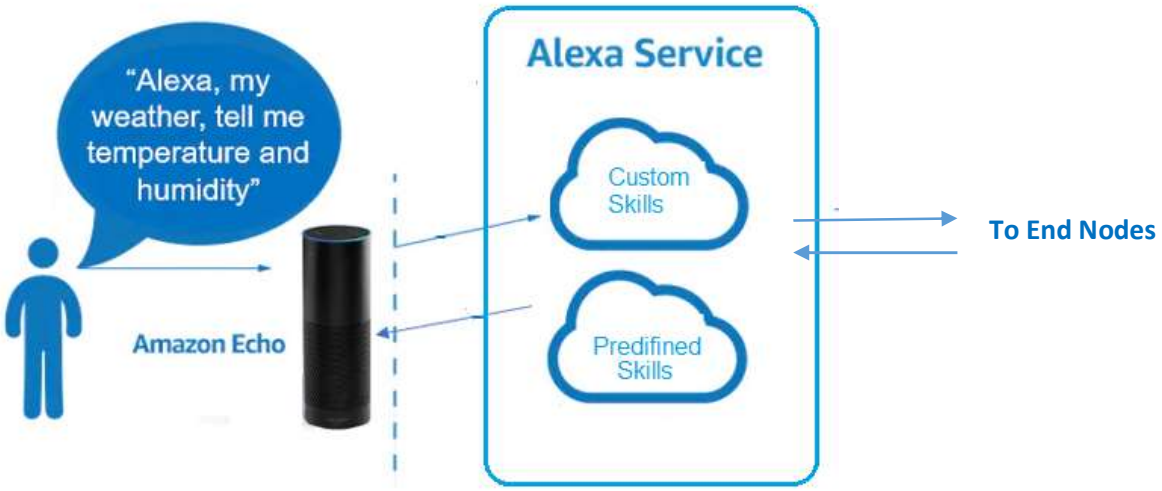
Voice Controlled Smart Devices with Amazon Alexa & AWS Lambda – part 1

1- Alexa Service & Alexa Skills

The Alexa Voice Service (AVS) allows developers to enable voice interactions on connected products.



A user, with an Alexa Service Account, can host many Skills. These skills can be predefined (Home Automation skill, Movies Skill, etc..) or Custom skills, developed by the user.

Skills are like apps that help to define interaction between user (speech) and a device.

A skill is ***triggered*** by an "**Skill Invocation name**".

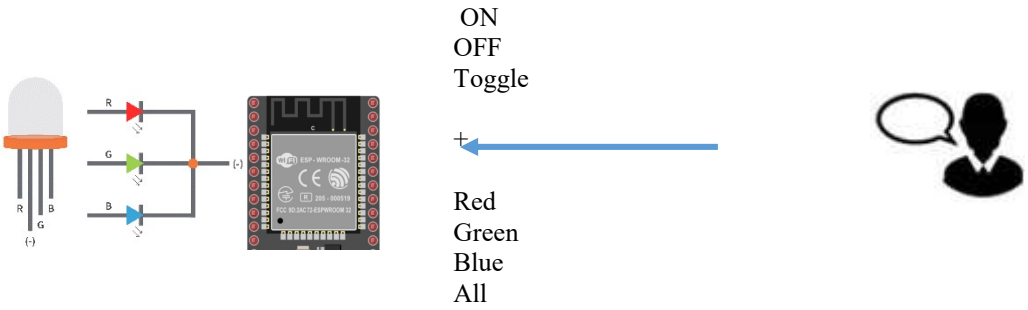
A Skill is composed of a set on **Intents**, each **Intent** represents an action that fulfills a user's spoken request. For example, in a Home Automation Skill, an Intent can be used to control the home lights, another to control the alarm system, another for the TV, etc.

For each Intent, we define a set of likely spoken phrases that include as many representative phrases as possible: **sample utterances**.

Each Utterance (of an Intent) contains generally one or many **Slots**. Each Slot can have a value among a set of values (Slot Type). These values are the words that define the instruction sent to the device.

