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School Of Mathematics
Computer Science and Engineering

Internet of Things
(CSCM035AZ2021/2)

Infant Sound Detection with TinyML on Seeed Wio Terminal

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INTRODUCTION

This project aims to build a system that detects infant sounds for the seeed wio terminal using TinyML and Edge Impulse. Edge Impulse is an online machine learning development platform for edge devices which enabled me to collect data using the wio terminals' built-in microphone or upload data from my host machine, filters and visualize the data using a processing block (Audio MFE) and a learning block (Keras Neural Network Classifier) to perform live classifications. A free account can be created here.

The Wio (Wireless Input and Output) Terminal is a SAMD51-based microcontroller with Wireless Connectivity which is compatible with Arduino and MicroPython and powered by Realtek RTL8720DN. It runs at 120MHz (Boost up to 200MHz), 4MB External Flash and 192KB RAM.

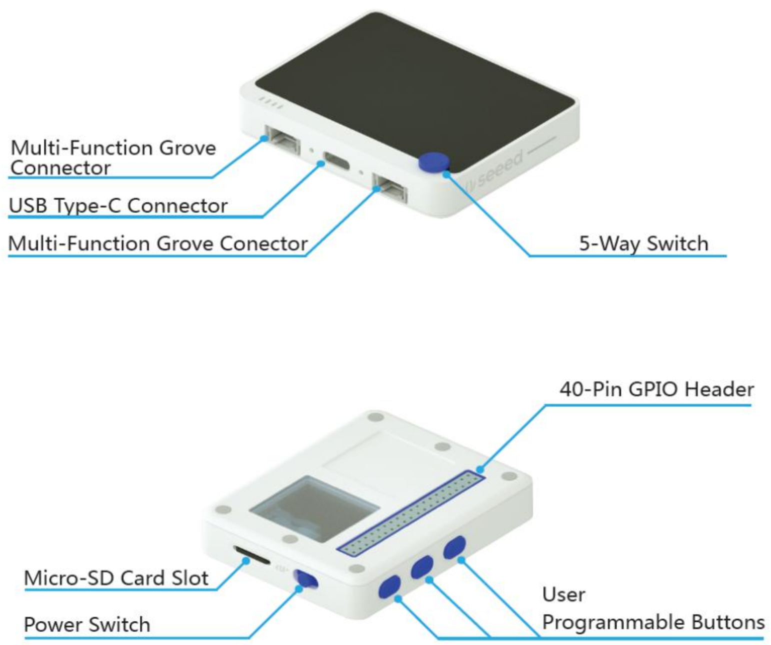

Figure 1: Seeed Wio Terminal

Figure 2: USB Type C Cable

GETTING STARTED

First, I installed [Node.js]() for windows then I tried installing Edge Impulse CLI but encountered node-gyp build errors on the command line so I manually installed [Python 2.7]() (I had Python 3 but apparently it is not supported yet) and Installed Visual C++ Build Environment: [Visual Studio Build Tools]() (using "Visual C++ build tools" workload) or [Visual Studio Community]() (using the "Desktop development with C++" workload). After installation, I launched `cmd` and typed in

`npm config set msvs_version 2017` then set the path to executable Python `npm config set python /usr/bin/python2.7`

