Introduction

In this how-to-guide, we will provide step-by-step instructions on creating a basic speech recognition program from a microphone connected to the BeagleBone Green running. It offers the ability to understand keywords from a user sufficiently well. This guide mainly uses pre-built libraries for speech recognition called Picovoice.

Required Hardware

- Beaglebone Green
- Headset Adapter to USB
- A microphone

Required Software

- ($Host) FileZilla
- ($Target) Picovoice
- ($Target) CMake

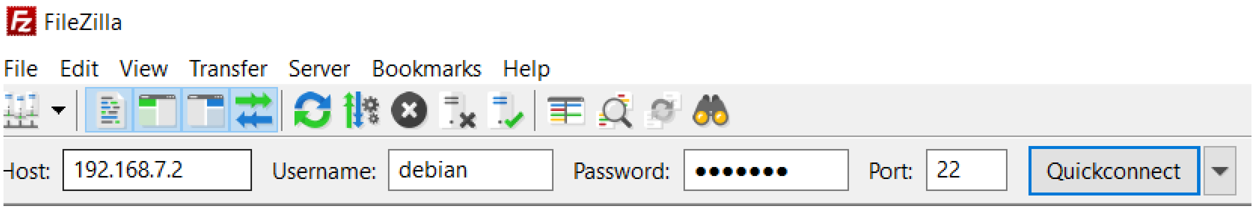
Setup:

1. Beaglebone Green (BBG)
    a. Connect the USB adapter to BBG
    b. Connect a microphone to the adapter jack
2. ($Host) Download FileZilla
3. ($Host) git clone --recurse-submodules https://github.com/Picovoice/picovoice.git
4. ($Target) sudo apt-get install cmake

Step 1:

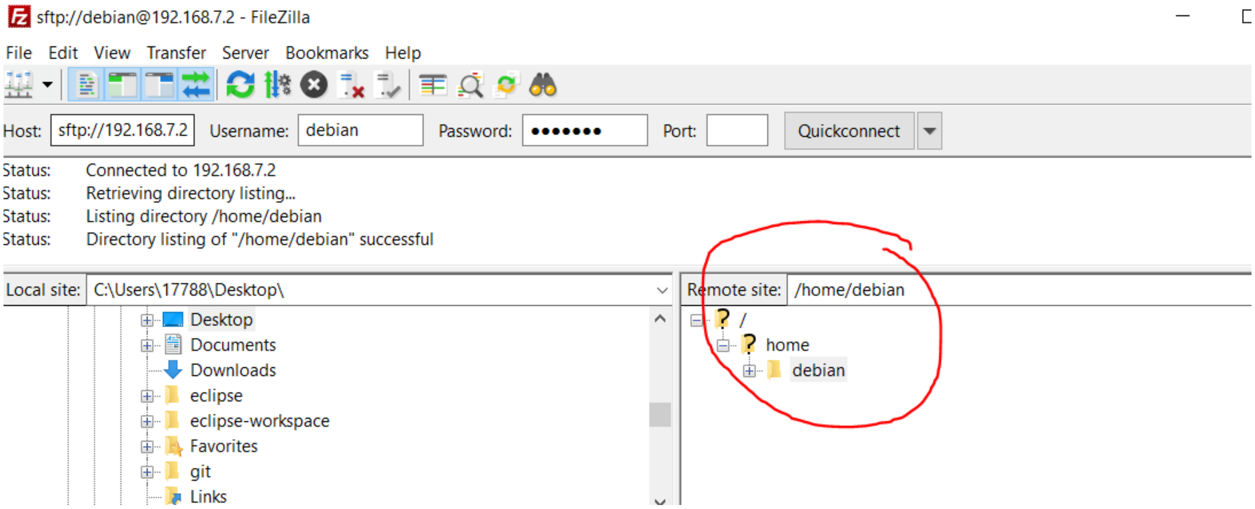
Moving file to BBG using FileZilla

- Open FileZilla
- Connect to BBG through FileZilla by entering Host, Username, Password, and Port then press Quickconnect as shown in the example below.



