Team name: Asclepius

Implementation of Edge AI for Healthcare.

IEEE HAXIOS Hackathon

Team members

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About

We have created an easily deployable (can be implemented in Arduino Nano/Mobile Phone/ STM Boards/ Any ARM Cortex Board) ML model trained to recognize the keyword "HELP" and reject (or classify as NOISE) others.

The advantage it offers is that it is done using Edge AI, meaning it doesn't require constant connection to the cloud. This reduces the cost and power required by the board, while simultaneously increasing efficiency, compared to existing models

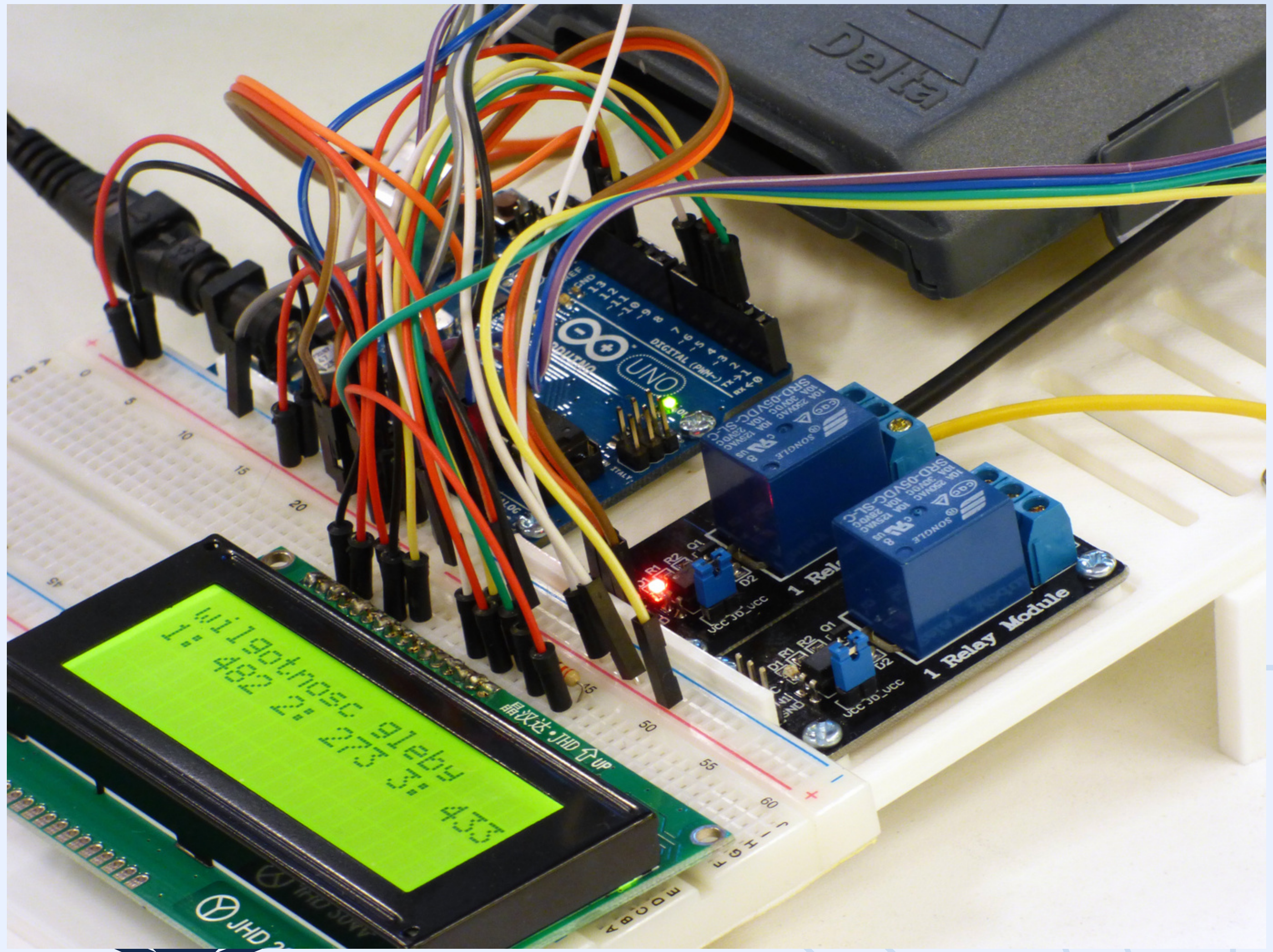
Project Requirements:

Hardware:

1) Arduino Nano 33 BLE.
2) Mobile Phone.

