Edison – The Voice Controlled AI Assistant and Clock Radio

Edison – The Voice Controlled AI Assistant and Clock Radio is a voice-controlled clock, internet radio and talking ChatGPT virtual assistant capable of answering questions, providing information and even telling bedtime stories. Edison also provides written responses if your device is wirelessly connected to a display.

Edison – The Voice Controlled AI Assistant and Clock Radio runs s a python program on a Raspberry Pi 4 that utilizes Picovoice Porcupine (and (PyAudio) to detect a wake word; Picovoice Cobra voice activity detection to determine when the user begins and finishes speaking their instruction or query; Picovoice Leopard to convert the spoken instruction or query to text; VLC media player to play requested internet music stations; OpenAI ChatGPT to respond to the query; Amazon Polly text to speech to convert the response into a natural-sounding human voice; and Pygame to play the converted audio.

You can watch a video demo of Edison – The Voice Controlled AI Assistant and Clock Radio here: https://youtu.be/p3imxEQMRdk

How to Run Edison on a Raspberry Pi 4 Mini-Computer

The following steps are required to run Edison – The Voice Controlled AI Assistant and Clock Radio on your Raspberry Pi 4:

- Obtain the necessary hardware
- Create an OpenAI account and obtain your personal secret API key
- Create a Picovoice account and obtain your personal secret access key
- Create an AWS account and obtain your personal access key and secret access key
- Follow the other steps below for preparing your Raspberry Pi and downloading the Python code for Edison – The Voice Controlled AI Assistant and Clock Radio

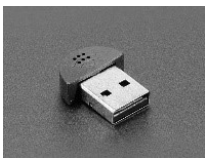
Note that although account registrations are required to obtain the keys to use the outside services and that production-use of those resources requires the payment of fees, these services should all be free (at least for a limited time) to a user who only utilizes them for the hobbyist requirements of Edison – The Voice Controlled AI Assistant and Clock Radio for private use.

Hardware Requirements

Raspberry Pi 4 – This needs to be a Raspberry Pi 4, so that you can run the 64-bit operating system. Earlier versions of Raspberry Pis are likely to throw memory errors while running this program. The 2 GB RAM model is sufficient: https://www.adafruit.com/product/4292

4-Digit 7-Segment Display w/ I2C Backpack – for the clock isplay. U used this green one: https://www.adafruit.com/product/880

5V Power Supply – I recommend the official Raspberry Pi power supply: https://www.adafruit.com/product/4298



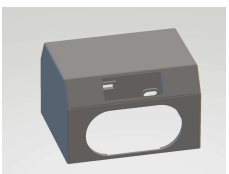
USB Microphone – for talking to Edison. Any USB mic should work, and this inexpensive one is sufficient: https://www.adafruit.com/product/3367

Angled USB Connector – Required to fit the Raspberry Pi into the Edison enclosure. I used this splitter one and plugged both the mic and the speaker into it: https://www.amazon.com/dp/B07ZV7RDNH?ref=ppx_yo2ov_dt_b_product_details&th=1

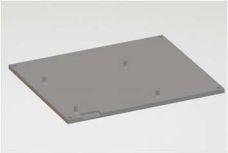
USB Speaker – for Edison to talk back to you and play the radio. I used this one: https://www.adafruit.com/product/3369

LED Filament (300mm) – The program lights the LED filament when it detects the wake word and pulses it when the frame is responding to your request. This lime green colored LED filament was used in the video demo: https://www.adafruit.com/product/5507

Heatsinks – Heatsinks are recommended for your Raspberry Pi. I used these: https://www.amazon.com/dp/B07ZLZRDXZ?psc=1&smid=A2PL6UUXJC5K5G&ref_=chk_typ_imgToDp