Host: 192.168.7.2 Username: debian Password: ••••••• Port: 22

- Once connected it should look something like the example below


sftp://debian@192.168.7.2 - FileZilla
File Edit View Transfer Server Bookmarks Help
Quickconnect

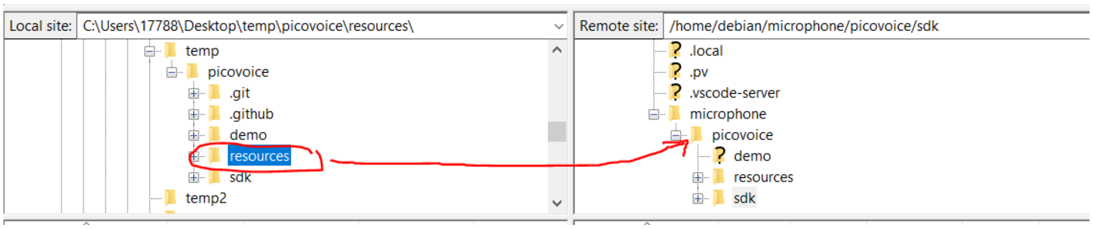
Host: sftp://192.168.7.2 Username: debian Password: ●●●●●●● Port:

```
Status:     Connected to 192.168.7.2
Status:     Retrieving directory listing...
Status:     Listing directory /home/debian
Status:     Directory listing of "/home/debian" successful
```

Local site: C:\Users\17788\Desktop\

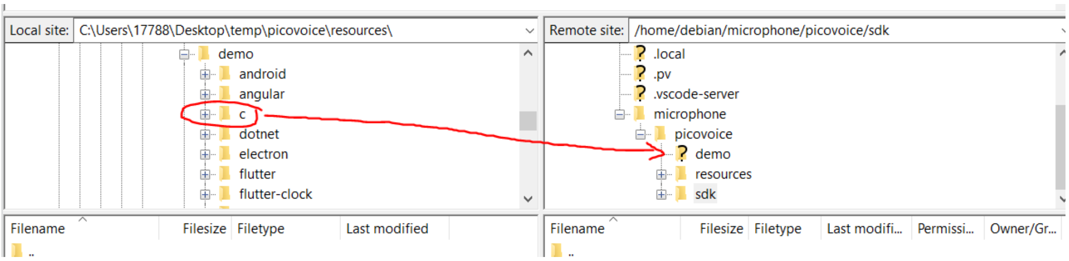
Remote site: /home/debian

- Note: for this guide, I will be only showing how to do it all in C
- ($Target) create a folder called “picovoice” (use the command mkdir to create a folder)
    - ($Target) cd picovoice and create more folders called “demo”, and “sdk”
- (In FileZilla) go to the git cloned folder and open picovoice folder
    - Drag ($Host side)resources to the newly created ($Target side) “picovoice” folder


Local site: C:\Users\17788\Desktop\temp\picovoice\resources\

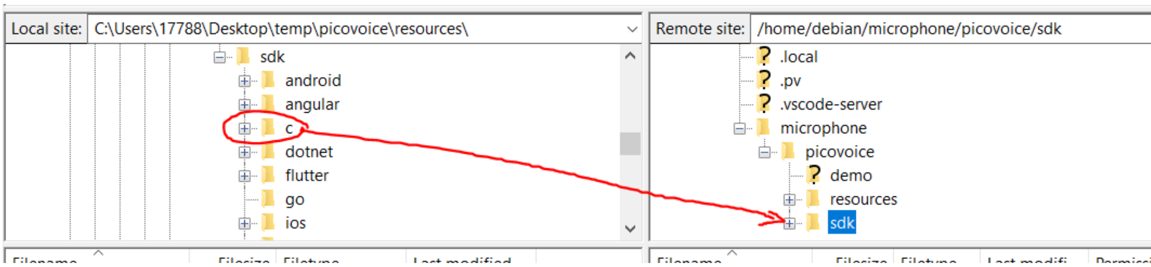
Remote site: /home/debian/microphone/picovoice/sdk

    - Go into “demo” on the Host side and drag the folder “C” into the newly created folder “demo” on the Target side as shown below


Local site: C:\Users\17788\Desktop\temp\picovoice\resources\

Remote site: /home/debian/microphone/picovoice/sdk

    - Go back into picovoice on the Host side and go into sdk on the Host side and drag C into the newly created folder “sdk” on the Target side as shown below



