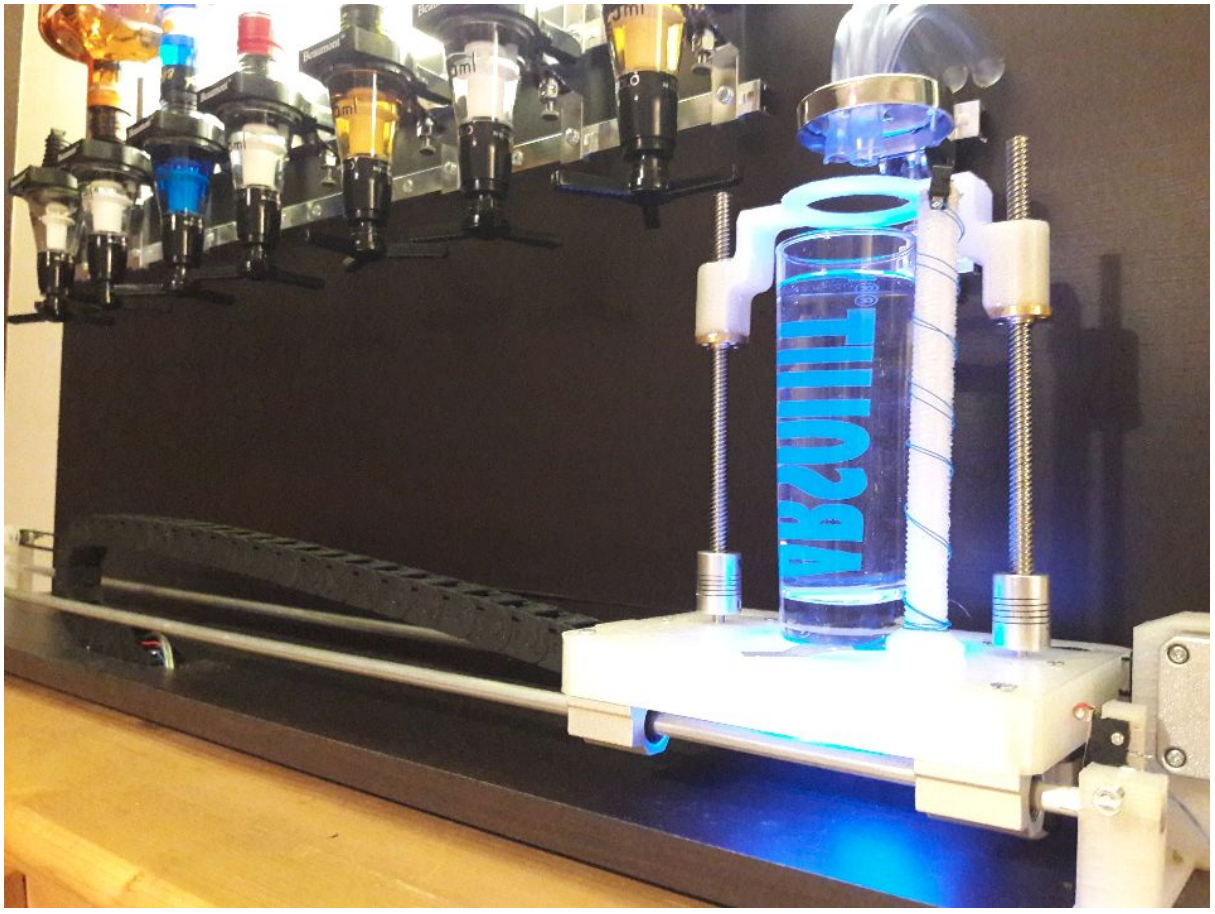
Realization of a connected cocktail machine with an espressif WROOM32



Revision	Data	Author	Modifications
R01	17/01/2018	Q.THEROND	Creation

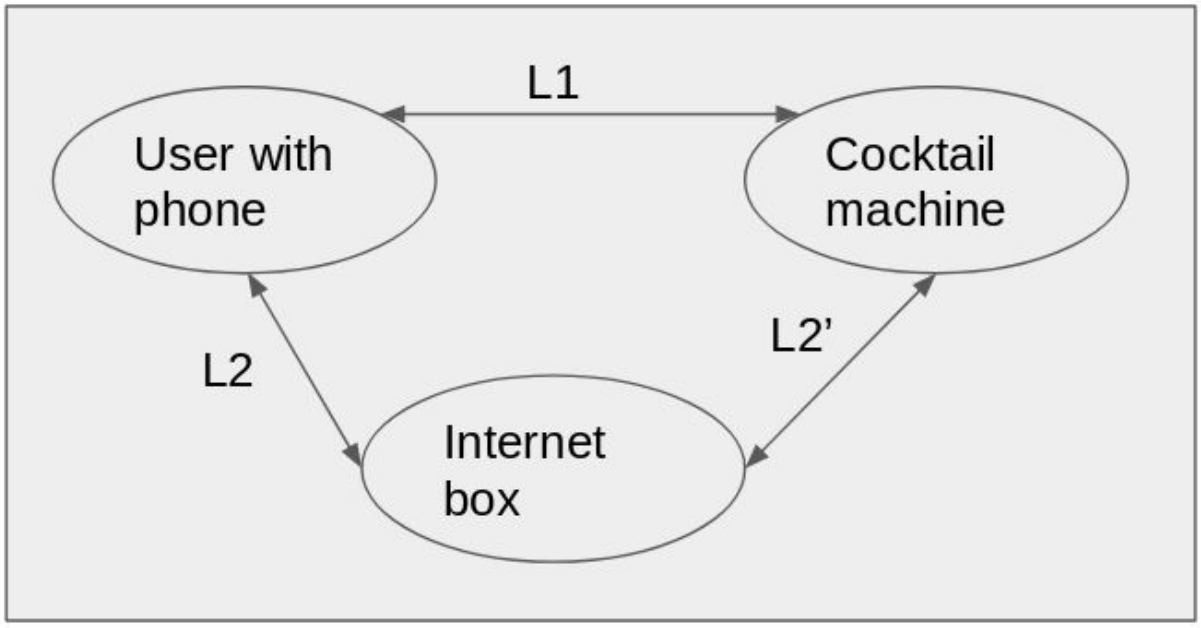
1) Introduction

Failing to achieve an interesting feature for the espressif SDK like wi-fi mesh I will present a fun project. The realization hardware and software of a connected cocktail machine with an espressif WROOM32. The goal is to be able to:
- Order a cocktail via a phone or PC
- Order a cocktail via a voice assistant (Google home, Alexa, ...).
- Order a cocktail via a IFTTT trigger

For that we will see different IOT functionality mover by the WROOM32 like:
- Connect the system to internet with smartconfig
- Create a web page
- Use a mDNS and a fixed IP.
- Use a socket
- Update the system with OTA and the flash partition of ESP32
- Use the hardware features on the ESP (gpio, file system, ...)
- Use the FreeRTOS operating system of the espressif SDK-IDF
- Use the cJson library

And sorry for my English!

2) Sagittal diagramme



2.1) Description of the links

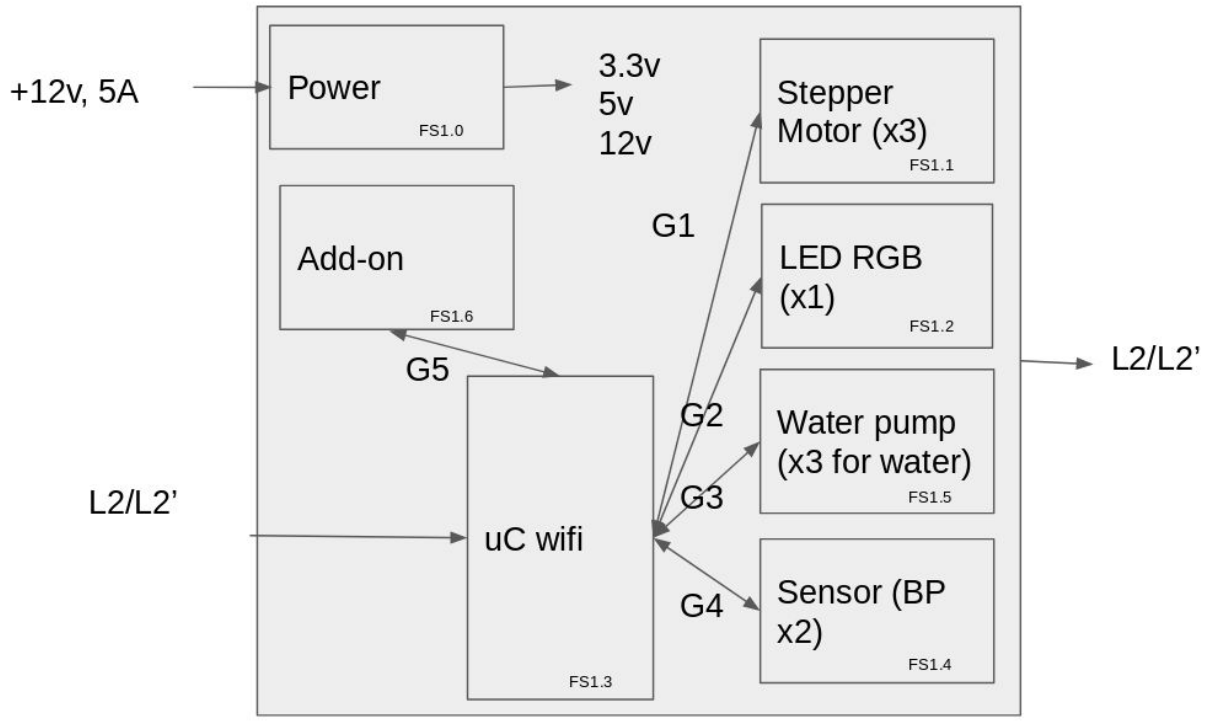
L2 / L2 ':

- Allows the user to order a cocktail via a web page.
- Allows the user to order a cocktail via a voice assistance (Alexa, Google Home, ...)
- Send his SSID and password with his smartphone to connect the system to the internet.
- Allows the system update with OTA

L1:

- Allows the user to put and retrieve his glass.
- Lighting information about the state of the system.
- Lets fill the bottles and clean them.

3) Functional diagram



3.1) FS1.0: Power supply

The power function allows to create, thanks to an input voltage of 12V 5A, + 5V, + 3.3V, 0V.

Input(s):
12V, 5ADC.

Output(s):
+ 5V, + 3.3V, 0V

3.2) FS1.1: Stepper motors

The motor function allows to control the tray with the glass and to serve the cocktail via the dosers.

Input(s):
G1: Digital signals (dir and clk) for controlling the stepper motors.

Output(s):
Physical movement of the engines

3.3) FS1.2: RGB LED

The RGB LED informs the user of the system status.

Input(s):
G2: Digital signals to control the RGB LED.

Output(s):
L2: Lighting signals to inform the user

3.4) FS1.3: uC wifi

Ensures through a programmed treatment (software) the acquisition, processing and return of information. The smartconfig mode of wroom32 allows to recover the SSID and password of the internet box. The wi-fi allows to control the system via a smartphone or a computer through a web page on a fixed IP address. It communicates with the motors, the RGB LED. sensors, and offers inputs / outputs to add additional functionality.