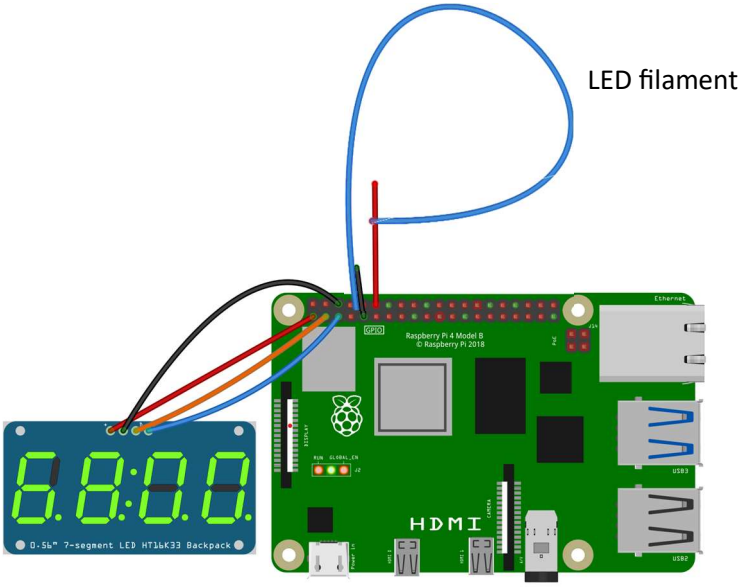


Edison Enclosure – The STL file for 3D-printing the top part of Edison is available on this GitHub repository. I recommend printing this top side up using organic supports. Make certain that your supports do not fill in the holes at the ends of the grooves in the front where the LED filament goes.



Edison Baseplate – The STL file for 3D-printing the bottom part of Edison is available on this GitHub repository

Wiring and Build



The LED filament is controlled by GPIO pin 18. The other end is connected to a ground pin. The filament should be pressed into the groove on the face of the enclosure and threaded through the holes at the ends of the groove. You may need to use needle nose pliers to help pull it through the holes.

The I2C backpack on the display is attached as follows:

Backpack V+ to GPIO pin 3V3 (red wire)
Backpack GND to GPIO pin Ground (black wire)
Backpack SDA to GPIO pin 2 (orange wire)
Backpack SCL to GPIO pin 3 (blue wire)
The USB microphone and speaker are connected to the USB

After you 3D-print the Edison Enclosure and Baseplate, mount the Raspberry Pi 4 on the four pegs on the Baseplate with the power socket over the indentation. You can permanently affix your RPi to the base by putting a little glue at each peg after the RPi is mounted. There is an elliptical hole on the back of the main enclosure for the power supply plug, so be certain to arrange your Pi on the base in the correct direction.

Push the metal part of the USB microphone through the rectangular hole on the backside of the enclosure so the half-sphere plastic part is outside the enclosure and the metal USB connection if on the inside. Use the angled USB connector to attach to the USB microphone and USB speaker inside the enclosure and plug it into the Raspberry Pi.

After you mount the 7-segment display and the USB speaker in the enclosure, secure them with some glue, and connect the wiring, push the excess wires inside the enclosure and attach the baseplate to the enclosure with glue or screws (2.5mm x 0.45mm x 10mm Phillips flat head).

Create an OpenAI Account

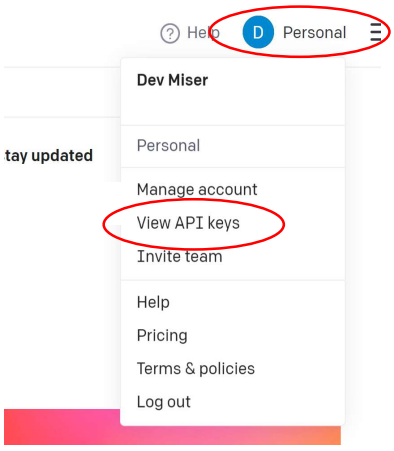
Open a web browser on your PC and navigate to the OpenAI website - https://openai.com/.

In the upper right-hand corner, click on “API”

On the next screen, click on SIGN UP and then follow the prompts to create your account.

Obtain Your Secret OpenAI API Key

Next, on the logged-in screen, click on your Personal icon in the upper right-hand corner and then click on “View API keys”.



Then click on + Create new secret key to create your new secret API key. Copy your API key and keep it in a secure location. You will need it in a later step.

Create a Picovoice Account

Create a free Picovoice account. Open a web browser and navigate to https://picovoice.ai/.

In the upper right-hand corner, click the Start Free button and follow the prompts to open your account.

Obtain Your Secret Picovoice Access Key

As soon as you complete your sign up, you will automatically be redirected to a page with your secret access key. Copy your AccessKey and keep it in a secure location. You will need it in a later step.

Create an AWS Account

Create a free AWS account. Open a web browser and navigate to the following website to use the AWS Free Tier: https://aws.amazon.com/free/

In the upper right-hand corner, click on the Complete Sign Up button and follow the prompts to open your account.

Create an AWS IAM User Account and Obtain Your AWS Access Key and Secret Access Key

After you create your AWS account, you will next need to create an IAM User Account on AWS. To do so, follow AWS's instructions here: https://docs.aws.amazon.com/IAM/latest/UserGuide/getting-set-up.html#create-an-admin

Or you can try the detailed steps in Addendum I. The process is revised occasionally by AWS and may no longer be the same as in the Addendum.