Local site: C:\Users\17788\Desktop\temp\picovoice\resources\

Remote site: /home/debian/microphone/picovoice/sdk

Step 2:

Building the microphone demo file

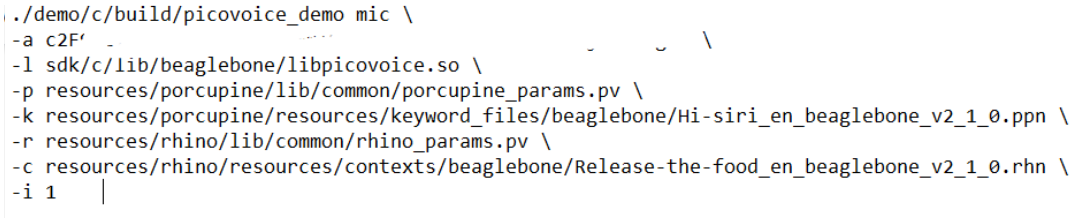
- ($Target) cd picovoice
- ($Target) run the command:

  -
    ```
    cmake -S demo/c/. -B demo/c/build && cmake --build demo/c/build --target picovoice_demo_mic
    ```
  - This build command will utilize the cmake file that is already in the cloned library from picovoice and build an executable file

Step 3:

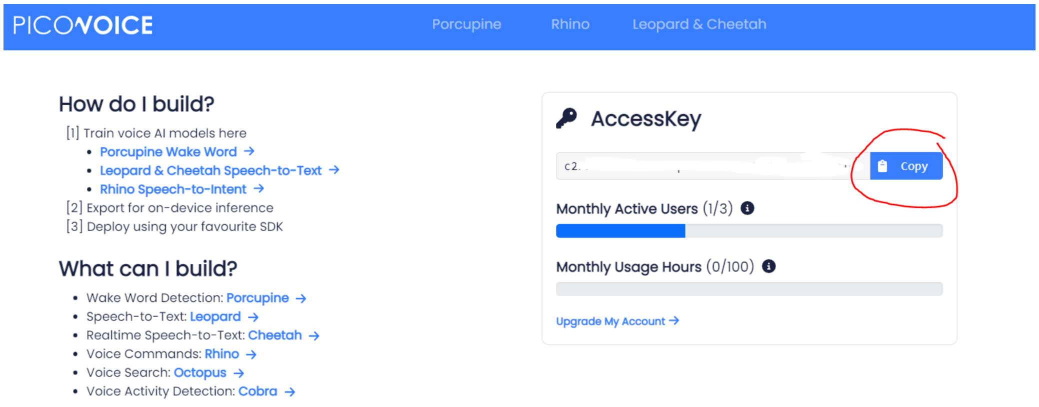
Running the executable file

- Make sure that you are in the “picovoice” directory when running this command
- The basic template is shown below
  ```
  ./demo/c/build/picovoice_demo_mic \
  -a ${ACCESS_KEY}
  -l sdk/c/lib/${PLATFORM}/${ARCH}/libpicovoice.so \
  -p resources/porcupine/lib/common/porcupine_params.pv \
  -k resources/porcupine/resources/keyword_files/${PLATFORM}/picovoice_${PLATFORM}.ppn \
  -r resources/rhino/lib/common/rhino_params.pv \
  -c resources/rhino/resources/contexts/${PLATFORM}/smart_lighting_${PLATFORM}.rhn \
  -i {AUDIO_DEVICE_INDEX}
  ```
- As an example