Input(s):
L2 / L2 ': Wifi connection in wpa2, wep, ... smartconfig mode,
G4: Digital Signals for Limit Detection

Output(s):
L2 / L2 ': http web page on IP fix
G1: Digital Signals for Stepper Motor Control
G2: Digital Signals for RBG LED Control
G3: Digital signals for pump control

3.5) FS1.4: Sensors

Allows detection of limit signals to delete the SSID and password of the wi-fi.

Input(s):
L1: Physical size

Output(s):
G4: Digital signals on / off

3.6) FS1.5: Pumps

The "pumps" function is used to control DC motors.

Input(s):
G3: Digital signals for pump control

Output(s):
Physical movement.

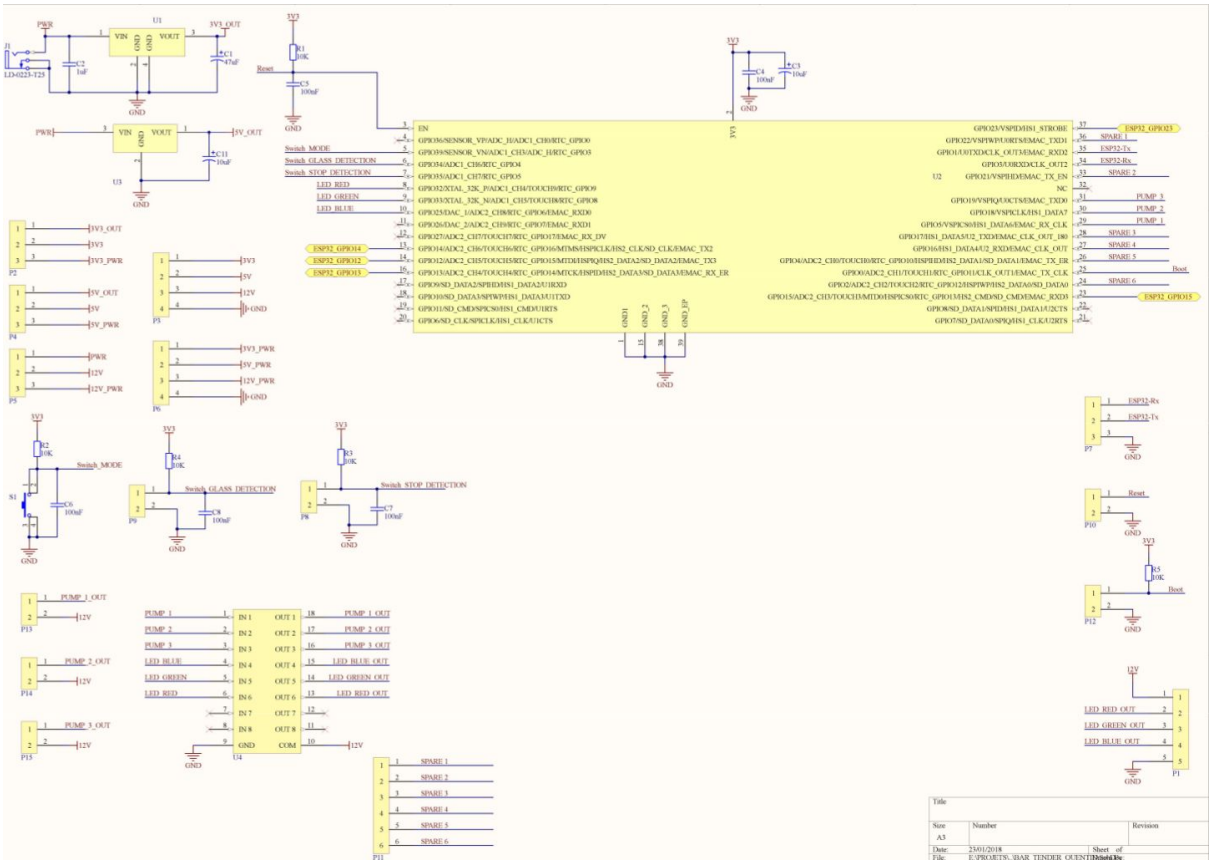
3.7) FS1.6: Expansion connector

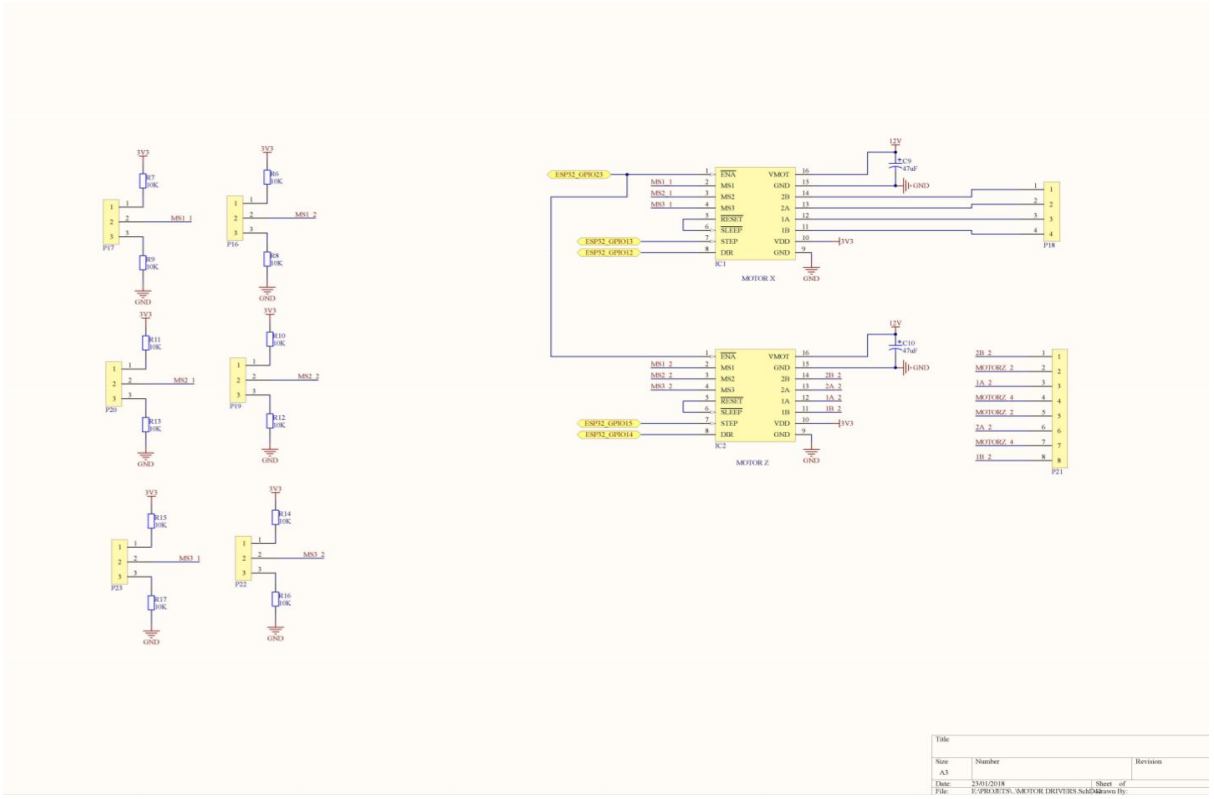
Allows you to add features to the e-card.

Input(s):
G5: Digital Signals

Output(s):
G5: Digital Signals

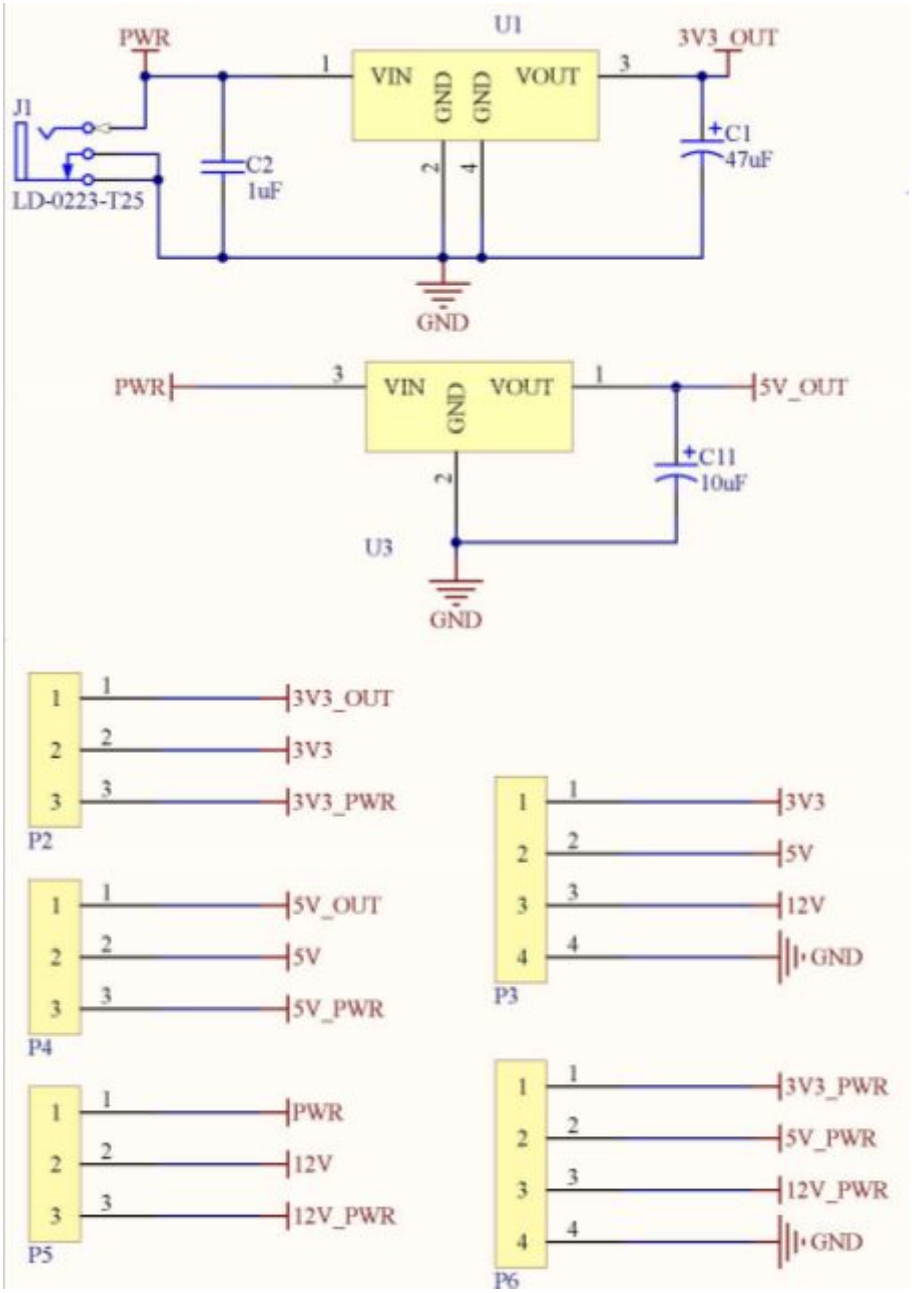
4) Structural diagram





4.1) FS1.0: Power

The power function allows to create, thanks to an input voltage of 12V 5A, + 5V and + 3.3V.