2- System Description

In this project, a Smart Device is controlled through Voice commands. More precisely, an RGB Led (Connected to an SoC such as ESP32) is controlled in such a way to **turn on**, **turn off** or **toggle** one or all of the **3 Leds** (Red, Blue and Green).



Obviously, this example could be applied to any application controlling Lights in a home. Just the words (Red, Green, Blue) will be replaced by appropriate words (bedroom light for example, etc..)

3- Solution Architecture

The Alexa voice control solution is composed of:

- **The Alexa echo dot** (optional) : it processes the spoken sentence and sends it to the Amazon Alexa Service.
- Three "Cloud Hosted Services". The Amazon Alexa Service, the AWS Lambda Service and A MQTT Broker.

- **The amazon Alexa Service**: It identifies the Skill to be triggered, detects the Intent and the slots contained in the spoken sentence (after processing by Alexa).

When an Intent is detected, the Amazon Alexa Service builds a JSON formatted data and sends it to a web service endpoint to handle the skill request. In case of a sentence containing the words (slot values) green and on, the json data has the following format

The AWS Lambda Service:

AWS Lambda is a serverless compute service that runs your code in response to events and automatically manages the underlying compute resources for you. These events may include changes in state or an update.

In this example, a Lambda Function (Node JS) will be deployed : it receives the JSON formatted data and publishes mqtt messages to a MQTT Broker.

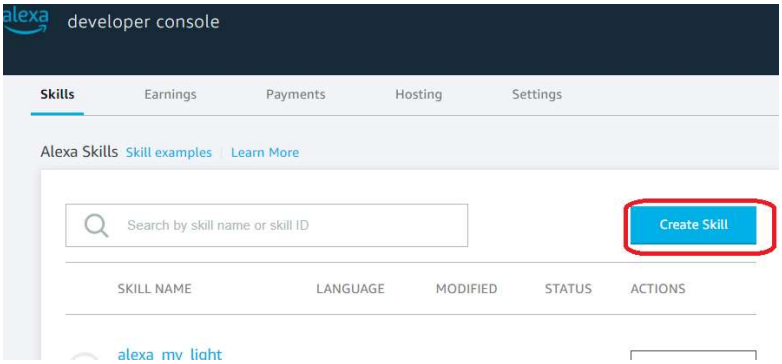
The MQTT Broker:

It receives the pusblished messages and sends them to the subscribed devices. In this case, the SoC that controls the RGB leds.