```
./demo/c/build/picovoice_demo mic \
-a c2F‘                                                    \
-l sdk/c/lib/beaglebone/libpicovoice.so \
-p resources/porcupine/lib/common/porcupine_params.pv \
-k resources/porcupine/resources/keyword_files/beaglebone/Hi-siri_en_beaglebone_v2_1_0.ppn \
-r resources/rhino/lib/common/rhino_params.pv \
-c resources/rhino/resources/contexts/beaglebone/Release-the-food_en_beaglebone_v2_1_0.rhn \
-i 1
```

- The access key is different for each account so go to the Picovoice website (https://console.picovoice.ai/) and sign up and copy the access key into the ${ACCESS_KEY}



How do I build?

[1] Train voice AI models here

- Porcupine Wake Word →
- Leopard & Cheetah Speech-to-Text →
- Rhino Speech-to-Intent →

[2] Export for on-device inference

[3] Deploy using your favourite SDK

What can I build?

- Wake Word Detection: Porcupine →
- Speech-to-Text: Leopard →
- Realtime Speech-to-Text: Cheetah →
- Voice Commands: Rhino →
- Voice Search: Octopus →
- Voice Activity Detection: Cobra →

AccessKey

c2.[redacted]

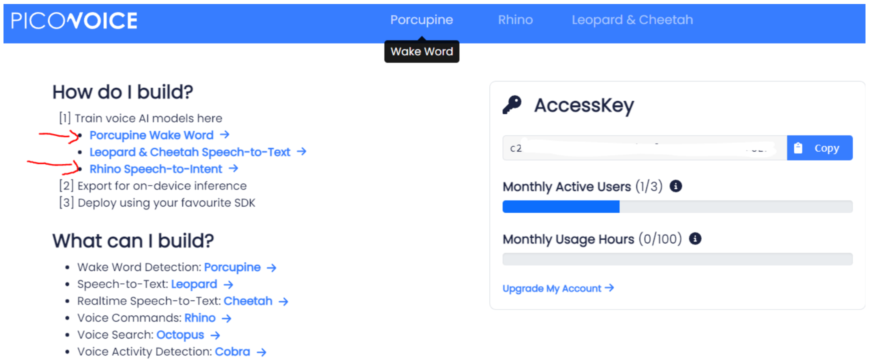
Monthly Active Users (1/3)

Monthly Usage Hours (0/100)

Upgrade My Account →

Optional:

- You can change the wake-up word (porcupine library) and speech recognition (rhino library) to your own custom word/sentence of your choice



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AccessKey

c2[redacted]

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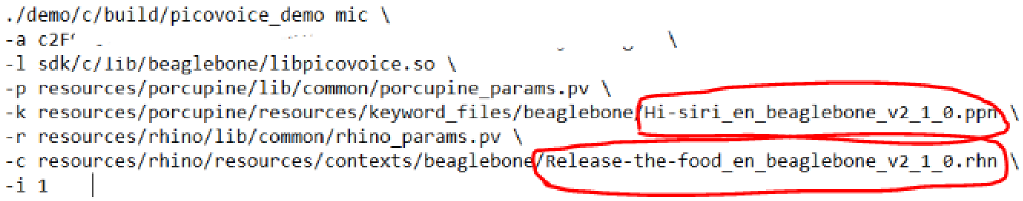
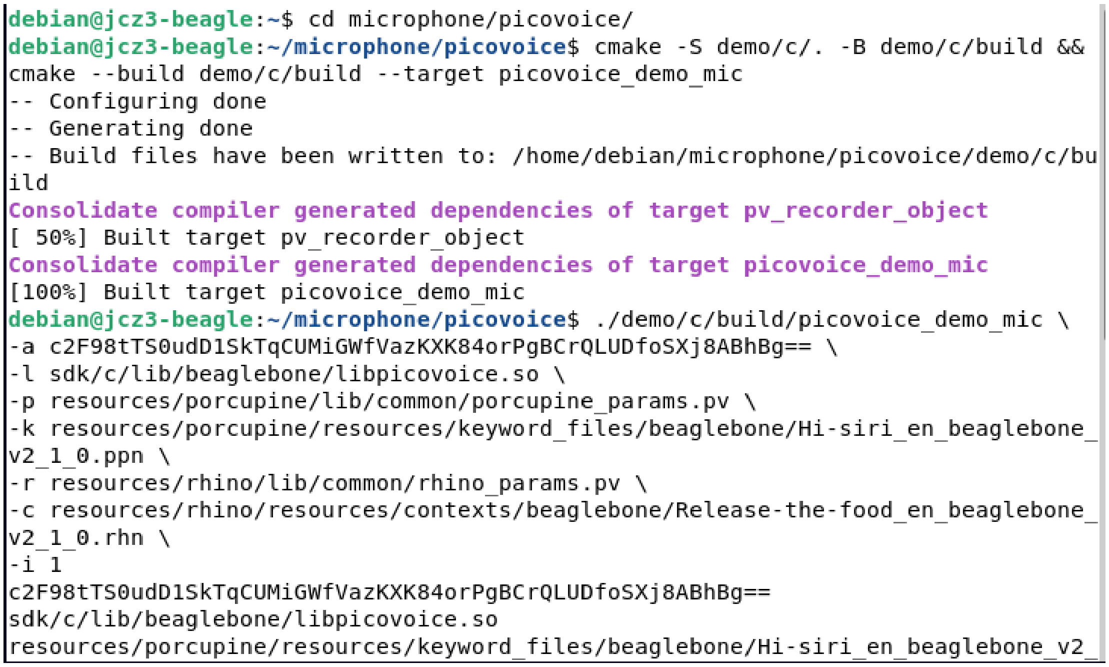
- Then you would need to go back to FileZilla and drag those newly created intent .ppn or .rhn files to their corresponding directory in the Target and rename the path of those intent when you are running the executables as shown below