J1: 12v input

C1, C11: Polarized chemical capacitors. They perform the filtering, and allow a decoupling in case of power supply

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

U3: 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.

U1: 3.3V LDO, it allows to regulate the input voltage 12V DC in a voltage of 3.3V DC.

P2, P4, P5: Choose the power source (internal or external) according to the current requirement. It is physically, connecting strips on which we just connect a "jumper" (or jumper) to select the desired voltage.

P3: Connector for testing output voltages.

P6: Connect an external power supply to not use the regulators (if more power is needed). Attention P2, P4, P5 must be connected correctly.

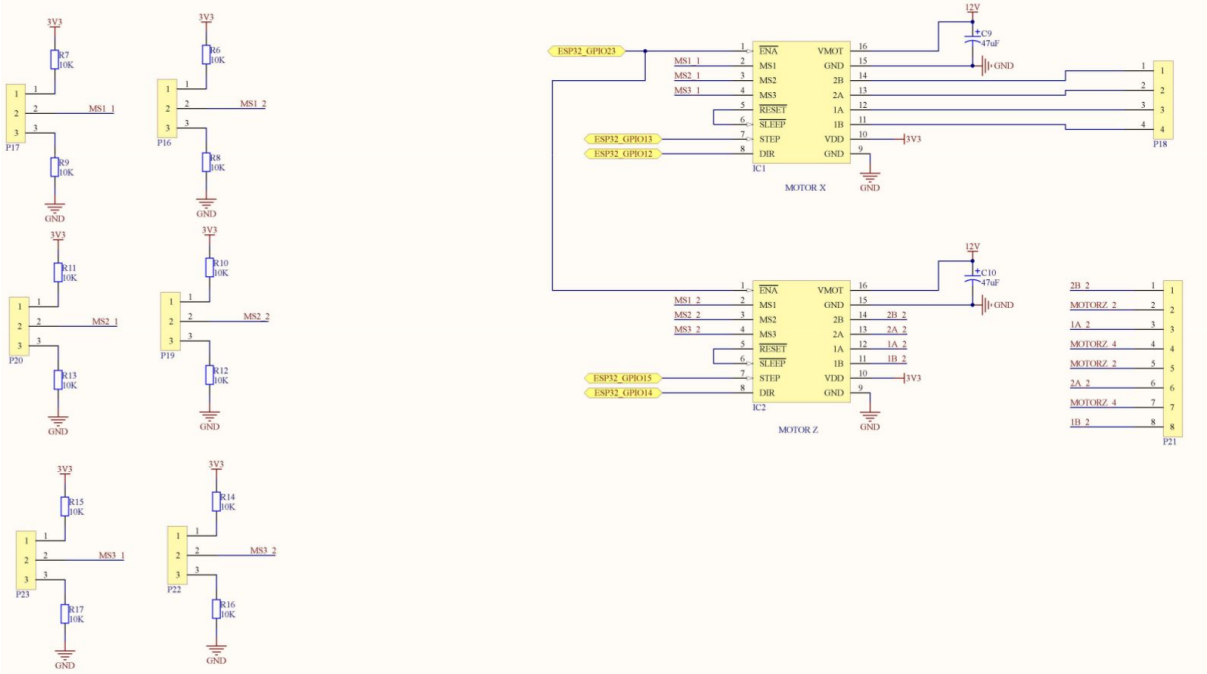
4.1.1) Calculation of a radiator

supposition: esp32=90mA, autre 50mA max
Isystem = 90+50 = 140mA
Pmax = (Tj – Ta)/RTHja = (125-25)/65 = 1,5W
Putil(3.3V) = Isystéme*(Ve-Vs) = 140*10^-3*(12-3.3) = 1,218W
Putil(5V) = Useless
Putil<Pmax.

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

4.2) FS1.1: Step motors

The motor function allows to control the tray with the glass and to serve the cocktail via the dosers.



IC1, IC2: are modules based on A4988 for the control of stepper motors powered by 3.3v. MSI_x inputs are used to configure the step resolution. the STEP input is a clock that triggers one step per clock period. the input DIR makes it possible to choose the direction of rotation of the motor.

P16, P17, P19, P20, P22, P32: Allows you to select one of the five state resolutions according to the truth table above. For the project I am in full step.

MS1	MS2	MS3	Microstep Resolution
Low	Low	Low	Full step
High	Low	Low	Half step
Low	High	Low	Quarter step
High	High	Low	Eighth step
High	High	High	Sixteenth step

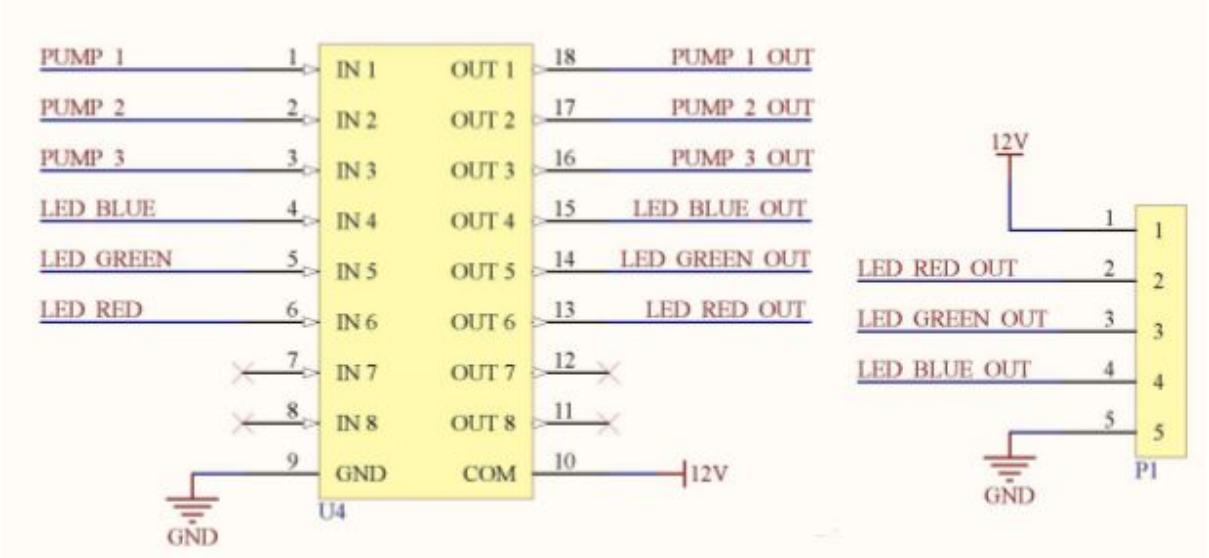
C9, C10: Polarized chemical decoupling capacitors.

P18: Used to connect the motor of the tray with the glass (X axis).

P21: Used to connect the motors to serve the cocktail via the dosers (Y axis).

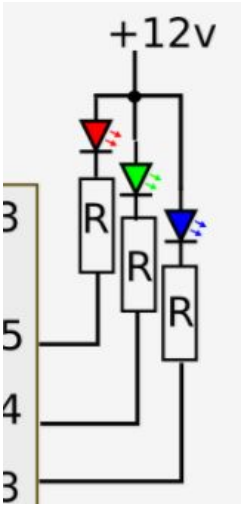
4.3) FS1.2: RGB LED

The RGB LED informs the user of the system status.



U4: Controlled switches (transistor network - ULN2803). Each of these 8 channels can be open or closed. It is capable of driving a load up to 500mA.

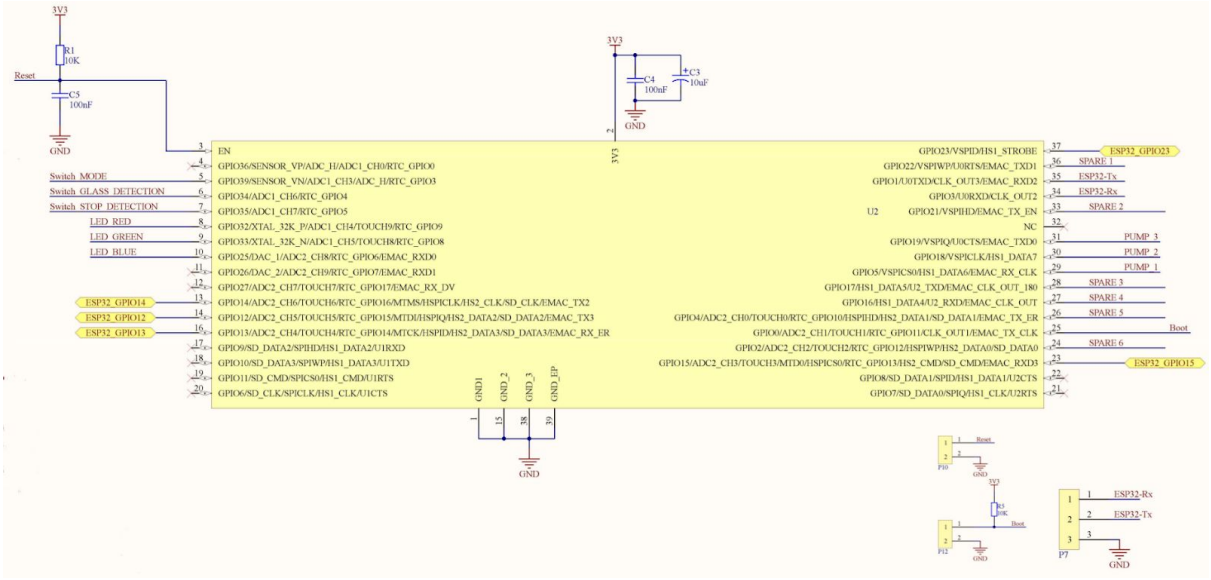
P1: Connect the RGB LED. PIN 5 is not used. You have to connect the LED as follow



(source: forum.arduino.cc/index.php?topic=465854.0)

4.4) FS1.3 : uC wifi

Ensures thanks to a programmed treatment (software) the acquisition the treatment and the return of the information. The smartconfig mode of WROOM32 allows to recover the SSID and password of the internet box. The wifi allows to control the system via a smartphone or a computer through a web page on a fixed IP address. It communicates with the motors, the RGB LED. sensors, and offers inputs / outputs to add additional functionality.



R1, C5, P10: Allows a reset on the wroom32.

C4, C3: used to filter high and low frequencies.

P7: Allows programming the wroom32 via a UART.

P12: Set wroom32 to programming mode.

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

4.4.1.1) Inputs

Switch_MODE: Allows you to delete the Wi-Fi configuration (SSID and password)

Switch_GLASS_DETECTION: Detects the end of the board.

Switch_STOP_DETECTION: Used to detect the end of the dispenser management system.

Boot: Set the WROOM32 to programming mode.

Reset: Allows a reset on the WROOM32.

ESP32-Rx: Allows to send the binaries to be saved in memory of the wroom32

4.4.1.2) Outputs

ESP32_GPIO14, 12, 13, 15: Used to control the direction of rotation of motors and the speed of steps.

ESP32_GPIO23: Allows you to enable and disable A4988-based modules

LED_RED: Used to control the red LED. When the system starts, the LED is red as long as the system has not reached the limit

LED_GREEN: Used to control the green LED. Not used yet.