Software:

1) Edge Impulse



Work Done on Edge Impulse

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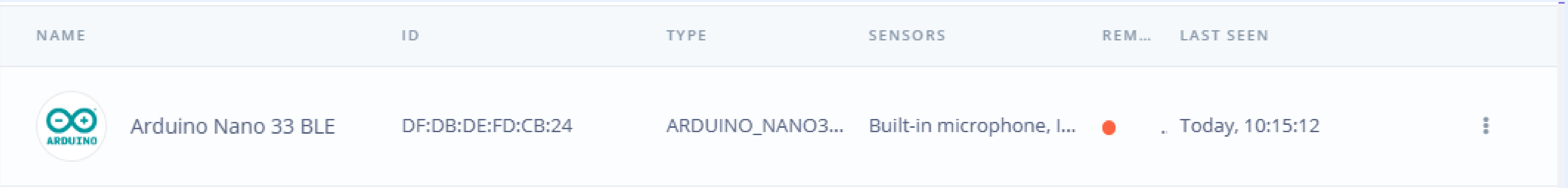
This is your Edge Impulse project. From here you acquire new training data, design impulses and train models

Data collection for training ML model is done using **Arduino Nano 33 BLE**

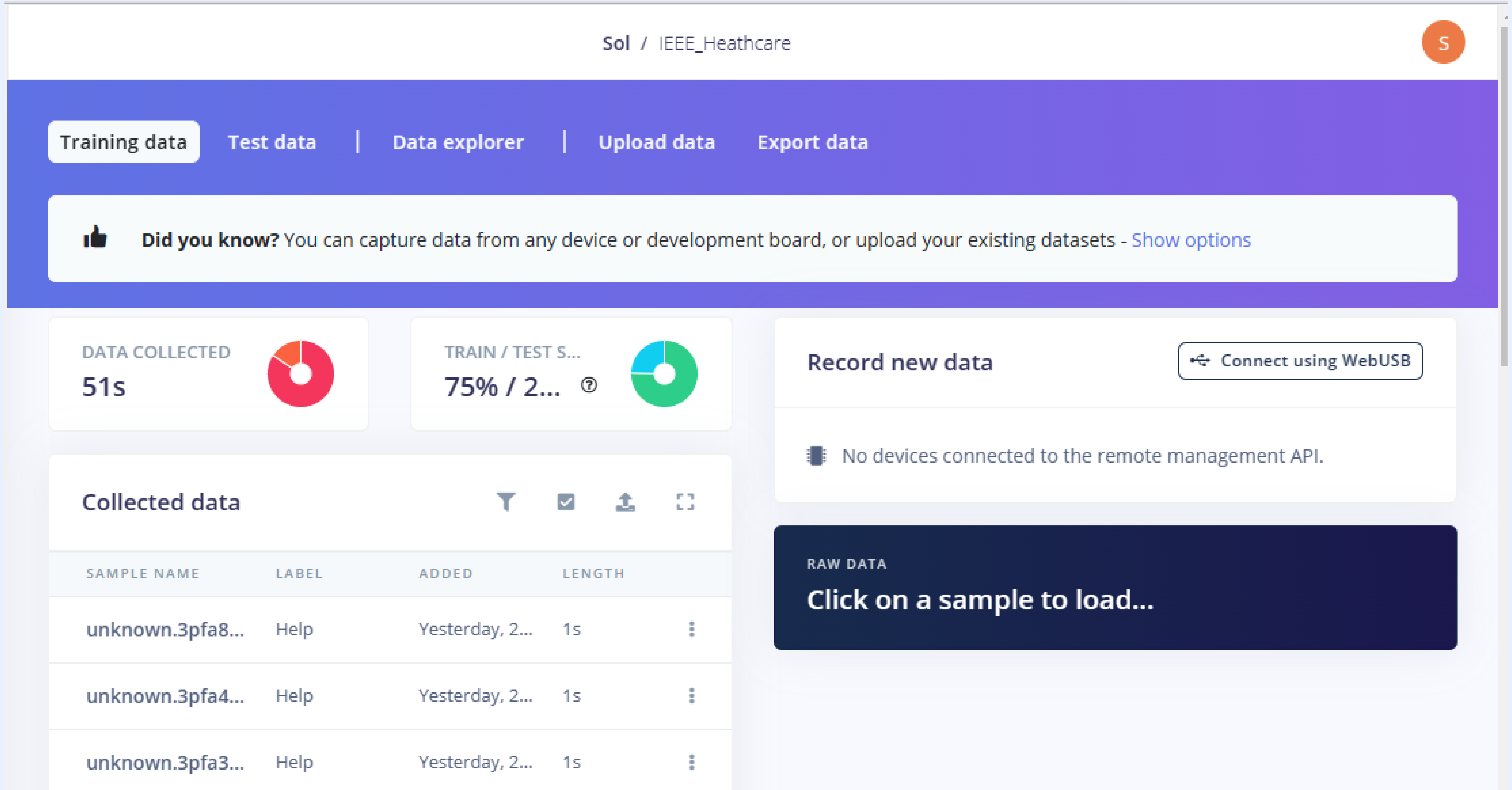


NAME	ID	TYPE	SENSORS	REM...	LAST SEEN
Arduino Nano 33 BLE	DF:DB:DE:FD:CB:24	ARDUINO_NANO3...	Built-in microphone, I...	●	Today, 10:15:12

Data Acquisition

Collected data (Audio) is classified into two labels - **"HELP" and "NOISE"**

Training and Testing ratio - **75:25**



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Did you know? You can capture data from any device or development board, or upload your existing datasets - Show options

DATA COLLECTED
51s

TRAIN / TEST S...
75% / 2...