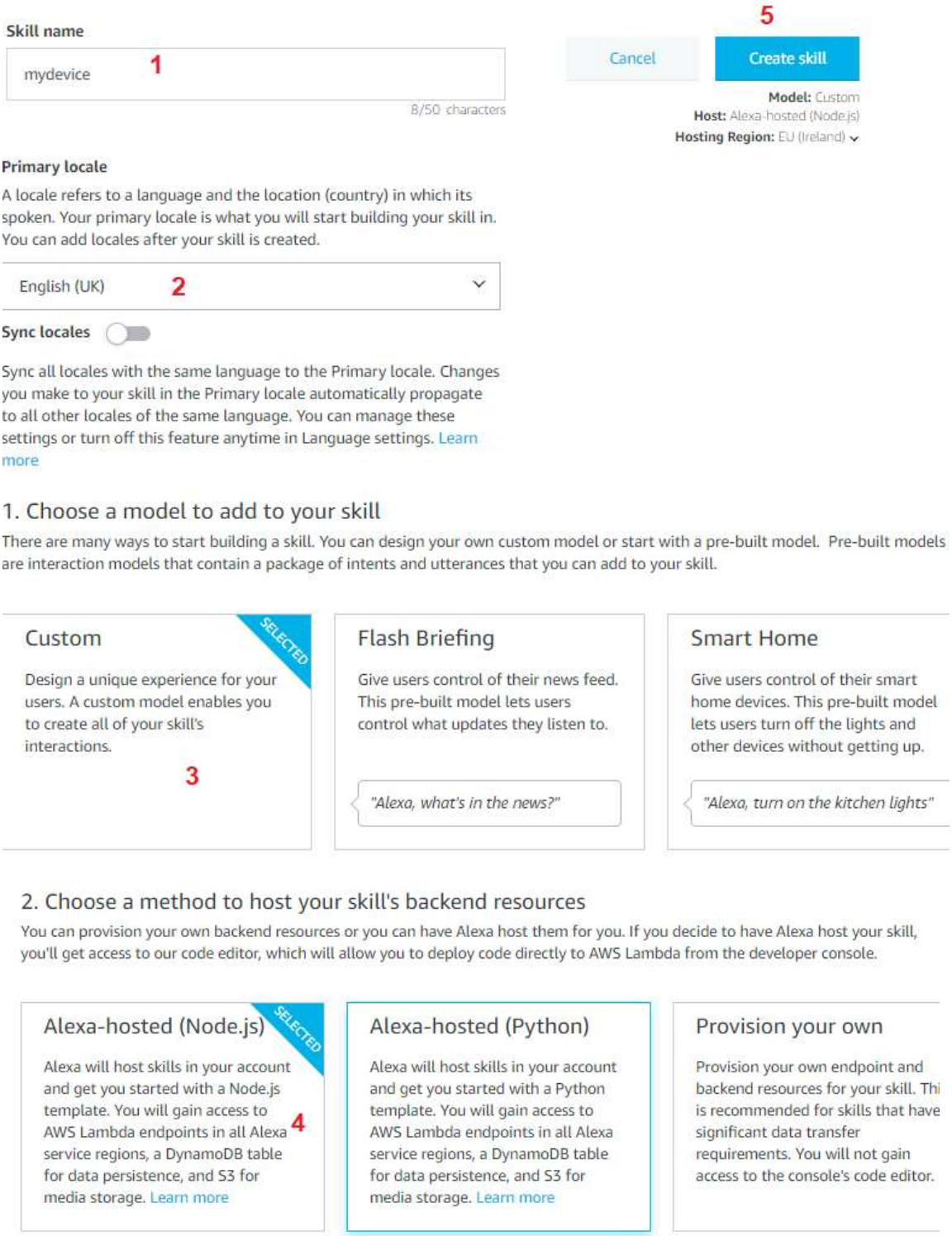
4- Solution Implementation on AWS

4-1 Skill creation

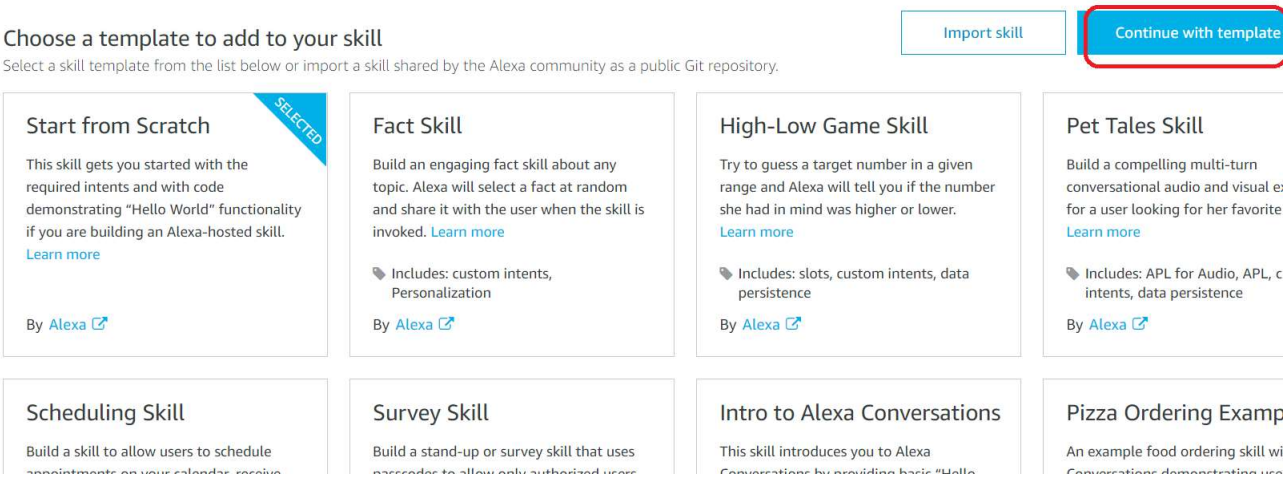
1- Create an Amazon Account to access Alexa Developer Console.
2- Click on Create Skill,