LED_BLEU: Used to control the BLUE LED. The blue fix indicates that the system is ready for use. The blinking blue indicates that the system is in preparation for a cocktail party.

ESP32-Tx: Allows you to send information to the programming tool.

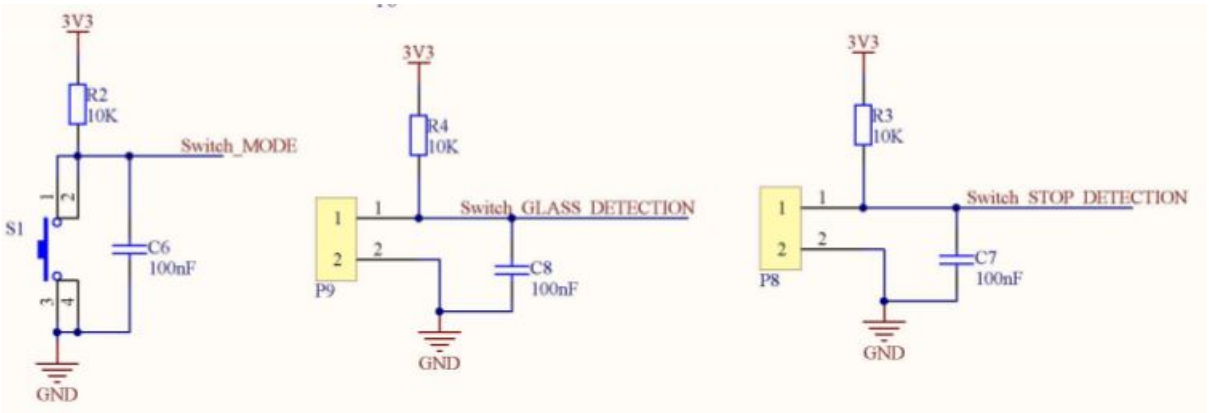
PUMP_1 to PUMP_3: Used to control pumps.

4.4.1.3) Other:

SPARE1 to SPARE6: The SPARE inputs / outputs allow you to add new features to the cocktail machine such as milk powder dosing (of course, this implies a whole system of milk preservation and hygiene. given as an example.)

4.5) FS1.4: Sensors

Allows detection of limit signals and deletes the SSID and password of the wi-fi. The push button (switch_MODE) allows you to request the removal of the SSID and password to the wroom32 module.



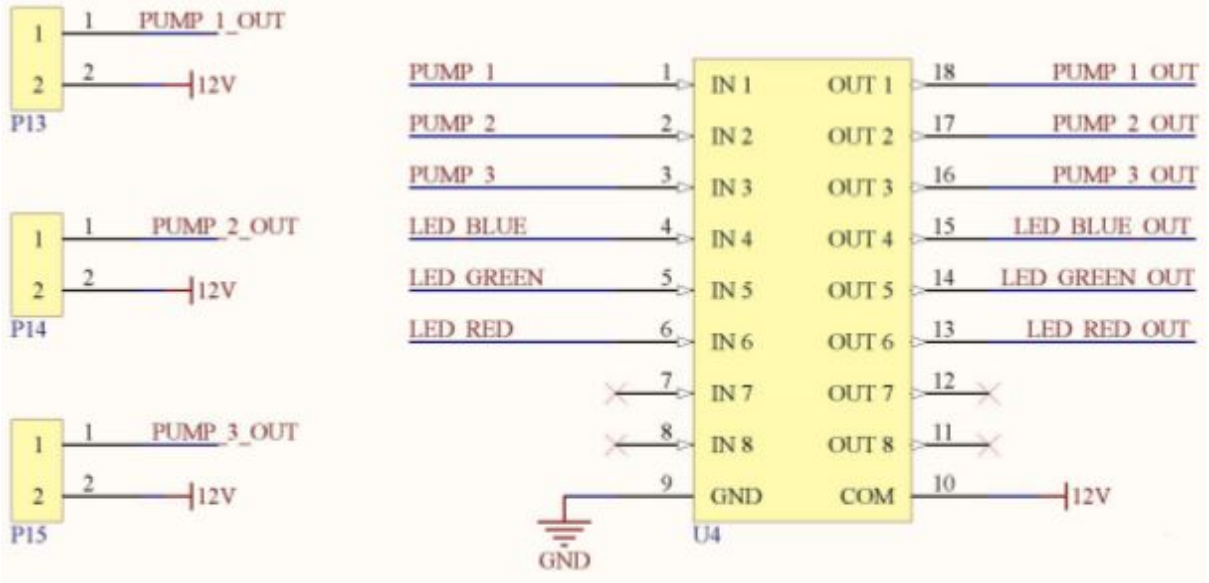
R2, R3, R4: Pull-up resistance.

C6, C7, C8: Anti-rebound capacitor.

P9, P8: Used to connect the limit switches.

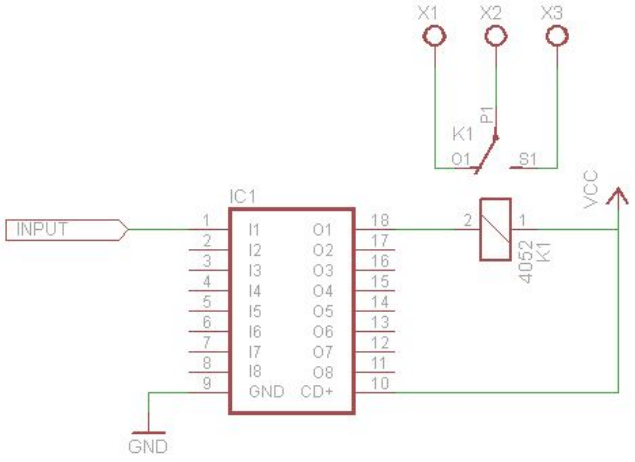
4.6) FS1.5: Pumps

The pump function is used to control DC motors.



P13, P14, P15: Used to connect the pumps.

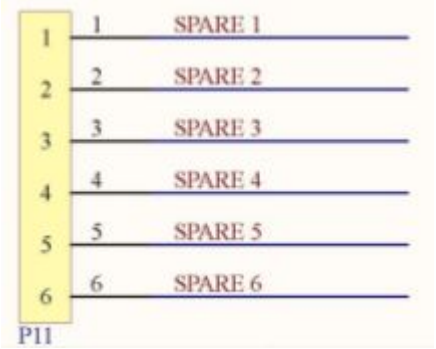
U4: Switches controlled. Each of these 8 channels can be open or closed. It is capable of driving a load up to 500mA. After the tests the chosen pump consumes more than 500mA, so I added an expansion board with relays. You can connect your relays on P13, P14, P15 as follow.



(source: www.brunwinkel.de/elektronik/ics/uln2803/)

4.7) FS1.6: Expansion connector

Allows you to add features to the board.

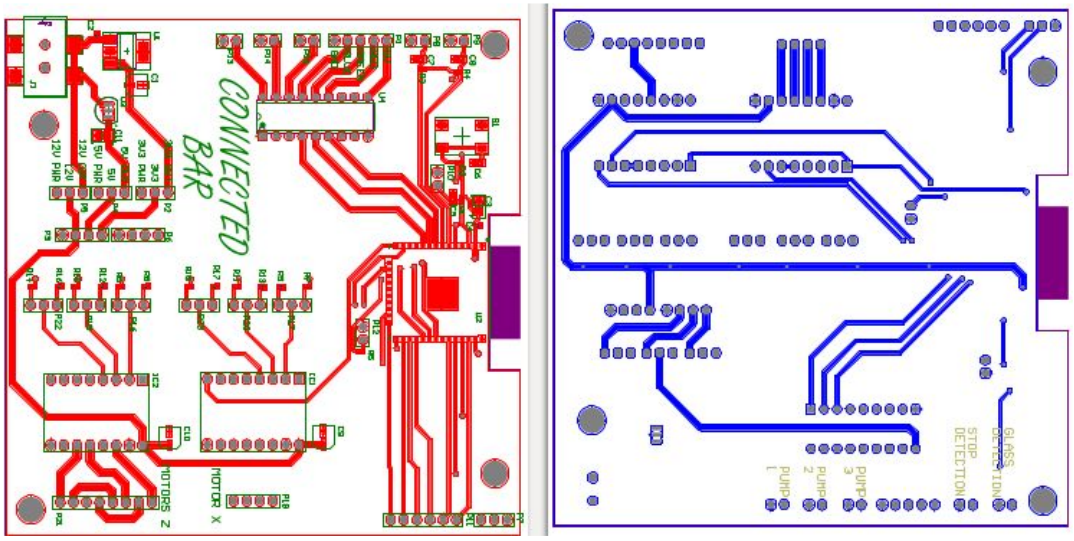


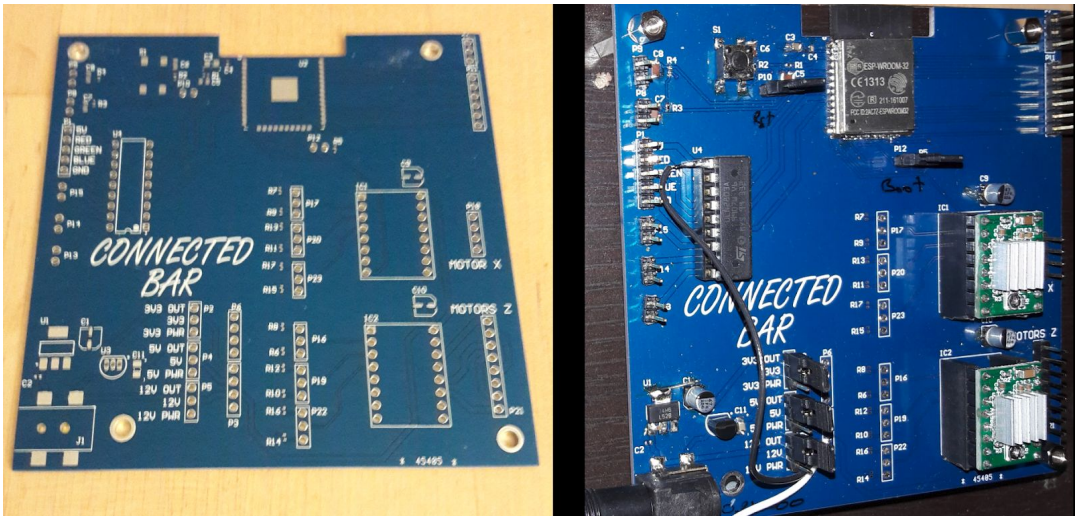
P11: Used to connect another electronic board to the central unit.

5) The PCB and List of components

5.1) PCB

The PCB does not have any particular constraint except to respect the "reference design" proposed by expressif to have the best radio performances (the plans of the masses were put in transparency here for a better representation).