Record new data

No devices connected to the remote management API.

Collected data

SAMPLE NAME	LABEL	ADDED	LENGTH
unknown.3pfa8...	Help	Yesterday, 2...	1s
unknown.3pfa4...	Help	Yesterday, 2...	1s
unknown.3pfa3...	Help	Yesterday, 2...	1s

RAW DATA
Click on a sample to load...

Signal Processing Techniques Used :

1) Mel-Frequency Cepstral Coefficients (MFCC)

Mel Frequency Cepstral Coefficients (MFCCs) are a representation of the spectral characteristics of a sound signal, often used to represent spectral characteriestics of speech and/or music.

2) Mel-Frequency Energies (MFE)

Mel Frequency Energy (MFE) is a representation of audio signals that is commonly used in speech recognition and audio analysis. It is based on the concept of the Mel scale, which is a logarithmic scale of pitches that is based on the way humans perceive sound.

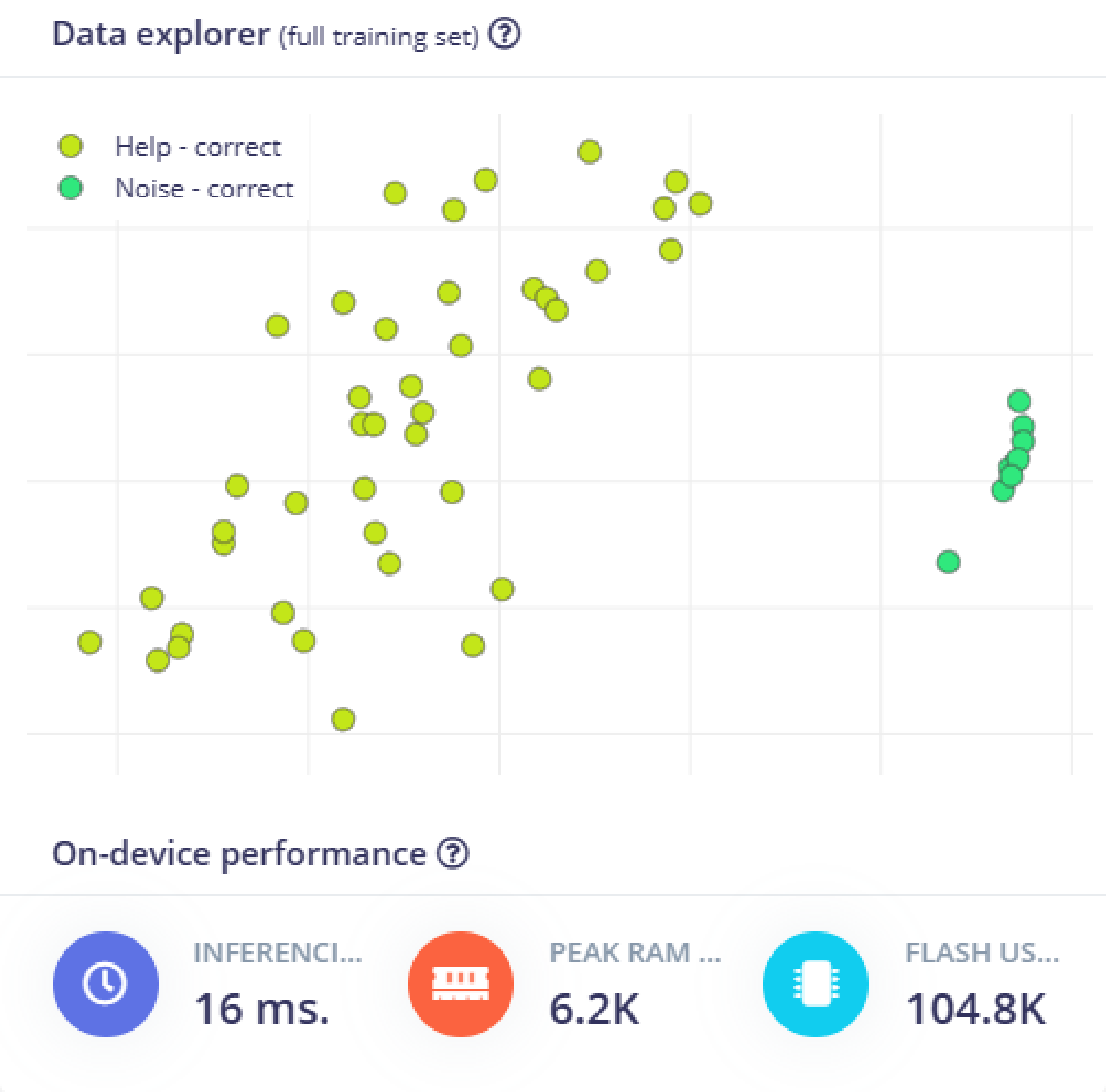
Classification algorithm used:

KERAS Classifier:

Keras is a popular open-source neural network library that is written in Python. It is user-friendly and intuitive, and it allows users to easily create and train neural networks for a wide range of applications.