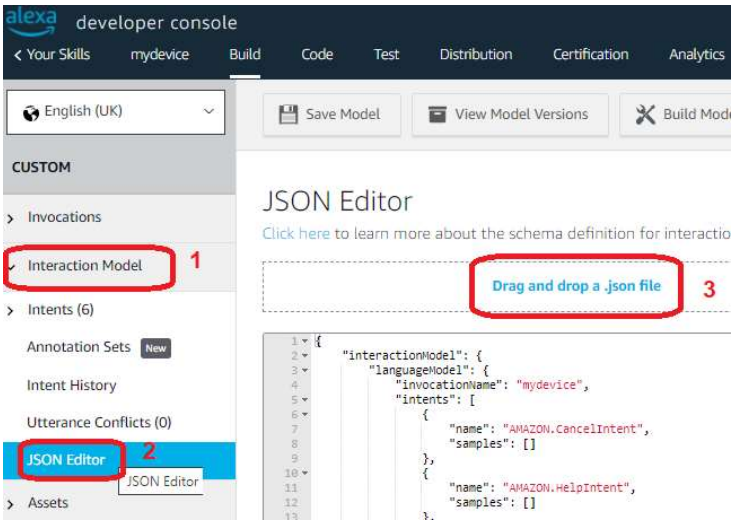
3- type the skill name , choose the language (English), the Model (Custom) and the programming language (NodeJS) and click **"Create Skill"**



4- Choose « Start From Scratch » and click on **Continue with template**.
In fact, there are an important number of existing skills (Home domotocs skill, movies skill, etc…) that can be used directly

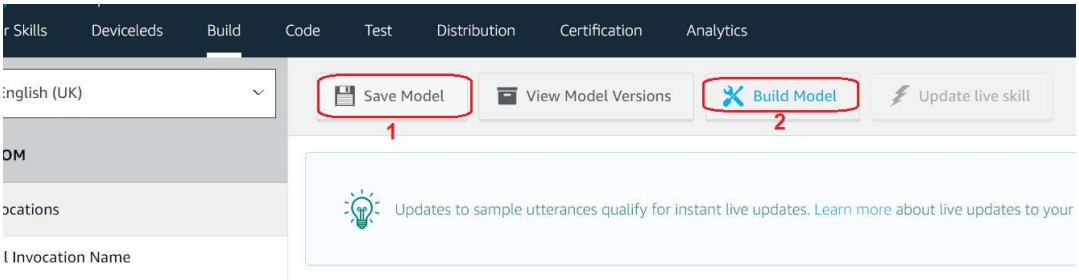


5- In the new Interface, expand the "Interaction Model" , click on "JSON Editor", "Drag and Drop a json file" and choose the file (skill_example.json attached).



If you want to develop the skill step by step, see Part2 (Alexa Skill Creation)