5.2) PCB List of components

Comment	Description	Designator	Footprint	LibRef	Quantity
EEEFK0J470UR	CAP 47uF 6.3V ALU CMS	C1, C9, C10	CAPA CHIMIQUE CMS	EEEFK0J470UR	3
GRM155R60J105KE19D	CAP 1UF 6V3 X5R CER 0402 CMS	C2	0402	GRM155R60J105KE19D	1
0805YD106KAT2A	CAP 10uF 16V X5R CER 0805 CMS	C3, C11	0805 POLARISE	0805YD106KAT2A	2
CC0402KRX7R6BB104	CAP 100NF K10V X7R CER 0402 CMS	C4	0402	CC0402KRX7R6BB104	1
MC0603B104K250CT	CAP 100NF 25V X7R CER 0603 CMS	C5, C6, C7, C8	0603	MC0603B104K250CT	4
A4988	MOTOR DRIVER	IC1, IC2	DRIVER MOTEUR	A4988	2
LD-0223-T25	CMS JACK SOCKET PLUG	J1	PJACK-LIHSHENG-LD-0223-25	LD-0223-T25	1
HEADER 1x5	EMBASE MALE 1 RANGEE VERT 5 VOIES	P1	EMBASE 5 VOIES	HEADER 1x5	1
HEADER 1x3	EMBASE MALE 1 RANGEE VERT 3VOIES	P2, P4, P5, P7, P16, P17, P19, P20, P22, P23	EMBASE 3 VOIES	HEADER 1x3	10
HEADER 1x4	EMBASE MALE 1 RANGEE VERT 4 VOIES	P3, P6, P18	EMBASE 4 VOIES	HEADER 1x4	3
HEADER 1x2	EMBASE MALE 1 RANGEE VERT 2 VOIES 2.54mm	P8, P9, P10, P12, P13, P14, P15	EMBASE 2 VOIES - 2.54mm	HEADER 1x2 - 2.54 mm	7
HEADER 1x6	EMBASE MALE 1 RANGEE VERT 6 VOIES	P11	EMBASE 6 VOIES - VERTICAL	HEADER 1x6	1
HEADER 1x8	EMBASE MALE 1 RANGEE VERT 8 VOIES	P21	EMBASE 8 VOIES - VERTICAL	HEADER 1x8	1

MC 0.0625W 0402 1% 10K	RESIST.CMS 0402 1/16W 5% 10K	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17	0402	MC 0.0625W 0402 1% 10K	17
Switch	SWITCH TACTILE	S1	TACT SWITCH 6X6	DTSM-61R-V-*	1
LM3940IMP-3.3/NOPB	REGULATEUR LINEAIRE 3V3	U1	SOT-223	LM3940IMP-3.3/NOPB	1
ESP-WROOM-32	MODULE WIFI ESPRESSIF WROOM 32	U2	MODULE_WIFI ESPRESSIF WROOM 32	ESP WROOM 32	1
LM78L05ACZ/NOPB	REGULATEUR LINEAIRE 5V	U3	TO-92	LM78L05ACZ/NOPB	1
ULN2803A	Transistor en réseau bipolaire	U4	DIP 18	ULN2803A	1

5.3) Meca and other:

BQLZR 500mm Longueur 8mm Diam¨¨¨tre ext¨¦rieur Axe linéaire horizontal Axe optique Ensemble de palier ¨¤ glissi¨¨¨re et axe linéaire Ensemble de soutien	https://www.amazon.fr/gp/product/B01K4MX1WW/ref=oh_aui_detailpage_o03_s00?ie=UTF8&psc=1
Myarmor 2 pcs 2 GT 20 dents Timing Poulie de roue + 5 m 2 Gt-6 mm Ouverture en caoutchouc Ceinture	https://www.amazon.fr/gp/product/B01K4MX1WW/ref=oh_aui_detailpage_o03_s00?ie=UTF8&psc=1
XCSOURCE NEMA 17 2 Phase Moteur 4-Wire 1.8A Stepper 42 * 42 * 34mm Pour Imprimante 3D TE225	https://www.amazon.fr/gp/product/B011NRMXYO/ref=oh_aui_detailpage_o02_s00?ie=UTF8&psc=1
Chenxi Shop 15 x 15 mm L1000 mm Plastique câble Drag Fil de chaîne de transport pour CNC Router machine	https://www.amazon.fr/gp/product/B073XFG975/ref=oh_aui_detailpage_o03_s00?ie=UTF8&psc=1
Doseur d'alcool Beaumont 25ml	https://www.amazon.fr/gp/product/B009VJ4M32/ref=oh_aui_detailpage_o04_s00?ie=UTF8&psc=1
SODIAL(R) 10 Pcs Mini Micro Fin de course Levier a galet bras SPDT Declic LOT	https://www.amazon.fr/gp/product/B00U8MPR8U/ref=oh_aui_detailpage_o07_s00?ie=UTF8&psc=1

Transformateur 220Vac vers 12Vdc Chargeur Alimentation à découpage pour guirlande Ruban Led Bande 5m 60W	https://www.amazon.fr/gp/product/B06WGRXCPK/ref=oh_aui_detailpage_o05_s00?ie=UTF8&psc=1
TecTake Boissons cuillère pour 6 bouteilles pour le mur bouteille support bar butler	https://www.amazon.fr/gp/product/B0196P9XR0/ref=oh_aui_detailpage_o07_s00?ie=UTF8&psc=1
Anycubic 20 Dents Alumium Timing Poulie 5mm Alésage Ceinture Roue D'entraînement pour 10mm Largeur GT2 Ceinture 5PCS	https://www.amazon.fr/gp/product/B06XT274LH/ref=oh_aui_detailpage_o08_s00?ie=UTF8&psc=1
Popprint 5 pcs Ramps1.4 A4988 pilote de moteur pas à pas avec dissipateur thermique pour imprimante 3d, Green, 5	https://www.amazon.fr/gp/product/B06Y28H956/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1
Anself Ultra silencieux Micro Mini DC12V Pompe à eau	https://www.amazon.fr/gp/product/B00OIHLTME/ref=oh_aui_detailpage_o03_s01?ie=UTF8&psc=1

6) The software

It is available with this document in zip file and on github
https://github.com/Mras2an/cocktail-machine

I have around 5000 code lines in the project, so it is impossible to present all code files. Please do not hesitate to see the code project in "src" directory.

6.0) Presentation of Wifi/Bluetooth WROOM-32 module and SDK-IDF

6.0.1) WROOM-32 module

I chose the Wi-fi/Bleutooth WROOM-32 module because this module has many advantages. Like an attractive price (for a wi-fi module), a nice memory capacity, a simple and complete SDK with lot of example and a stable wi-fi connection. So it's a great choice for making a homemade connected cocktail machine. But like all products, it also has drawbacks. The disadvantages of the resident module is in the flash protection management which requires 30 seconds (at first boot) to encrypt the 4Mb. It also lacks real hardware acceleration for ssl handshake (between 1 and 5 seconds for RSA256 in 2048).

6.0.2) SDK-IDF

I chose SDK-IDF instead of Arduino SDK because I already know the Arduino SDK. The SDK-IDF has a lot of contributors and I was able to propose three patches for the SDK-IDF. My pull requests was integrated in cind days, so the project maintainers are responsive.

6.1) Flash partition

To allow the update of the system via the wifi we need more partition. Espressif proposes the possibility of creating a cvs file to define the addresses. Here is the one of the cocktail machine:

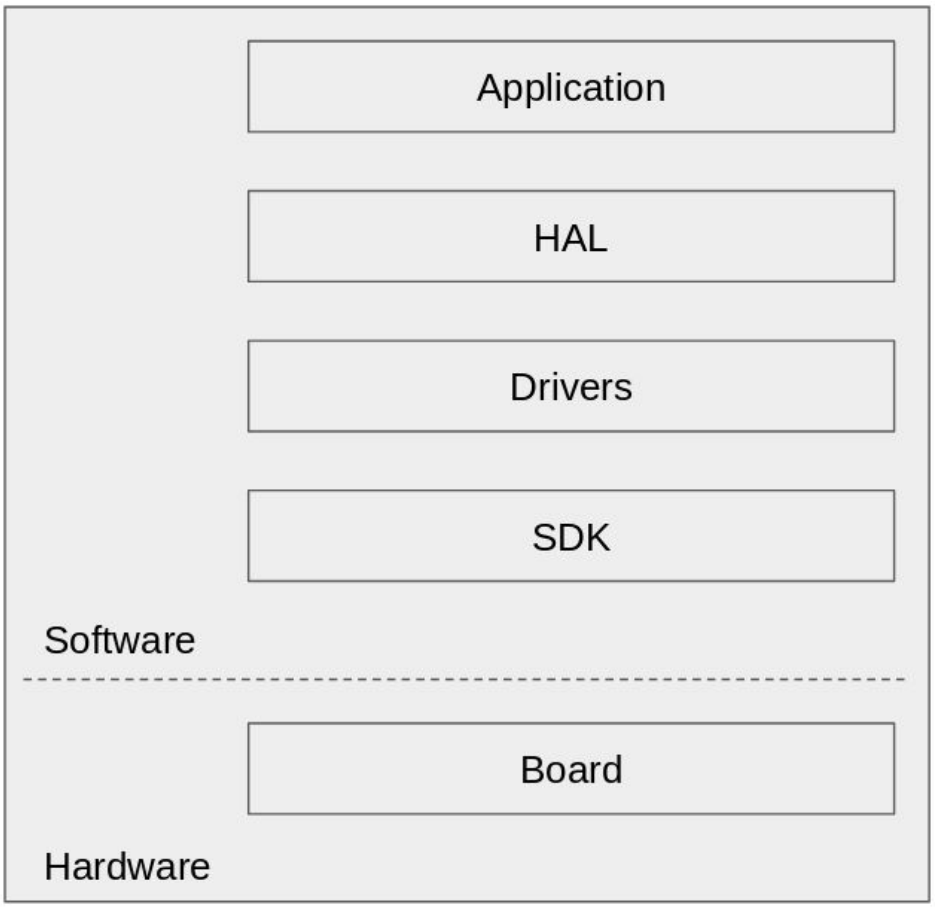
```
# Name, Type, SubType, Offset, Size, Flags
otadata,data,ota,0xd000,8K,
phy_init,data,phy,0xf000,4K,
factory,app,factory,0x10000,1M,
ota_0,app,ota_0,0x110000,1M,
ota_1,app,ota_1,0x210000,1M,
nvs,data,nvs,0x315000,500K,
```

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

6.2) The architecture

The software is architectured as follows:



6.2.1) The espressif SDK

The SDK used is the SDK-IDF on the v2.1 branch available on github at (https://github.com/espressif/esp-idf). This is the official development system of the ESP32 chip.