A Keras classifier can be built using the Sequential API or the Functional API, both of which allow users to stack layers to create a neural network.
Once the classifier is built, it can be trained using a variety of optimization algorithms [such as stochastic gradient descent (SGD), Adam, RMSprop, etc].
The model can then be evaluated on a test set to determine its accuracy and performance.

Device Requirements for deploying the model:



Data explorer (full training set)

On-device performance

INFERENCI... 16 ms.

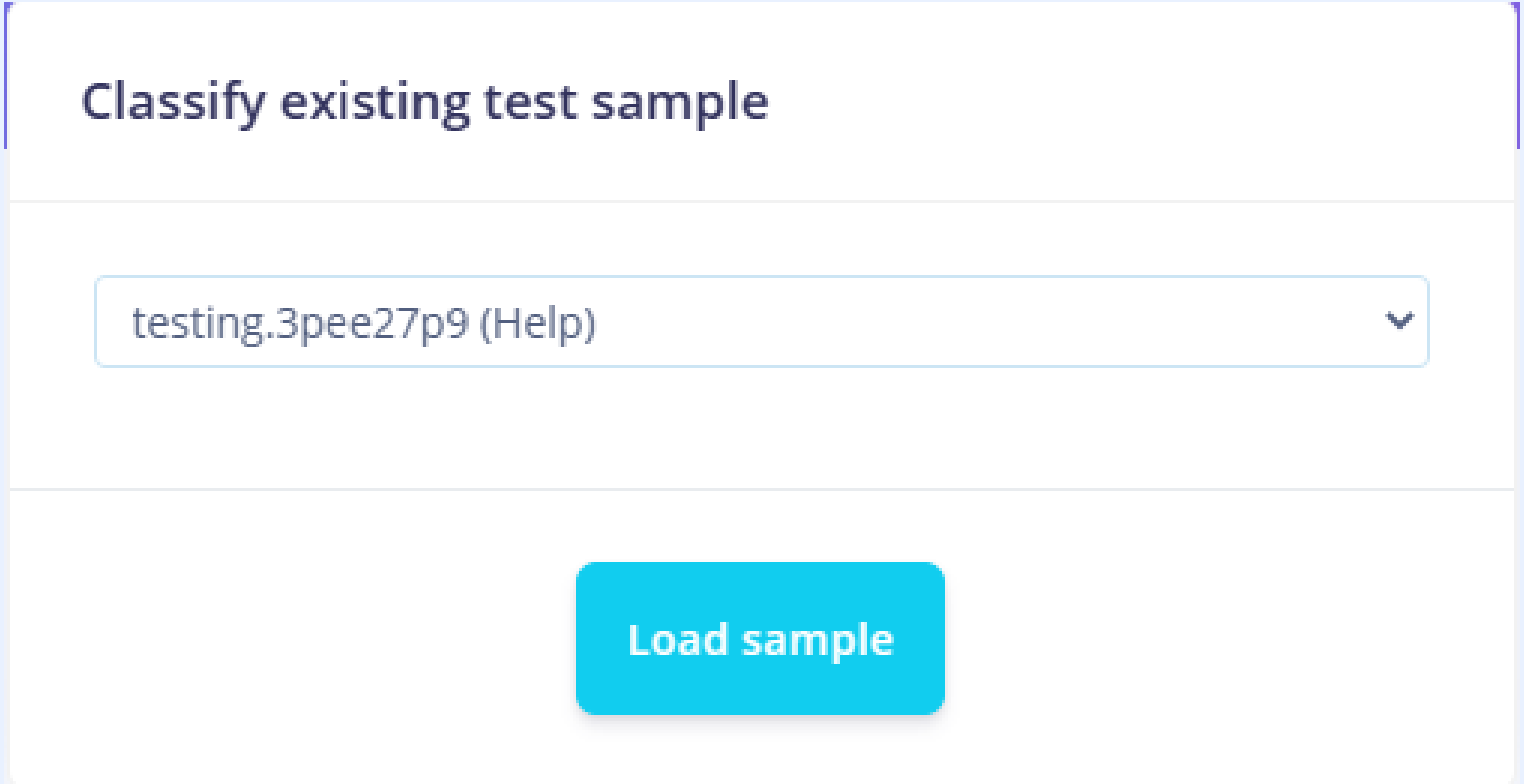
PEAK RAM ... 6.2K

FLASH US... 104.8K

1) RAM - 6.2KB

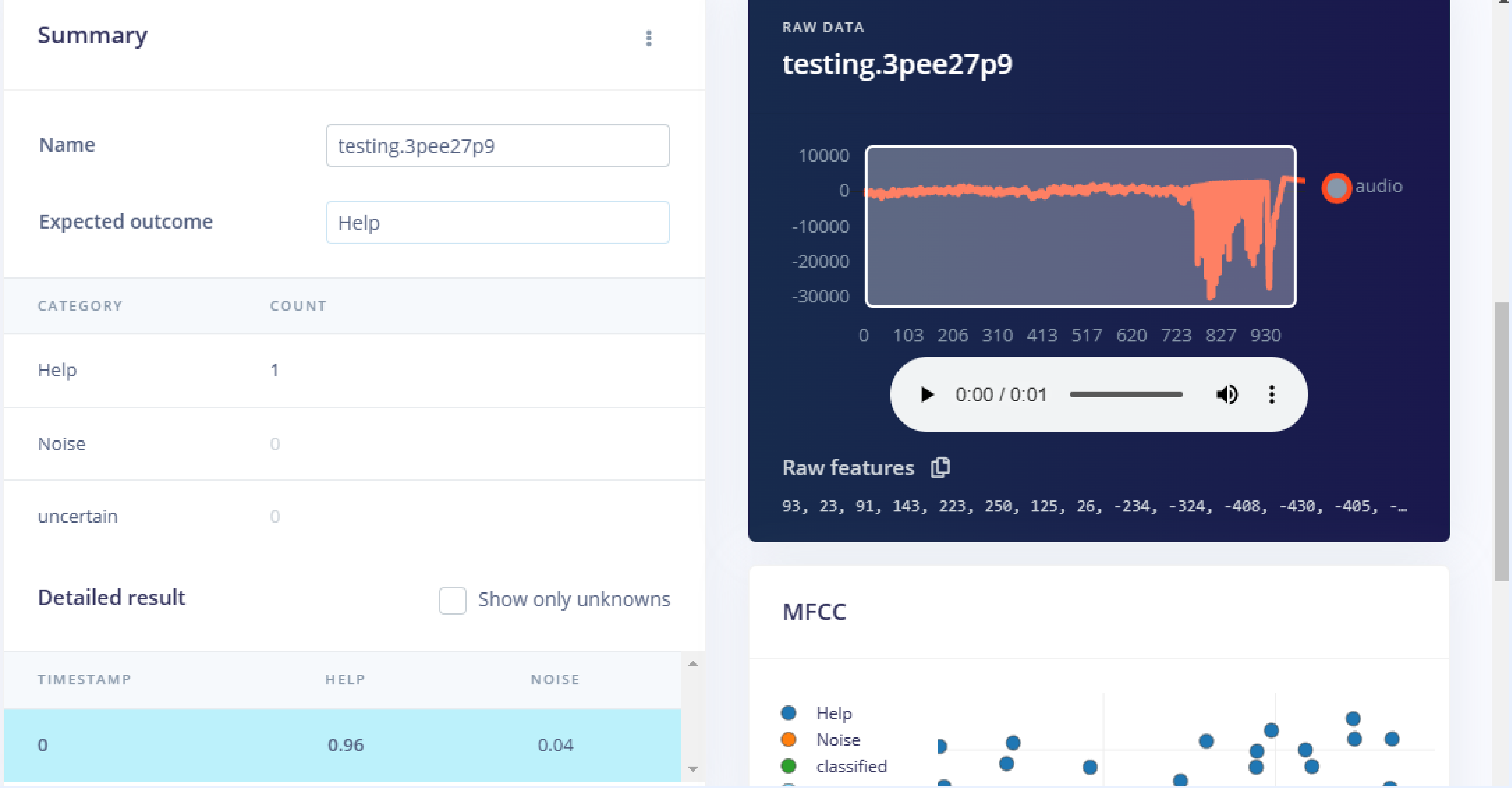
2) FLASH - 104.8KB

Classifying Test sample:



Classify existing test sample

testing.3pee27p9 (Help)