After that I was able to install Edge Impulse CLI

`npm install -g edge-impulse-cli`

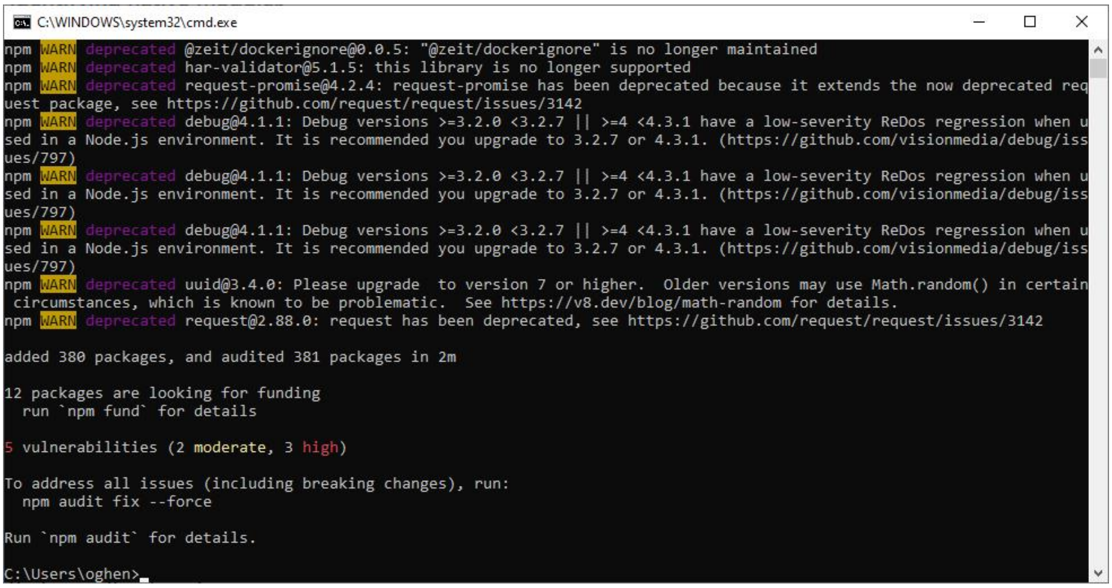

Figure 3: Edge Impulse CLI Installed

Then, I created an account on [Edge Impulse](), verified the account through my email and logged in. To connect the Wio terminal, I plugged it in and entered boot mode by sliding the power switch quickly twice then dragged the already downloaded Edge Impulse uf2 firmware file (`wio-terminal-ei-mic.uf2`) to Arduino drive.

I then launched Edge Impulse Daemon on `cmd` by going to a given location where the downloaded stand alone `node.js` is and executing `edge-impulse-daemon`.