Copy your "Access key" and "Secret access key" and keep them in a secure location. You will need them in a later step.

Prepare Your Raspberry Pi 4 to Run the Program

These instructions assume you already have a Raspberry Pi 4 set up and running. If not, set up your Raspberry Pi using the instructions found here: https://www.raspberrypi.com/tutorials/how-to-set-up-raspberry-pi/

Be certain to load the 64-bit (not the 32-bit) version of the Raspberry Pi OS when setting up your Raspberry Pi. If you use the 32-bit version, you are likely to get memory errors when running the program.

To prepare your Raspberry Pi to run DaVinci – The ChatGPT Virtual Assistant, do the following:

1. Edit the bashrc file on your Raspberry Pi as follows:

a. Open a terminal  and enter the following command to open the bashrc file:

```
sudo nano ~/.bashrc
```

b. Scroll to the bottom of the file using your keyboard and add the following lines at the end (be certain to include the #s):

```
# sets a location where the Raspberry Pi OS and Python can look for
# executable/configuration files
export PATH="$HOME/.local/bin:$PATH"
```

c. Press the CTRL and X keys simultaneously on your keyboard, then press Y and then press Enter to save the revisions to the file.

d. Then enter the following command:

```
sudo reboot
```

This will reboot your Raspberry Pi. After the reboot is completed, log back in.

2. Open a terminal and enter the following commands in the following order:

```
sudo apt update

sudo apt full-upgrade

pip3 install --upgrade pip

sudo apt-get install portaudio19-dev [When asked if you want to continue, enter Y
and then press Enter]

sudo apt-get install python3-pil

pip3 install adafruit-circuitpython-ht16k33

pip3 install python-vlc
```

pip3 install pyaudio

pip3 install pvrecorder

pip3 install pvporcupine

pip3 install pvcobra

pip3 install pvleopard

pip3 install pytz

pip3 install word2number

pip3 install --upgrade openai

pip3 install boto3

pip3 install awscli

sudo reboot – will reboot your Raspberry Pi; log back in after the reboot.

3. Configure the AWS command line interface by opening a terminal and entering the following command:

aws configure

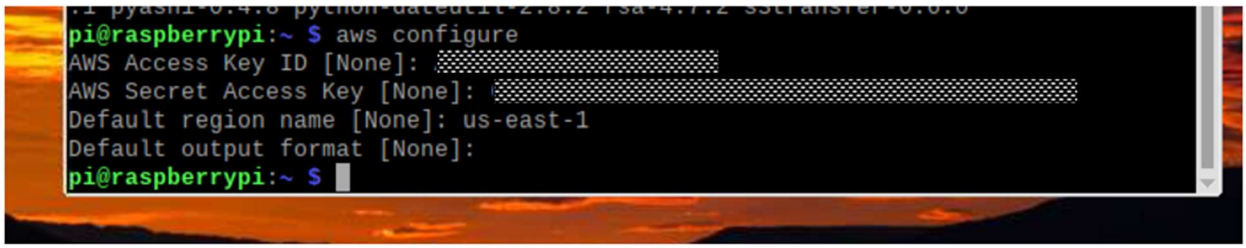
The following lines will appear one-by one. Take the actions specified in the brackets:

AWS Access Key ID [None]: [type in your access key ID and press enter]

AWS Secret Access Key [None]: [type in your secret access key and press enter]

Default region name [None]: [check for the name of the region closest to you here: https://docs.aws.amazon.com/general/latest/gr/rande.html#pol_region – mine is us-east-1 – then type it in and press enter]

Default output format [None]: [leave this blank and press enter]



4. Download the DaVinci.py program and associated files by opening a terminal and entering the following command:

git clone https://github.com/DevMiser/Edison.git

5. Modify Edison.py to include the secret API key that you previously created in your OpenAI account and the secret access key that you created in your Picovoice account by doing the following:

a. Open a terminal and enter the following commands:

cd /home/pi/Edison

sudo nano Edison.py

b. Use your keyboard to scroll down to the lines that say:

openai.api_key = "*put your secret API key between these quotation marks*"
pv_access_key= "*put your secret access key between these quotation marks*"

Now modify those lines to replace the portions that are italicized above with your secret OpenAI API key and your secret Picovoice access key, respectively.

c. Press the CTRL and X keys simultaneously on your keyboard, then press Y and then press Enter to save the revisions to the file.