Summary

Name	testing.3pee27p9
Expected outcome	Help

CATEGORY	COUNT
Help	1
Noise	0
uncertain	0

Detailed result

□ Show only unknowns

TIMESTAMP	HELP	NOISE
0	0.96	0.04

RAW DATA

testing.3pee27p9

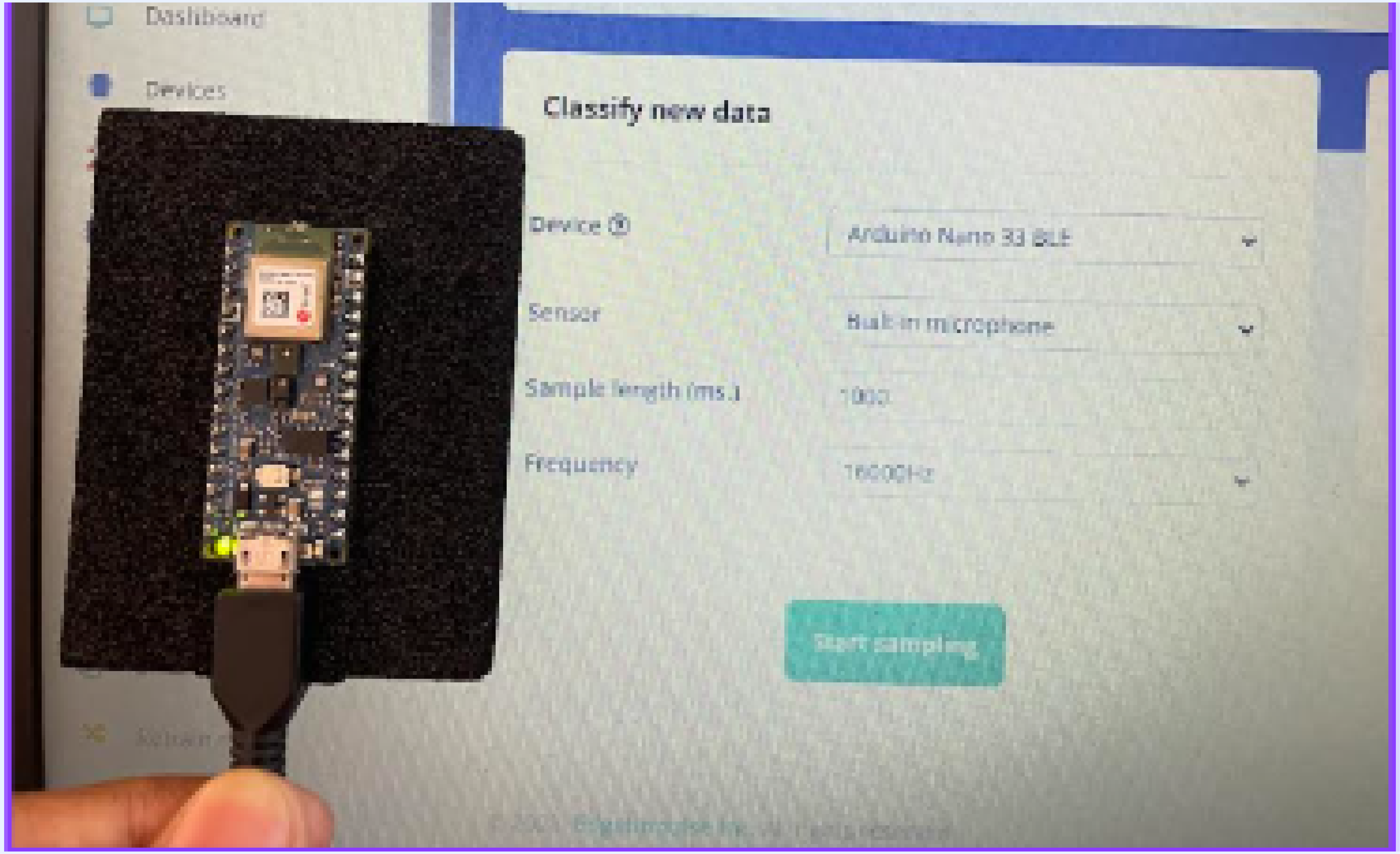
Raw features

93, 23, 91, 143, 223, 250, 125, 26, -234, -324, -408, -430, -405, -…

MFCC

Our model has identified the voice with **HELP - 0.96 and Noise - 0.04 Threshold** respectively