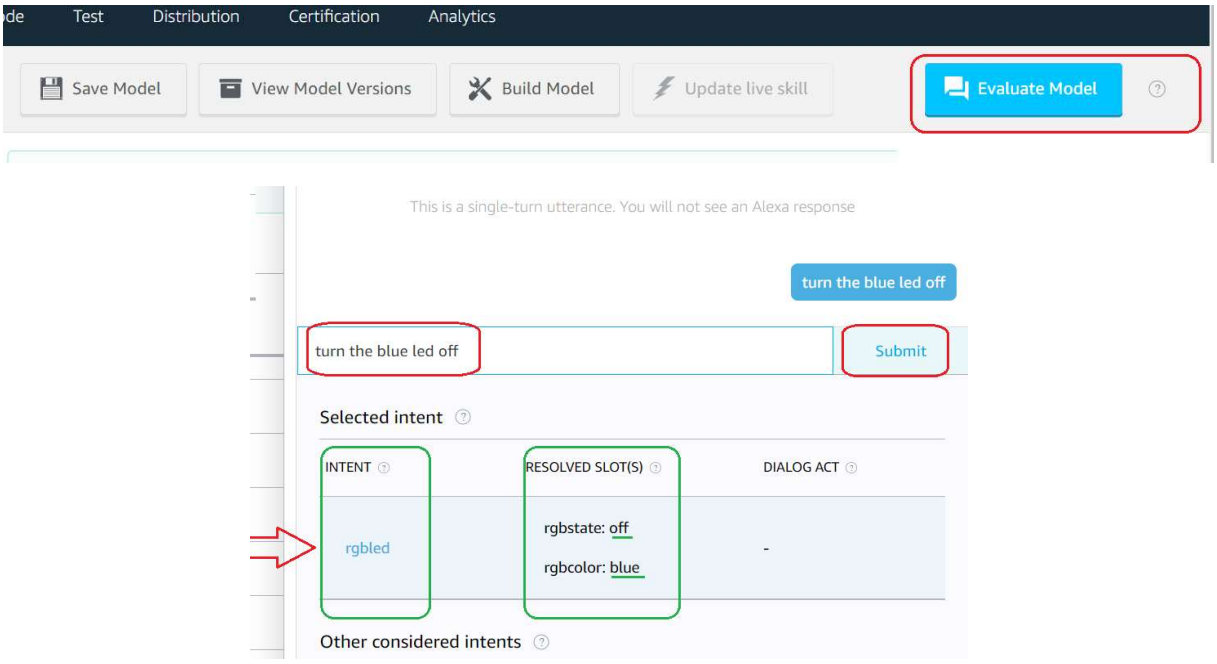
6- Save and build the model.



7- Now, it is possible to test if the built model is able to detect the slot values in one sentence (written then spoken).

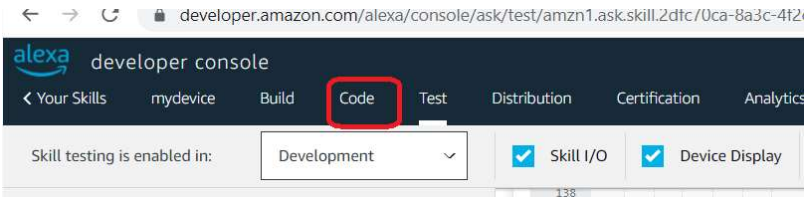
Click on Evaluate Model and write a sentence that contains 2 slot vales (one for color and one for control), and submit the sentence.

A result will be displayed and shows if the intent and the slot values are resolved.