6.2.2) The drivers

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

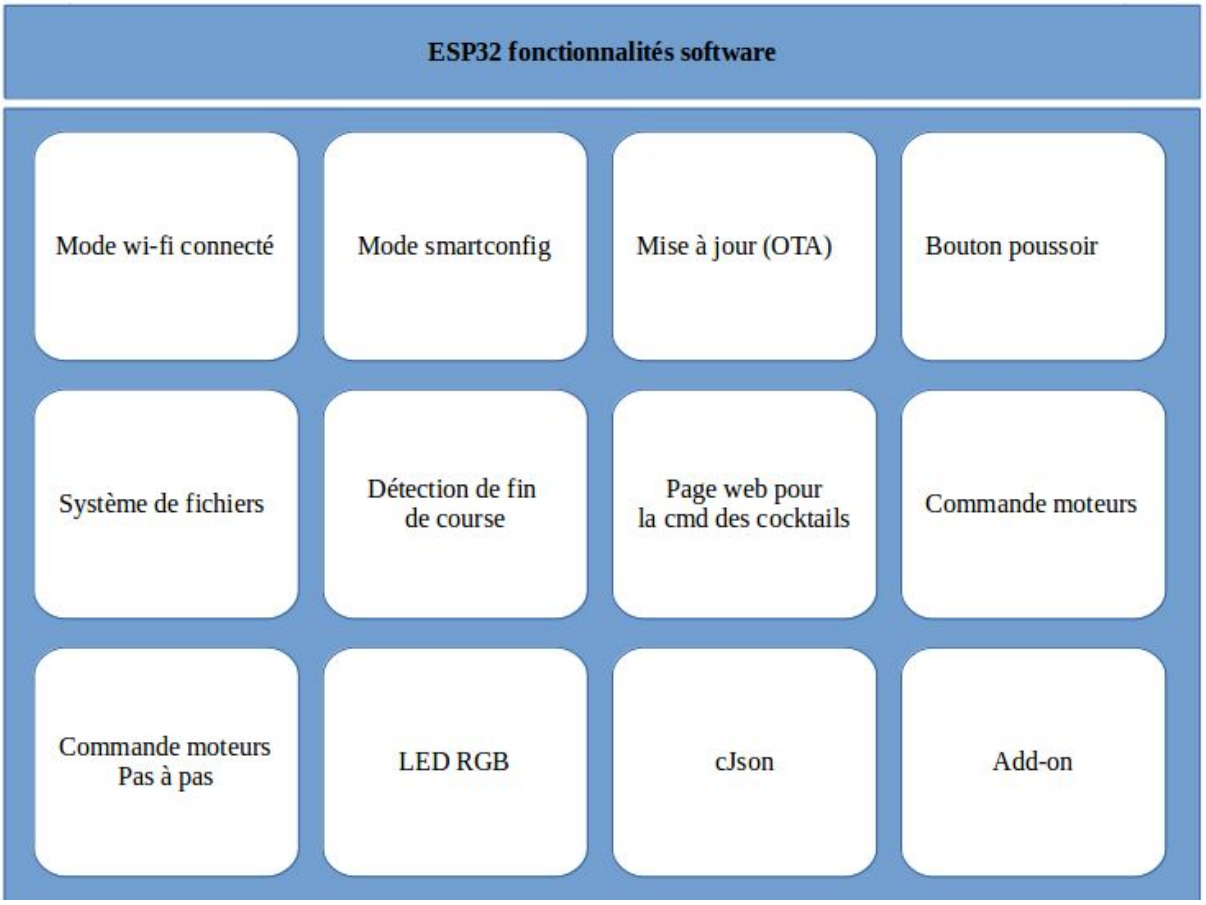
6.2.3) The HAL and OSAL

HAL ans OSAL allows simple porting of cocktail machines to another SDK, OS, or hardware platform.

6.2.4) the application

The application proposes the web page and the management of cocktails.

6.3) The features of the software



6.3.1) Wi-Fi connected mode

Connect to an internet box with WEP, WPA-PSK [TKIP], WPA2-PSK [AES] or WPA-PSK [TKIP] + WPA2-PSK [AES] security.
The function Esp32wifi_init allows you to set the wi-fi for your country and fill the structure "wifi_config_t" with your SSID and password.

```
wifi_init_config_t cfg = WIFI_INIT_CONFIG_DEFAULT();
ESP_ERROR_CHECK(esp_wifi_init(&cfg));
ESP_ERROR_CHECK(esp_wifi_set_storage(WIFI_STORAGE_RAM));
ESP_ERROR_CHECK(esp_wifi_set_mode(WIFI_MODE_STA));
wifi_config_t sta_config = Esp32Wifi_getSSIDAndPass();
ESP_ERROR_CHECK(esp_wifi_set_config(WIFI_IF_STA, &sta_config));
ESP_ERROR_CHECK(esp_wifi_set_country(WIFI_COUNTRY_EU));
ESP_ERROR_CHECK(esp_wifi_start());
```

The Esp32_init function is used to configure an ip static on the wroom32. If your network is not 192.168.1.x with a mask in 255.255.255.0 you must modify the code below.

```
tcpip_adapter_init();
ESP_ERROR_CHECK(tcpip_adapter_dhcpc_stop(TCPIP_ADAPTER_IF_STA));
```

```
tcpip_adapter_ip_info_t info = { 0,};
IP4_ADDR(&info.ip, 192, 168, 1, 51);
IP4_ADDR(&info.gw, 192, 168, 1, 1);
IP4_ADDR(&info.netmask, 255, 255, 255, 0);
ESP_ERROR_CHECK(tcpip_adapter_set_ip_info(TCPIP_ADAPTER_IF_STA, &info))
```

6.3.2) smartconfig mode

Allows sending the SSID and password in wi-fi broadcast. When the system has finished smartconfig the task Esp32SmartConfig_task saves the information in memory.

```
if((this->pass != NULL) && (this->ssid != NULL))
{
    Wifi_saveSSIDAndPass(this->ssid, this->pass);
    OsFree(this->ssid);
    OsFree(this->pass);
}
```

If the backup file exists then the smartconfig is disabled. You can see Esp32SmartConfig.c for more informations.

I choose the smatconfig mode instead of blufi (bluetooth wifi config connection to ap) because there is no example of smartphone application for Ios. While there are Andoid and Ios example apps for smartconfig mode.

6.3.3) Update (OTA)

Allows updating via wifi. To start the OTA functionality I used the cocktail machine web page. When you click on the Update button, the system reboot and start the update task. I have integrate the example of "classycodeoss" for the update function. We need of 3 functions, Esp32Ota_begin, Esp32Ota_writeHexData, and Esp32Ota_end.

```
        char * update = Fs_read("Update", "Update");
        if (update != NULL)
        {
          BarDebug_info("LED GREEN\n");
          LedRGBHandling_ExecuteLedTaskFromISR(GREEN_LED);
          Fs_delete("Update", "Update");
          OsFree(update);
          Ota_InitTask();
        }
```

6.3.4) Push button

Allows you to delete the SSID and wifi password. The button is managed by an OS task (Idel, rising edge and falling edge).

```
typedef enum eButtonMode_t
{
  IDLE_BUTTON,
```

```
  RISING_BUTTON,
  FALLING_BUTTON
} eButtonMode_t;
```

6.3.5) File system

Lets you read or write data to a file system. Example for the SSID and password wi-fi.

```
if(Fs_write(SSID_WIFI_FILE, ssid, SSID_WIFI_FILE) != ESP_OK)
{
        BarDebug_err("Error to save SSID\n");
}

if(Fs_write(PASSWORD_WIFI_FILE, password, PASSWORD_WIFI_FILE) != ESP_OK)
{
        BarDebug_err("Error to save password\n");
}
```

6.3.6) End-of-run detection

Allows you to initialize the system using the "MotorHandling_setInitialPosition" function. This function is called at startup and at each cocktail request.

```
  uint32_t bp1[1], bp2[1];
  BarDebug_info("Set motor at the initial position on y...\n");
  Gpio_get(DETECTION_AXE_Y, bp2);
  BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_Y_DIR, BAR_LEVEL_HIGH));
  int end = MOTOR_LIMIT;
  while(bp2[0] && (end != 0))
  {
        Gpio_get(DETECTION_AXE_Y, bp2);
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_Y_CLK, BAR_LEVEL_LOW));
        CpuDelay_ms(1);
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_Y_CLK, BAR_LEVEL_HIGH));
        CpuDelay_ms(1);
        end--;
  }
  BarDebug_info("Motor is now at the initial position on y.\n");
  BarDebug_info("Set motor at the initial position on x...\n");
  Gpio_get(DETECTION_AXE_X, bp1);
  BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_DIR, BAR_LEVEL_HIGH));
  while(bp1[0])
  {
        Gpio_get(DETECTION_AXE_X, bp1);
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_CLK, BAR_LEVEL_LOW));
        CpuDelay_ms(1);
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_CLK, BAR_LEVEL_HIGH));
        CpuDelay_ms(1);
  }
```

```
BarDebug_info("Motor is now at the initial position on x.\n");
```

6.3.7) Web page for the cmd cocktails

Allows you to order a cocktail. Once the system connected to the wi-fi network is called "Cocktail_init" and "QueueCocktail_init".
The "Cocktail" task will retrieve the JSON information to save it in RAM in the structures below:

```
typedef struct
{
  char name[MAX_NAME_SIZE];
  char note[MAX_NOTE_SIZE_FOR_BOTTLE];
  int position;
} sBottle;

typedef struct
{
  char name[MAX_NAME_SIZE];
  int measure;
} sIngredient;

typedef struct cocktail
{
  char name[MAX_NAME_SIZE];
  sIngredient ingredient[MAX_INGREDIENT];
} sCocktail;

sCocktail cocktail[MAX_COCKTAIL];
sBottle bottle[MAX_BOTTLE];
```

When the "Cocktail" task has finished retrieving the information we call "Html_init". Who will create the HTML web page.

```
  html_indexBegin(http_index_hml);
  html_indexTitle(http_index_hml);
  html_tabBegin(http_index_hml);
  html_tabColumnBegin(http_index_hml, "Selection");
  html_tabColumnMiddle(http_index_hml, "Ajouter");
  html_tabColumnEnd(http_index_hml, "Fourni");
  Cocktail_createHtmlCodeForCocktails(http_index_hml);
  html_tabEnd(http_index_hml);
  html_indexEnd(http_index_hml);
```

The function "Cocktail_createHtmlCodeForCocktails" will sort the available ingredients according to the bottles on the cocktail machine. This allows you to tell the user which ingredients are unavailable.

```
for(i = 0; i < MAX_COCKTAIL; i++)
{
```

```
 for(j = 0; j < MAX_INGREDIENT; j++)
 {
    if(cocktail[i].ingredient[j].name[0] != '\0')
    {
      if(Cocktail_isBottleExiste(cocktail[i].ingredient[j].name))
      {
...
```

The "QueueCocktail_receivedTask" task is called when a user selects a cocktail on the web page. If we ask for three cocktails then they will be put on the waiting list. The variable "goToPosition" and "currentPosition" make it possible to calculate the future position of the tray according to the current state.

```
OsQueueReceive(pCtx->xQueueCocktailEventQueue, &QueueCocktail,
OsPortTimingPeriod);
LedRGBHandling_ExecuteLedTaskFromISR(BLUE_LED_FAST_BLINKING);
MotorHandling_setInitialPosition();
int nbIngredients = Cocktail_getDispoIngredients(bottleList.bottle, bottleList.position,
bottleList.measure, QueueCocktail);
int goToPosition = 0;
int currentPosition = 0;
for(int i = 0; i < nbIngredients; i++)
{
        if(currentPosition != bottleList.position[i])
        {
                goToPosition = bottleList.position[i] - currentPosition;
                MotorHandling_setPositionOnX(goToPosition);
                currentPosition += goToPosition;
                CpuDelay_ms(500);
        }
        if(currentPosition != 0)
        {
                MotorHandling_getAMeasureOnY(bottleList.measure[i]);
        }
        else
        {
                MotorHandling_getAMeasureOnPump(bottleList.measure[i]);
        }

}
MotorHandling_setInitialPosition();
LedRGBHandling_ExecuteLedTaskFromISR(BLUE_LED);
```