Classifying new data from Arduino



Classify new data

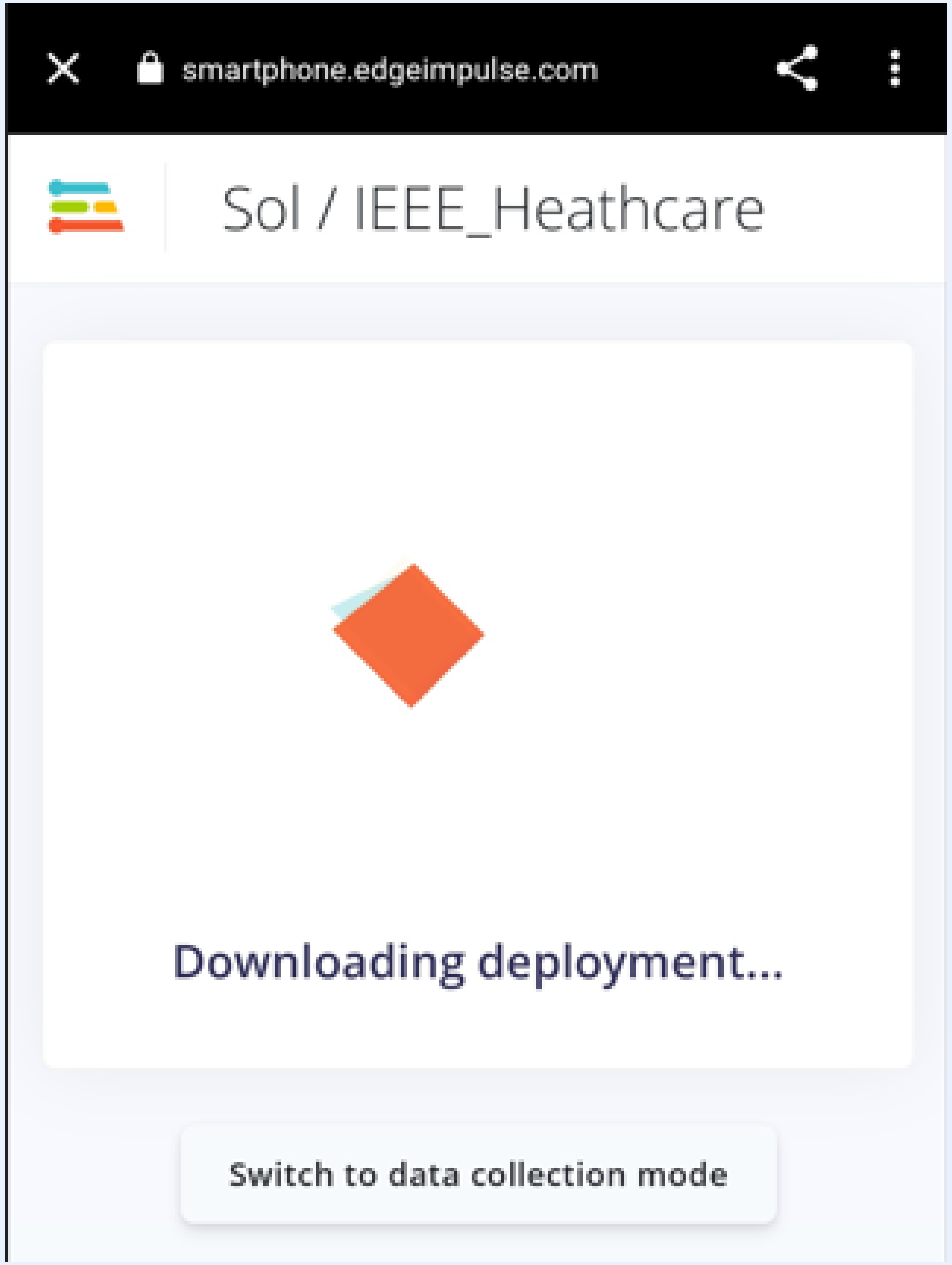
Device: Arduino Nano 33 BLE

Sensor: Built-in microphone

Sample length (ms.): 1000

Frequency: 16000Hz

Deployment of model in "Mobile Phone"



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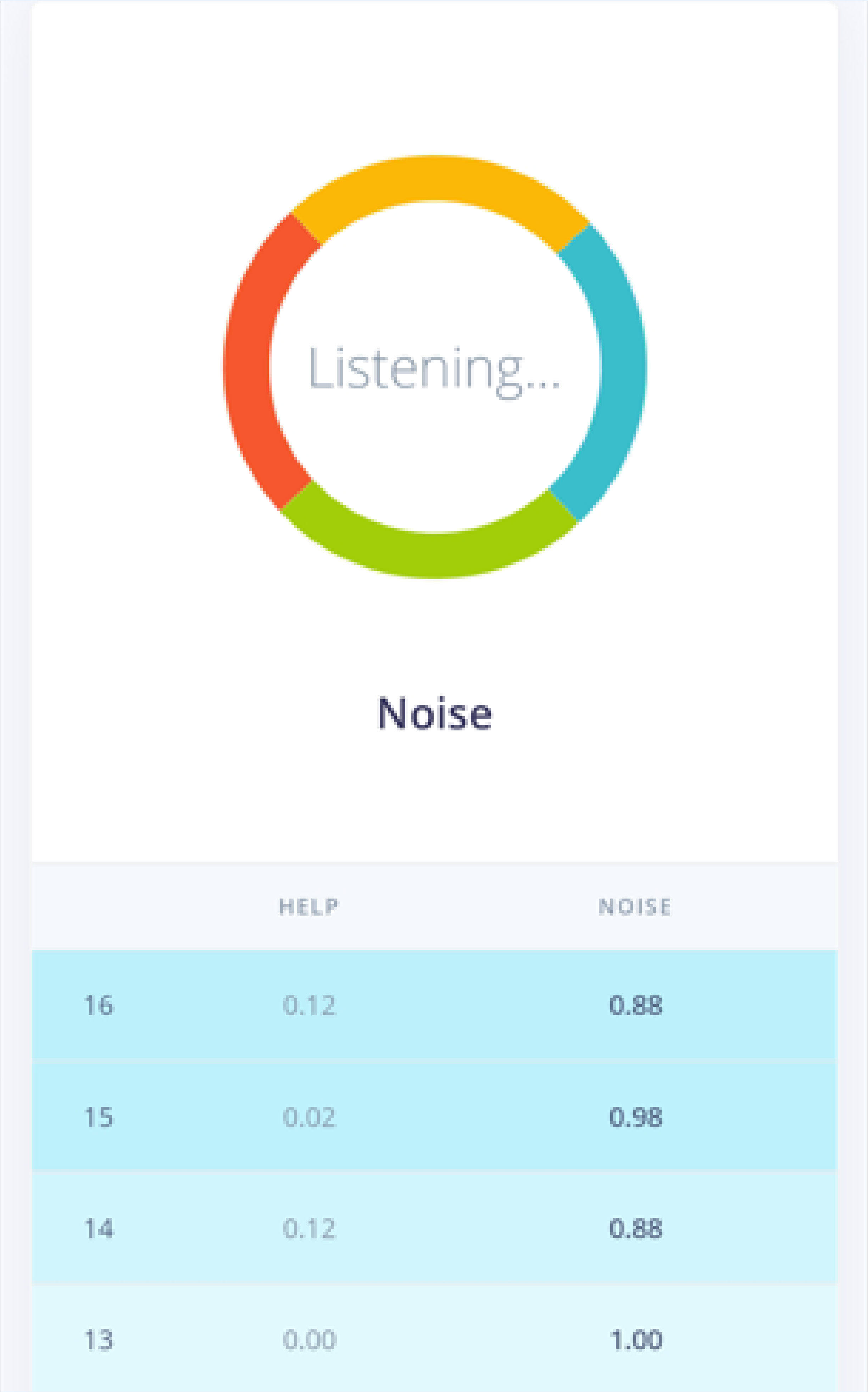
Downloading deployment...