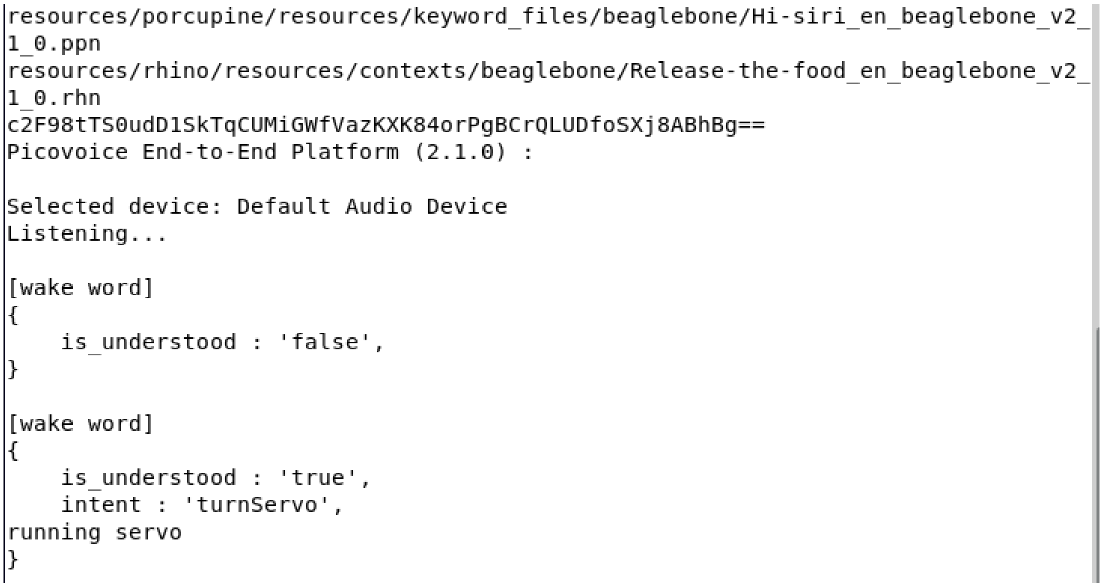
```
./demo/c/build/picovoice_demo mic \
-a c2F[redacted] \
-l sdk/c/lib/beaglebone/libpicovoice.so \
-p resources/porcupine/lib/common/porcupine_params.pv \
-k resources/porcupine/resources/keyword_files/beaglebone/Hi-siri_en_beaglebone_v2_1_0.ppn \
-r resources/rhino/lib/common/rhino_params.pv \
-c resources/rhino/resources/contexts/beaglebone/Release-the-food_en_beaglebone_v2_1_0.rhn \
-i 1
```

Step 4:

The streamlined process:



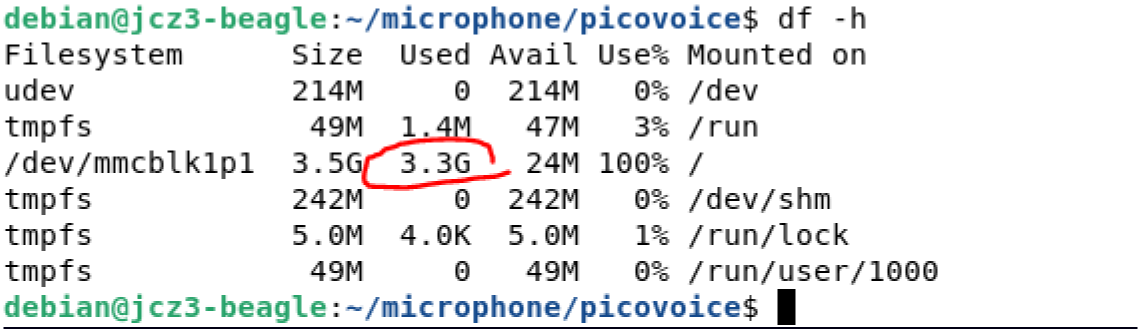
```
debian@jcz3-beagle:~$ cd microphone/picovoice/
debian@jcz3-beagle:~/microphone/picovoice$ cmake -S demo/c/. -B demo/c/build &&
cmake --build demo/c/build --target picovoice_demo_mic
-- Configuring done
-- Generating done
-- Build files have been written to: /home/debian/microphone/picovoice/demo/c/bu
ild
Consolidate compiler generated dependencies of target pv_recorder_object
[ 50%] Built target pv_recorder_object
Consolidate compiler generated dependencies of target picovoice_demo_mic
[100%] Built target picovoice_demo_mic
debian@jcz3-beagle:~/microphone/picovoice$ ./demo/c/build/picovoice_demo_mic \
-a c2F98tTS0udD1SkTqCUMiGWfVazKXK84orPgBCrQLUDfoSXj8ABhBg== \
-l sdk/c/lib/beaglebone/libpicovoice.so \
-p resources/porcupine/lib/common/porcupine_params.pv \
-k resources/porcupine/resources/keyword_files/beaglebone/Hi-siri_en_beaglebone_
v2_1_0.ppn \
-r resources/rhino/lib/common/rhino_params.pv \
-c resources/rhino/resources/contexts/beaglebone/Release-the-food_en_beaglebone_
v2_1_0.rhn \
-i 1
c2F98tTS0udD1SkTqCUMiGWfVazKXK84orPgBCrQLUDfoSXj8ABhBg==
sdk/c/lib/beaglebone/libpicovoice.so
resources/porcupine/resources/keyword_files/beaglebone/Hi-siri_en_beaglebone_v2_
```