6.3.8) Motor control

Used to control a DC motor in position 0. For the moment only one motor is possible.

```
 BAR_ERROR_CHECK(Gpio_set(MOTOR_PUMP_1, BAR_LEVEL_HIGH));
 for(int j = 0; j < measure; j++)
```

```
{
        CpuDelay_ms(1000);
}
BAR_ERROR_CHECK(Gpio_set(MOTOR_PUMP_1, BAR_LEVEL_LOW));
```

6.3.9) Step motor control

Controls the X and Y axes and their senses. Below is an example for the X axis. The "MOTOR_OFFSET" allows to advance the plate of 10cm (distance between each bottle). "MOTOR_OFFSET" is calculated according to the degree of a step and the perimeter of the pulley.

```
if(position > 0)
{
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_DIR, BAR_LEVEL_LOW));
        end = position * MOTOR_OFFSET;
}
else
{
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_DIR, BAR_LEVEL_HIGH));
        end = (position * (-1)) * MOTOR_OFFSET;
}

for(int i = 0; i < end; i++)
{
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_CLK, BAR_LEVEL_LOW));
        CpuDelay_ms(1);
        BAR_ERROR_CHECK(Gpio_set(MOTOR_AXE_X_CLK, BAR_LEVEL_HIGH));
        CpuDelay_ms(1);
}
```

6.3.10) RGB LED

Used to control the color of the LED to inform the user. This is a task that manages the timing of the flashing. The variable "enableLed" allows to enable or disable the LED. The variable "queueReceiveDelay" is used to manage the flashing speed in milliseconds.

```
OsQueueReceive(tsQueueForLed, &eAsyncMsg, queueReceiveDelay);
eAsyncCurrent = eAsyncMsg;

if(IDEL_LED == eAsyncMsg)
{
        LedRGBGpioDriver_SetColor(LED_NOT_DEFINED);
}
else if((BLUE_LED_FAST_BLINKING | enableLed) == eAsyncMsg)
{
        queueReceiveDelay = BLINK_FAST;
        if(!LedRGBGpioDriver_ToggleColor(LED_BLUE))
        {
                BarDebug_info("LED NOT DEFINED");
        }
```

```
}
...
```

6.3.11) cJson

Allows to recover the fields of JSON thanks to the cJon library. Here is an example to retrieve information from a bottle.

```
cJSON * _name = cJSON_GetObjectItem(_bottle, "name");
if(_name != NULL)
{
	cJSON * _note = cJSON_GetObjectItem(_bottle, "note");
	if(_note != NULL)
	{
		cJSON * _position = cJSON_GetObjectItem(_bottle, "position");
		if(_position != NULL)
		{
		memcpy(bottle[i].name, _name->valuestring, strlen(_name->valuestring));
		memcpy(bottle[i].note, _note->valuestring, strlen(_note->valuestring));
		bottle[i].position = (int) _position->valuedouble;
...
```

6.3.12) mDNS hostname

Allows access to the web page without the ip address. Example: http://mybar.local/ instead of http://192.168.1.51. It works on my PC but not on my phone.

```
mdns_server_t * mdns = NULL;
mdns_init(TCPIP_ADAPTER_IF_STA, &mdns);
ESP_ERROR_CHECK( mdns_set_hostname(mdns, "mybar") );
ESP_ERROR_CHECK( mdns_set_instance(mdns, "mybar") );
ESP_ERROR_CHECK( mdns_service_add(mdns, "_http", "_tcp", 80) );
ESP_ERROR_CHECK( mdns_service_instance_set(mdns, "_http", "_tcp", "mybar") );
```

You can also ping the cocktail machine with:

```
$ ping mybar.local
PING mybar.local (192.168.1.51) 56(84) bytes of data.
64 bytes from 192.168.1.51: icmp_seq=1 ttl=255 time=5.07 ms
64 bytes from 192.168.1.51: icmp_seq=2 ttl=255 time=2.76 ms
```

6.3.13) Voice assistant (Alexa, Google Home, ...)

To add a compatibility between the connected cocktail machine and a voice assistant we have lot of possibility. The most simple is to use IFTTT (If This Then That) to send a curl request to the ESP32 with "webhooks". For that we need to configure NAT and dynDNS on the internet box, create an Applet on IFTTT and open a TCP socket on the ESP32.

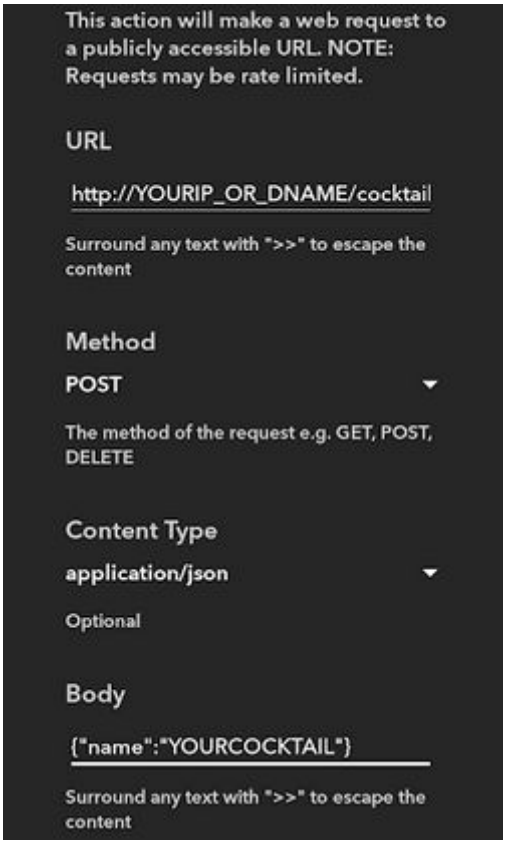
6.3.13.1) Configure NAT and dynDNS

we need to configure the NAT on our internet box to make a redirection on our public IP on our local IP. As our public IP is dynamic we use dynDNS as a DNS service to have a fixed domain name. All this configuration can be make on you internet box manager web page.

The domain name used is useful for the IFTTT trigger

6.3.13.2) Create an Applet on IFTTT

To create an applet on IFTTT with Google home, we have to create an account on "https://ifttt.com/". Click on "New applet". You will see (if "this" then "that"). Click on "this", select "Google assistant" and follow the instructions. After that click on “that”, select "Webhooks", and follow the instructions. Webhooks, allows to send a "curl request" on the cocktail machine



In my example I use "Google home", but you can make the same trigger with "Alexa", "Button widget", "location", "date & time", and more. Example with "Button widget" you can create a favorite cocktail widget on your desk phone.

6.3.13.3) Open a TCP socket on the ESP32

To open a TCP socket on the ESP32 I use "socket", "bind", "accept" functions. I use "read" and "write" functions for data communications. when I receive the "request post" send by IFTTT, I check if the cocktail name is available in the cocktail list and I answer the HTTP status code "HTTP/1.1 204" or "HTTP/1.1 400".

```
static const char HeadPostHttp[] = "HTTP/1.1 204 No Content\r\n\r\n";
static const char HeadPostHttpErr[] = "HTTP/1.1 400 Bad Request\r\n\r\n";
...
cJSON * _name = cJSON_GetObjectItem(_root, "name");
if(_name != NULL)
{
	int numCocktail = Cocktail_isCocktailExiste(_name->valuestring);

	if(numCocktail != 255)
	{
		write(sock, HeadPostHttp, strlen(HeadPostHttp));
		QueueCocktail_received(numCocktail);
	}
	else
	{
		write(sock, HeadPostHttpErr, strlen(HeadPostHttpErr));
	}
}
...
```

6.3.14) Add-on

Nothing yet.

6.4) The JSON

there are two JSONs in the project. The first allows to define the location of the bottles and the second the list is ingredient of the cocktails.

6.4.1) The JSON of the location of the bottles

The "bottles" table below is a bottle list with a name and a position. Te careful the position must exist physically on the cocktail machine. Position 0 is the initial position of the tray.

```
{
   "bottles": [{
                    "bottle": {
                                "name": "eau",
                                "note": "0%/vol",
                                "position": 0
```

```
                }
        }, {
                "bottle": {
                        "name": "jus de pomme",
                        "note": "0%/vol",
                        "position": 1
                }
        },
        ….
    }]
}
```

6.4.2) The JSON of the cocktail ingredient list.

The cocktail table below is a cocktail list. A cocktail must have a name and a table "ingredients" which is an ingredient list. Each ingredient has a name (which is not necessarily available in the cocktail machine) and a "measure" which is the amount of liquid to serve (1 = 2ml, 2 = 4ml, ...).

```
{
   "cocktails": [{
                "cocktail": {
                        "name": "Virgin mojito",
                        "ingredients": [{
                                        "ingredient": {
                                                "name": "sirop de mojito",
                                                "measure": 2
                                        }
                                }, {
                                        "ingredient": {
                                                "name": "menthe verte",
                                                "measure": 1
                                        }
                                }, {
                                        "ingredient": {
                                                "name": "jus de citron",
                                                "measure": 1
                                        }
                                }, {
                                        "ingredient": {
                                                "name": "sucre de canne",
                                                "measure": 1
                                        }
                                }, {
                                        "ingredient": {
                                                "name": "eau gazeuse",
                                                "measure": 2
                                        }
                                },
```

```
                                {
                                        "ingredient": {
                                                "name": "glace pilee",
                                                "measure": 1
                                        }
                                }
                        ]
                }
        }, {
        ....
    }]
}
```

When displaying a cocktail on the web page you can see two columns. A column for the ingredients available in the machine and a column for the ingredients to be added manually.

6.5) The web page

Yes but why a web page and not a mobile application? The answer is simple, because it is compatible on all smartphones and PCs.

The web page is accessible at the IP address http://mybar.local/ or http://192.168.1.51 of your network. This is HTML and CSS code generated by the C code of wroom32. When the module starts, the software cycles through the JSON "bottles" and "cocktails" to create a dynamic HTML table with three columns and N line(s). In column one, we have the CSS buttons with the name of the cocktail (available in the JSON). In column two we have the ingredient(s) to add manually (not available in bottle list). In column three we have the ingredient (s) available in the cocktail machine (available in bottle list).

6.5.1) The CSS

In the CSS we have buttons, the font, the background color …

```
<style>
h1 {
color: white;
text-align: center;
}
p {
font-family: verdana;
font-size: 20px;
}
body {
background-color: lightblue;
}
table
{
border-collapse: collapse;
}
td
```

```
{
border: 1px solid black;
}
.button {
 width:85px;
 height:85px;
 background:#fafafa;
 box-shadow:2px 2px 8px #aaa;
 font:bold 13px Arial;
 border-radius:50%;
 color:#555;
}
</style>
```

6.5.1) HTML

In the first line of the HTML code is the title and a link to an image. This line allows, when we add the shortcut of the web page on a smartphone to have a nice shortcut with a name and logo.

<title>Connected bar</title><link href="https://www.bodipure.com/wp-content/uploads/2016/09/B-favicon.png" rel="icon" type="image/x-icon" />	

The rest of the HTML code is the three-column table. Here is an example below:

Welcome, on Quentin's bar!