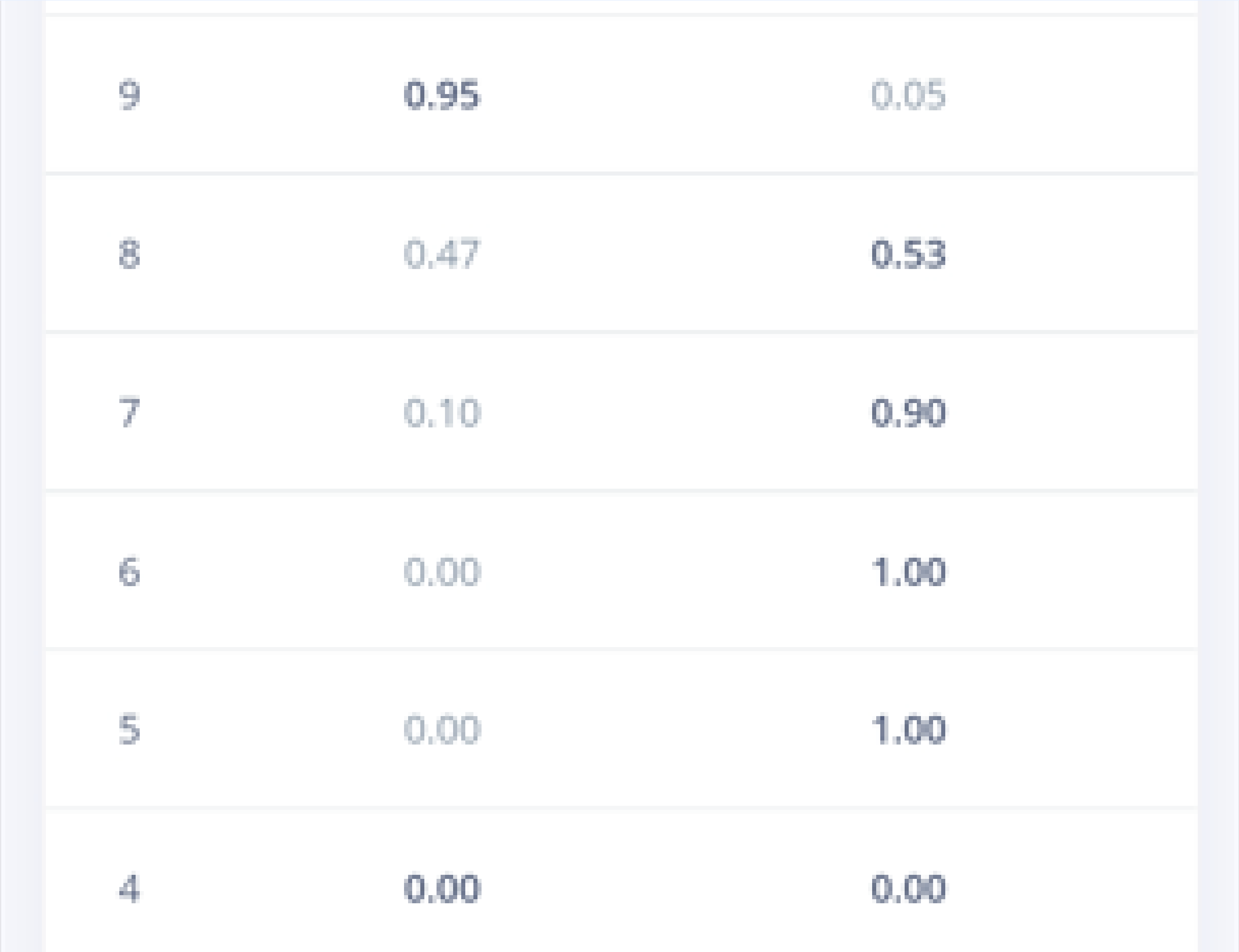
Developed Edge Impulse model is deployed and tested in mobile phone for live classification.



Listening...

Noise

	HELP	NOISE
16	0.12	0.88
15	0.02	0.98
14	0.12	0.88
13	0.00	1.00



Timestamp	HELP	NOISE
9	0.95	0.05
8	0.47	0.53
7	0.10	0.90
6	0.00	1.00
5	0.00	1.00
4	0.00	0.00

Demonstration video

https://drive.google.com/file/d/1cX9dX2vOE5EC6Y3Cb935vsDKVdk0v_U-/view?usp=sharing

Thank You

Credits

Data collection and Video editing: Kavin Udayasuryan

Model Creation, training and testing: Vignesh, Karthikh