```
resources/porcupine/resources/keyword_files/beaglebone/Hi-siri_en_beaglebone_v2_
1_0.ppn
resources/rhino/resources/contexts/beaglebone/Release-the-food_en_beaglebone_v2_
1_0.rhn
c2F98tTS0udD1SkTqCUMiGWfVazKXK84orPgBCrQLUDfoSXj8ABhBg==
Picovoice End-to-End Platform (2.1.0) :

Selected device: Default Audio Device
Listening...

[wake word]
{
    is_understood : 'false',
}

[wake word]
{
    is_understood : 'true',
    intent : 'turnServo',
running servo
}
```

Troubleshoot:

- **Issues with CMAKE:**
    - Make sure you have internet access when you are building your file so run the command ./internetToTarget.sh (#!/bin/sh sudo route add default gw 192.168.7.1 echo nameserver 8.8.8.8 | sudo tee -a /etc/resolv.conf)
- **Program running but not detecting user's voice:**
    - Make sure your microphone is connected to the USB adapter and your microphone is working (Pretty sure the earbud microphone does not work)
- **An issue with FileZilla moving files to BBG**
    - Most likely due to not enough storage space on the BBG check by running the command "df -h" on the Target as shown below



```
debian@jcz3-beagle:~/microphone/picovoice$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            214M     0  214M   0% /dev
tmpfs            49M  1.4M   47M   3% /run
/dev/mmcblk1p1  3.5G  3.3G   24M 100% /
tmpfs           242M     0  242M   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
tmpfs            49M     0   49M   0% /run/user/1000
debian@jcz3-beagle:~/microphone/picovoice$ 
```

    - Possible fixes for this issue
        - ($Target) sudo apt autoremove
        - Worst case reflash the BBG

Reference:

https://picovoice.ai/docs/quick-start/picovoice-c/