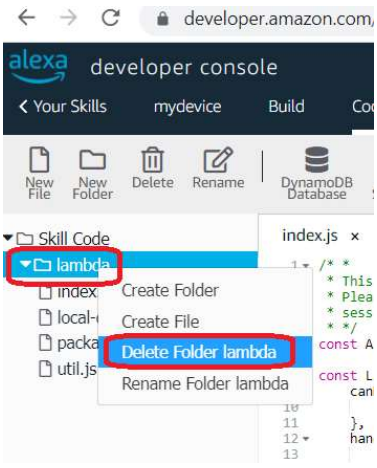


4-2 : Lambda Code

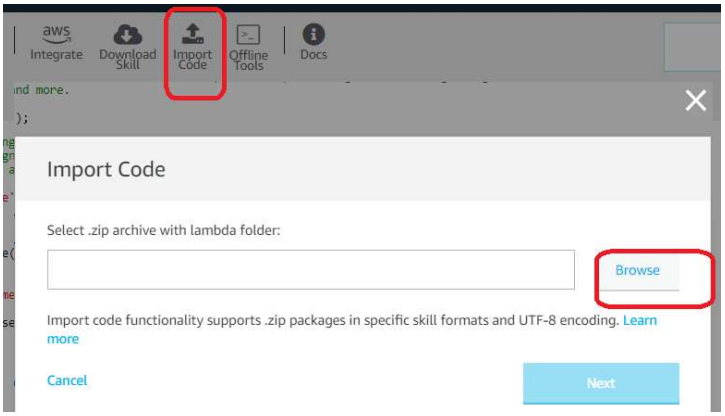
1- Switch to the code section



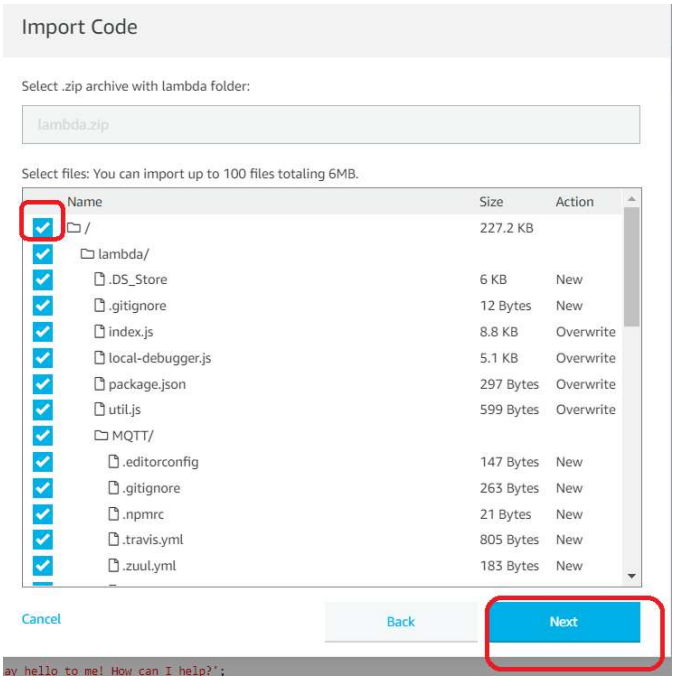
2- Delete the Lambda Folder



3- Click on Import Code, then browse and choose the attached lambda.zip file



4- Select all files and click next.

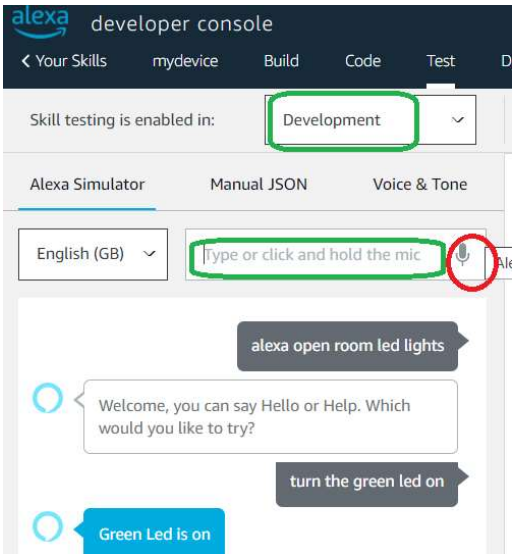


5- Save and deply the created Lambda code

6- Test the Lambda Function:

Enable Development testing mode and

- type the sentence that triggers the skill (alexa, open room led lights). Or click on the Mic and say it.
- then a sentence to turn on or off one of the leds. Or click on the mic and say it.
- Alexa will send vocal responses.



- Alexa publishes also mqtt messages to the topic iotdevice/action (the mqtt account used in TP). Normally the messages will be displayed in the MQTT Client application when it subscribes to the topic.

The sent mqtt messages contain 2 letters for the color:
GR for Green
RD for Red
BL for Blue
AL for All

And one letter for the instruction
N for ON
F for OFF
T for Toggle

So
ALN means All Leds ON
GRN measn Green Led ON
BLF means Blue Led OFF

Finally it is possible to test it with the ESP32 based Smart Device.