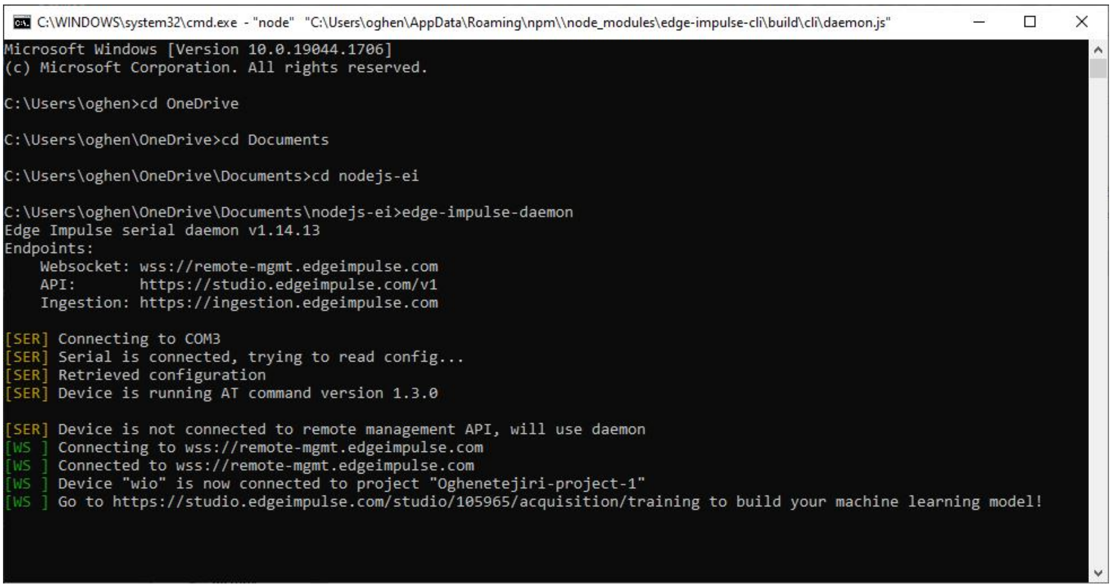

Figure 4: Launching Edge Impulse

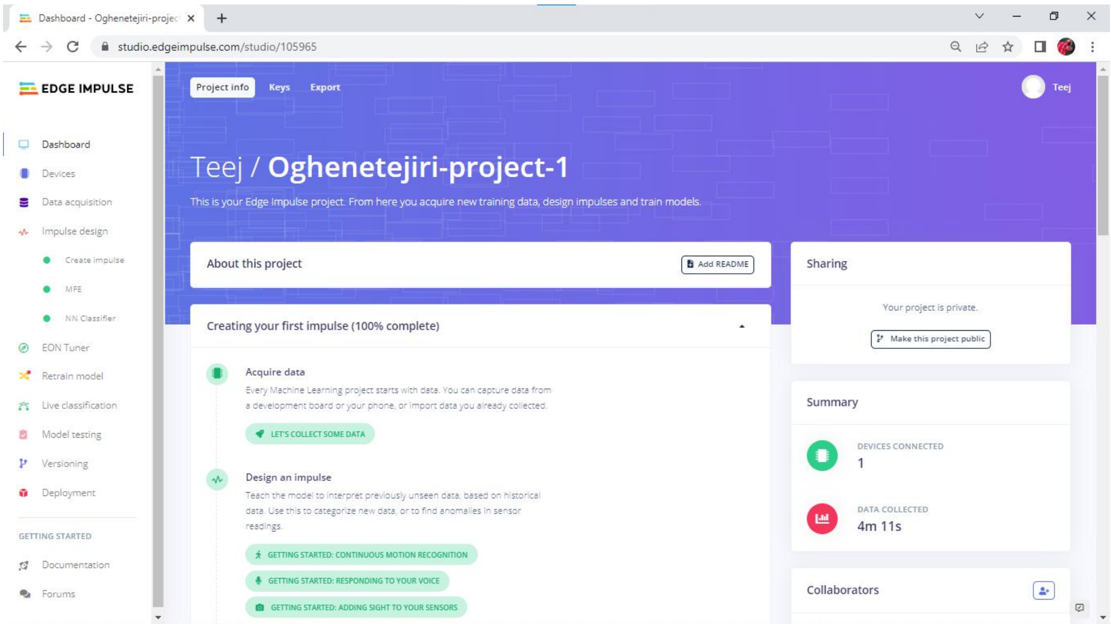

Figure 5: Dashboard

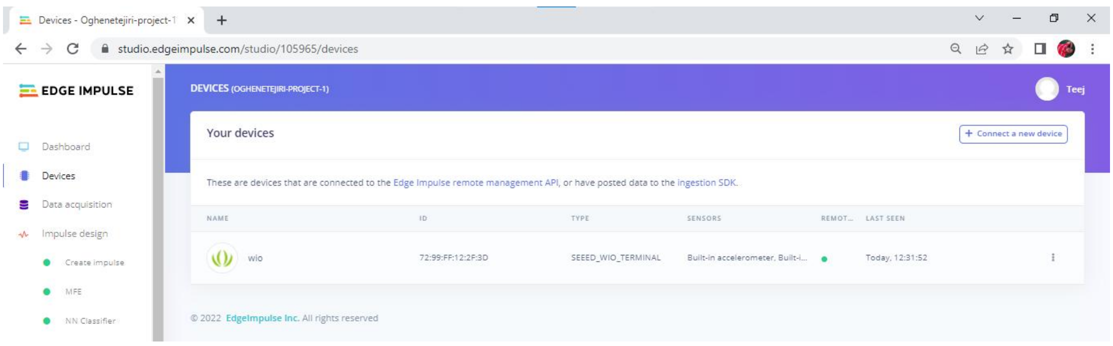

Figure 6: Wio Connected

DATA ACQUISITION

I download infant sounds from https://freesound.org/ and uploaded them. I also recorded silence dataset using the build-in microphone. I also ensured that all three datasets (baby cry, baby laugh, silence) were equal.

