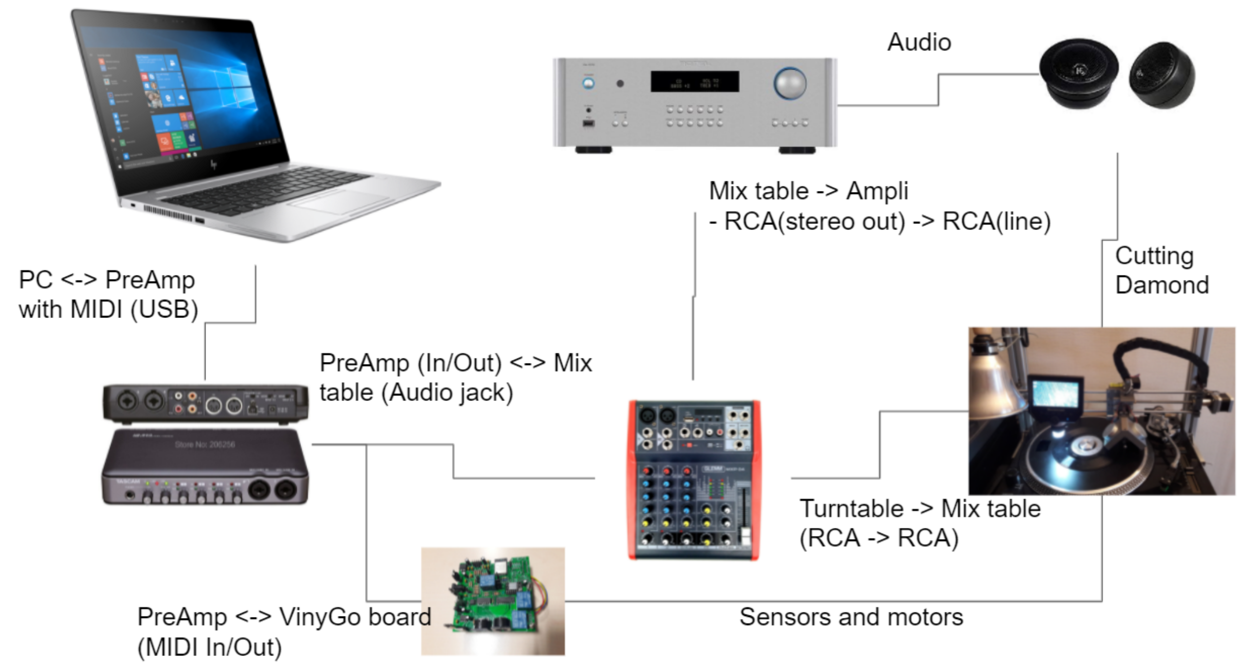
7) List of components

PC	~ 400 $
Turntable	~ 250 $
Mix table	~ 100 $
Ampli	~ 100 $
PreAmpli	~ 50 $
VinyGo board with motors, sensors and LCD	~ 117,37 $
VinyGo mechanic with diamond (if you have 3D printer)	~ 200 $
Cables (RCA, MIDI, Jack)	~ 30 $
Total	**1247,37 $**

8) Getting started and functioning

You have to clone VinyGo git repository: git clone https://github.com/Mras2an/VinyGo.git

8.1) Hardware connection



8.2) Compile and program the code

See doc “VinyGo flash LCD and WROOM32”

8.3) First boot

1 - Power on the VinyGo board, You see the LCD test menu.
2 - Click on it, and check all the tests (sensors, and commands). If it OK return to the menu
3 - Go to the calibration menu and make your calibration for è, 10, and 12p vinyl.
4 - The system is ready, enjoy :-)

8.4) Movies

You can watch videos on my youtube channel:

9) The future of the project

- Create VinyGo community open at all
- Create VinyGo sound mastering board documentation
- Finish the V2 mechanics tests
- Replace Turntable by VinyGo turntable add-on

https://www.heatpressnation.com/gcc-red-cap-for-expert-ii-series-45-degree-standard-for-vinyl-or-flock-5-pack.html

https://www.youtube.com/watch?v=yTXD2HKoCXM