Please select your shooter or cocktail:

Selection	Ajouter	Fourni
	menthe verte, jus de citron, sucre de canne, eau gazeuse, glace pilee,	rhum blanc,
	jus de citron,	rhum blanc, sirop de sucre,

7) Mechanics

7.1) The wood

I bought wood and metal brackets at a hardware store. You need a drill, a circular saw, and a screwdriver.

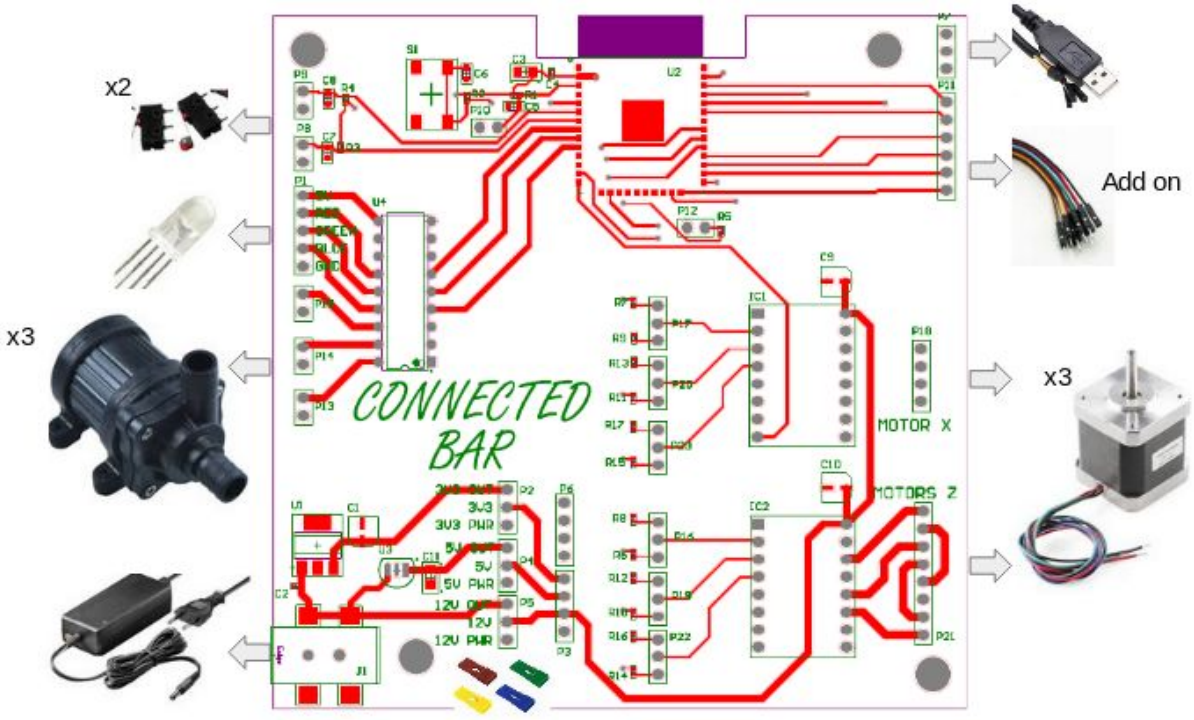
7.2) The tray

You can easily make yourself the mechanical tray, however to avoid spending too much time on the realization of this mechanical part I use the 3D plans propose by "DIY Machines" (https://www.thingiverse.com/thing: 2478890/zip).

8) Getting started and functioning

You have to clone the git repository: https://github.com/Mras2an/cocktail-machine

8.1) Hardware connection



8.2) Configure the software

After soldering your card and building the mechanical part of the system you have to configure some parameters.

1 - Board.h

Used to define the GPIO mapping of the system. Example for the RGB LED:

```
#define LED_GPIO_RED            BAR_GPIO_NUM_32
#define LED_GPIO_GREEN          BAR_GPIO_NUM_33
#define LED_GPIO_BLUE           BAR_GPIO_NUM_25
...
```

1 - the motors

you have to modify the "#define" of Motor.c to calibrate the number of steps according to the mechanics of the cocktail machine.

2 - The JSON

You have to bring in your bottles and create your cocktail.

8.3) Compile and program the code

1 - In a GNU / Linux terminal do an export of the SDK and the toolchain.

```
$ export IDF_PATH=/YOUR_PATH/esp-idf
$ export PATH=$PATH:/YOUR_PATH/xtensa-esp32-elf/bin/
```

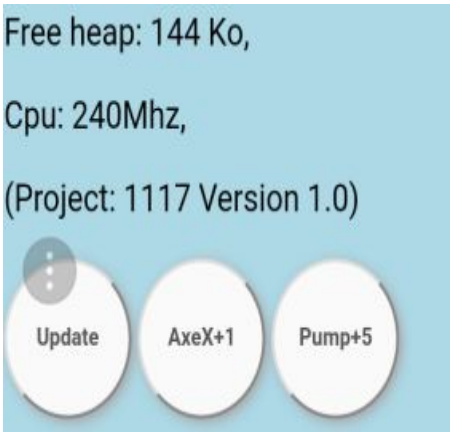
2 - In the project make a "make"

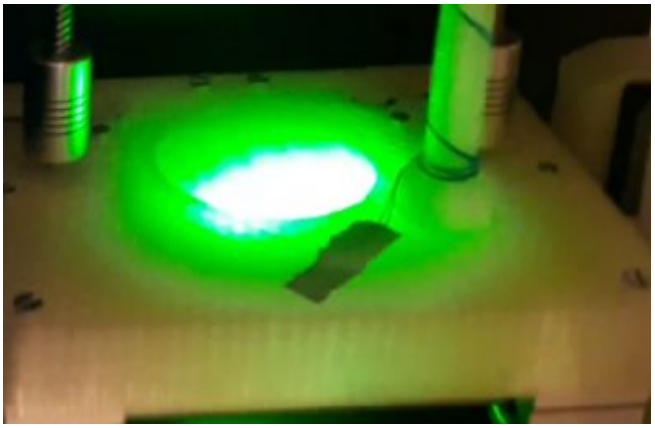
3 - Connect the card with the jumper Boot. Then use the espressif flashing software.

```
$ python /esptool.py --chip esp32 --port /dev/ttyUSB0 --baud 115200 --before
default_reset --after hard_reset write_flash -z --flash_mode dio --flash_freq 40m
--flash_size detect 0x1000 bootloader.bin 0x10000 cocktail-machine.bin 0x8000
customPart.bin
```

4 - Now you can use OTA functionality to update your system (you have to be connected to your home wi-fi). For that go to the web page (http://mybar.local/ or http://192.168.1.51) and click on the button "Update" at the end of the page (the LED is green). Go to utils file and execute the command follow:

```
$  python update_firmware.py 192.168.1.51 cocktail-machine.bin
```

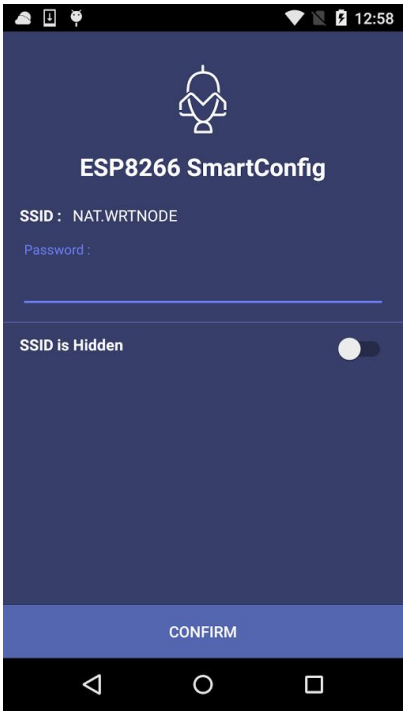




8.4) First boot

1 - At start-up the LED is red, the Y-axis searches for the end position, then the X-axis searches for the end position. Once the system is initialized the LED goes blue.

2 - When you start the system for the first time, connect the system to your Wi-Fi box. To do this download the application "ESP8266 SmartConfig" on your phone's awning. Connect your phone to your wifi, and launch the espressif application. You just have to enter your wifi password and click on "confirm". The module will save in flash your SSID and password. Once saved the smartconfig mode will be disabled at startup.



3 - Go to http://mybar.local/ or http://192.168.1.51 and choose your cocktail.

4 - Enjoy :-)

8.4) Video

You can watch videos on my youtube channel:
https://www.youtube.com/watch?v=C-QNyAYlRnY
https://www.youtube.com/watch?v=Tx3ExhTUp6A&t
https://www.youtube.com/watch?v=QJvKOMsrSR0

8.5) Hygiene of the cocktail machine

For good hygiene, remember to clean the machine after each bottle switch.

9) The future of the project

The version presented is the version 1. Many things remain to be modified and added

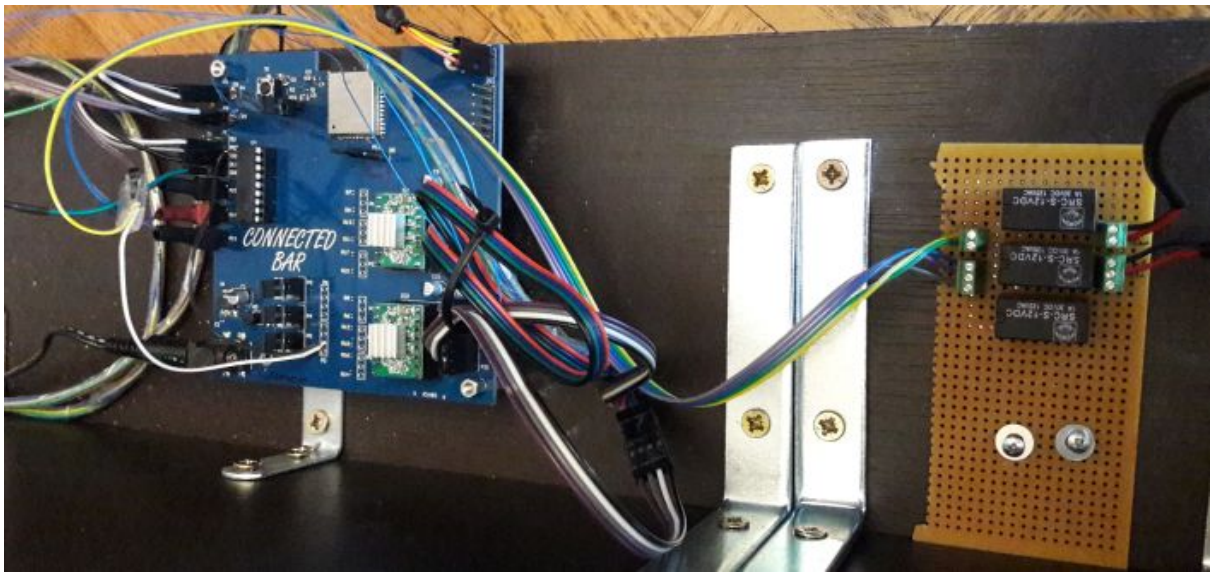
9.1) Modify

- Be careful, on my board (PCB) I switch the 5v in 12v on the ULN2803 but you can use the 5 volts if you want.

9.2) Add

- Detection of the glass.

10) Pictures


CONNECTED
BAR