6. Move the Edison keyword file to the Porcupine raspberry-pi folder by entering the following command:

mv /home/pi/Edison/Edison_raspberry-pi.ppn /home/pi/.local/lib/python3.9/site-packages/pvporcupine/resources/keyword_files/raspberry-pi
[Note that there are two blank spaces in the above command - between "mv" and "/home" and between ".ppn" and "/home". Be sure to include them. There is no space in "site-packages".]

7. Reboot your Raspberry Pi.

Run the Program

Plug your microphone and speaker into USB ports on your Raspberry Pi 4.

To run the program, open a terminal and enter the following commands:

cd /home/pi/Edison

```
python3 Edison.py
```

You can then wake up your Edison – The Voice Controlled AI Assistant and Clock Radio by saying one of the following wake words: Edison, computer or Jarvis.

Edison – The Voice Controlled AI Assistant and Clock Radio will respond by saying "How may I assist you?", "I'm listening." or something similar.

Then make your request. For example, say:

Turn on/off the radio.

Turn on/off the clock.

Dim/Brighten the display.

Change the station to Mandarin. [The choices currently available are Classical, Mandarin, French, Acoustic, Calm, Rock, Calm, Pop, Guitar, and Spa – this may be updated from time to time, so check the python code to see what stations are currently included]

Tell me a joke.

Tell me a bedtime story about a wise queen who convinces a dragon not to be evil.

What are the top 5 foods that should be included in a healthy diet.

Make a short poem about dancing robots.

How can I avoid procrastinating today?

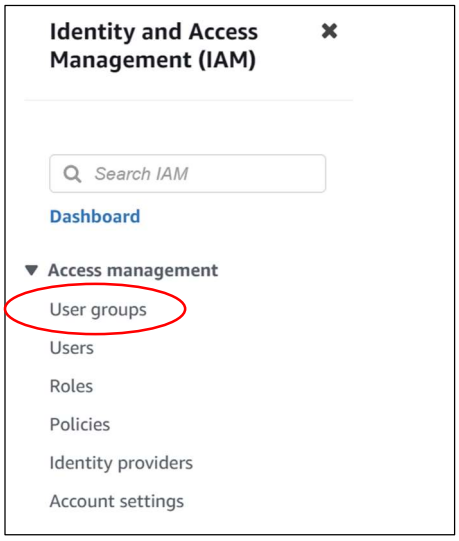
When you are finished with the program, press the CTRL and C keys simultaneously on your keyboard and you will exit the program.

Addendum I

AWS Identity and Management Access (IAM) Dashboard Instructions

The following instructions are how to to create an IAM User Account on AWS. This process is revised occasionally by AWS and may no longer be exactly the same as in this Addendum. You can check AWS's documentation for the most current instructions.

After you create your AWS account, sign in and go to the Identify and Manage Access (IAM) dashboard at this url: https://console.aws.amazon.com/iamv2



1. Select "User groups" from the menu on the left-hand side and then click Create group in the upper right-hand corner.

2. On the next page, enter "Polly" into the box underneath "User group name ".

3. Further down on the same page in the box that says "Attach permissions policies – Optional", search for "Polly" and then select "AmazonPollyFullAccess" from the search results.

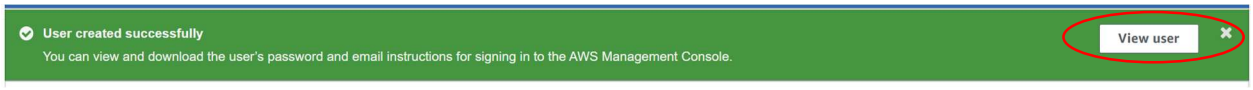
4. Next select "Users" from the left-hand menu.

5. Click Add users from the upper right-hand corner and type "Polly_User" in the box under "User name" and click "Next".

6. On the next page under Permission options, select "Add user to group" and check the box next to "Polly" under "User groups", and then click "Next".

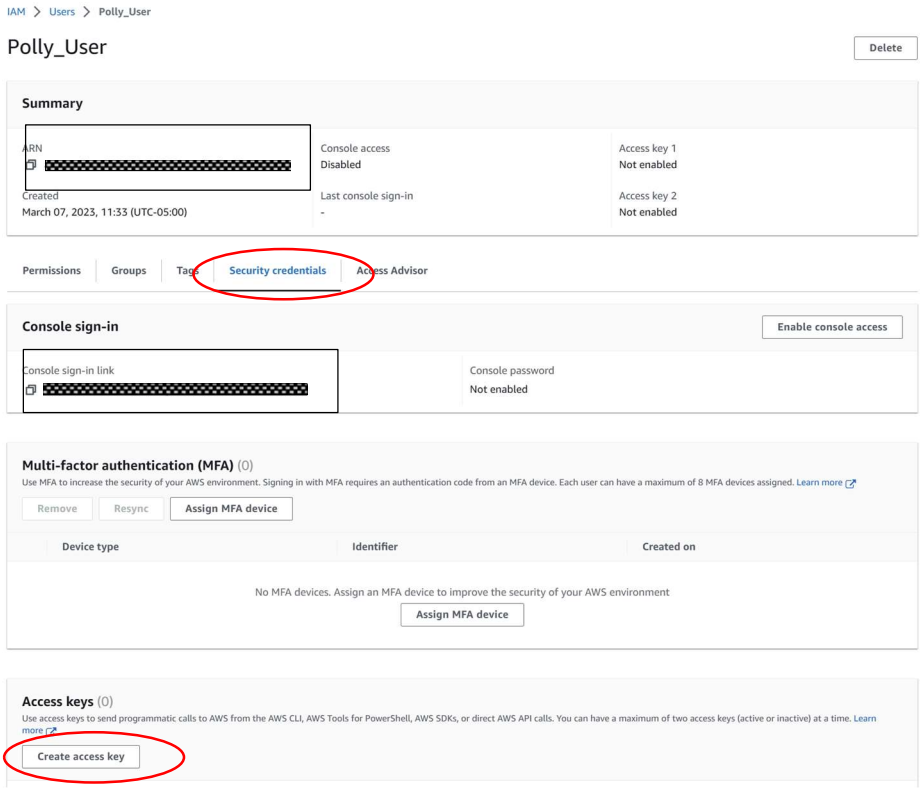
7. On the next page, click Create user.

8. On the next page, click the "View User" button:

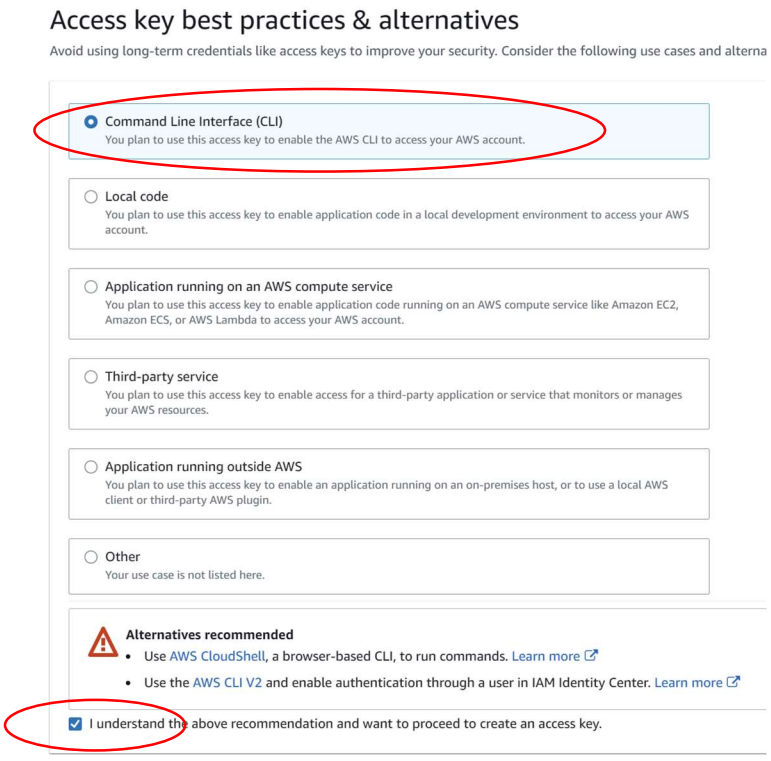


9. On the next page, click the “Security credentials” tab that is part way down the page.

And then scroll further down on the page and select the “Create access key” button.



10. On the next page, select the Command Line Interface (CLI) option, check the “I understand…” box at the bottom, and then click “Next”.



11. On the next page, leave it blank and click 

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12. The next page will be headed “Retrieve access keys”.

Copy both the “Access key” and “Secret access key” and keep them in a secure location. This is the only time that the secret access key can be viewed or downloaded. If you lose it, you will need to create a new access key and make the old one inactive.