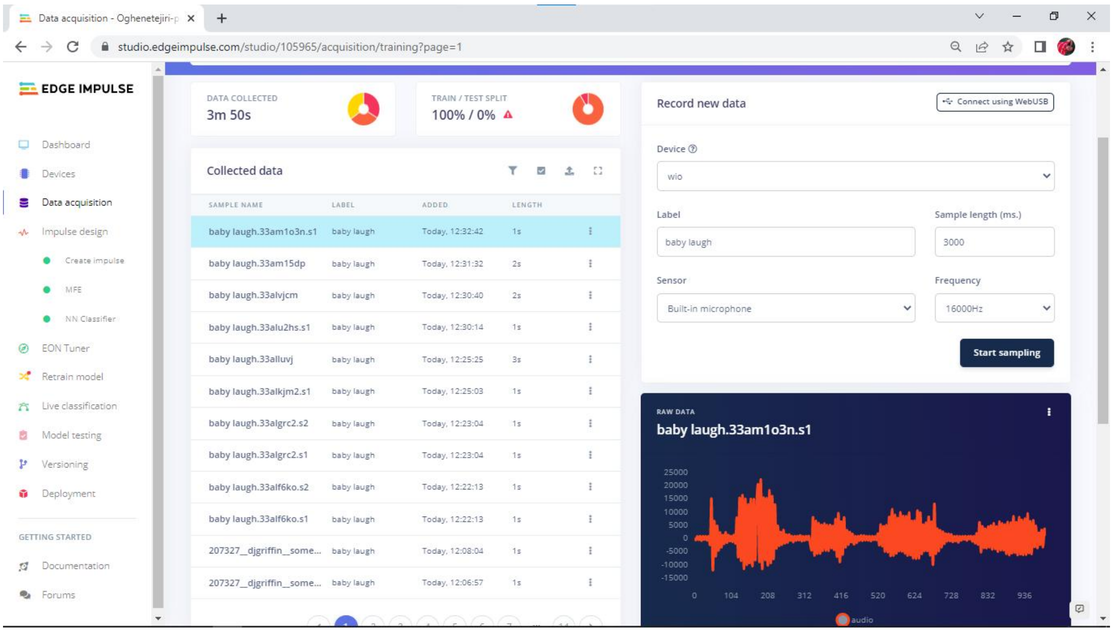

Figure 7: Data Acquisition

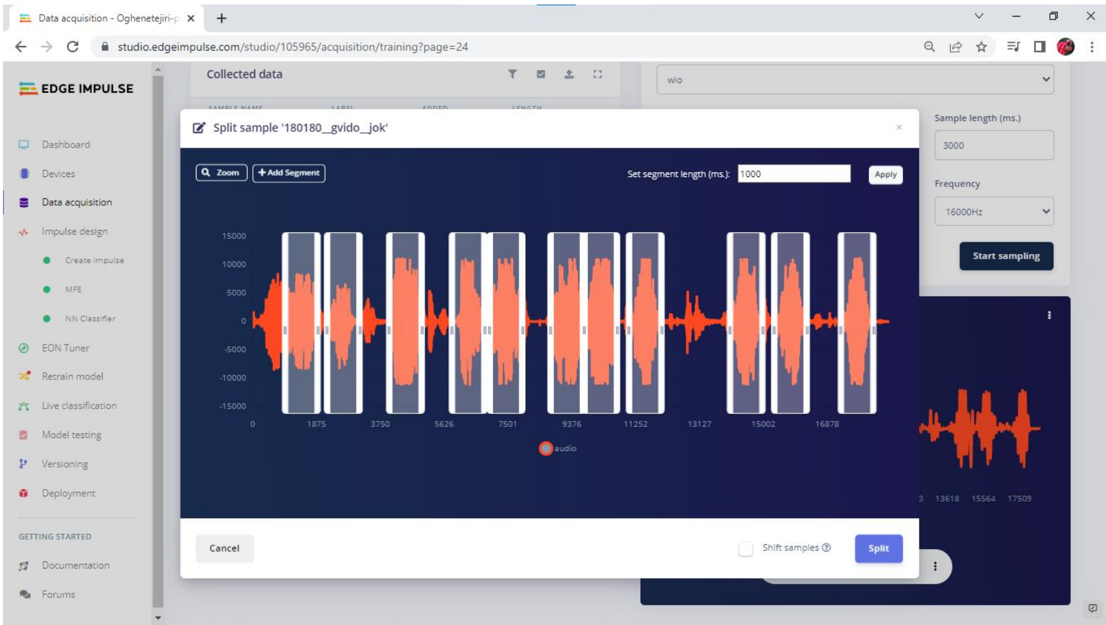

Figure 8: Spilt Samples

I then created the impulse with Audio MFE and Keras Neural Network Classifier,

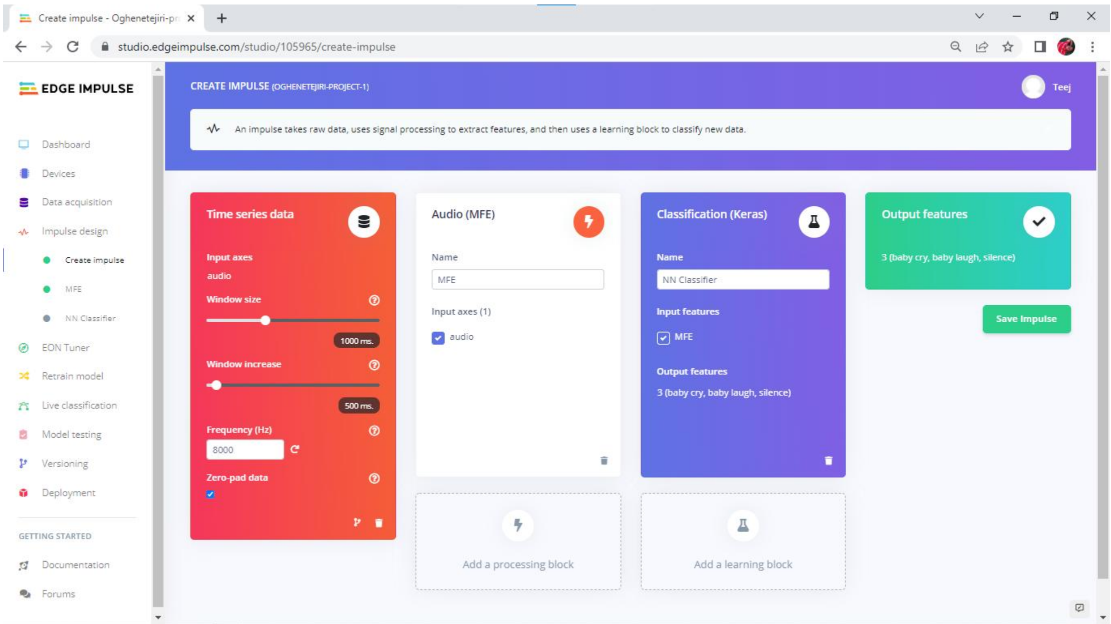

Figure 9: Create Impulse

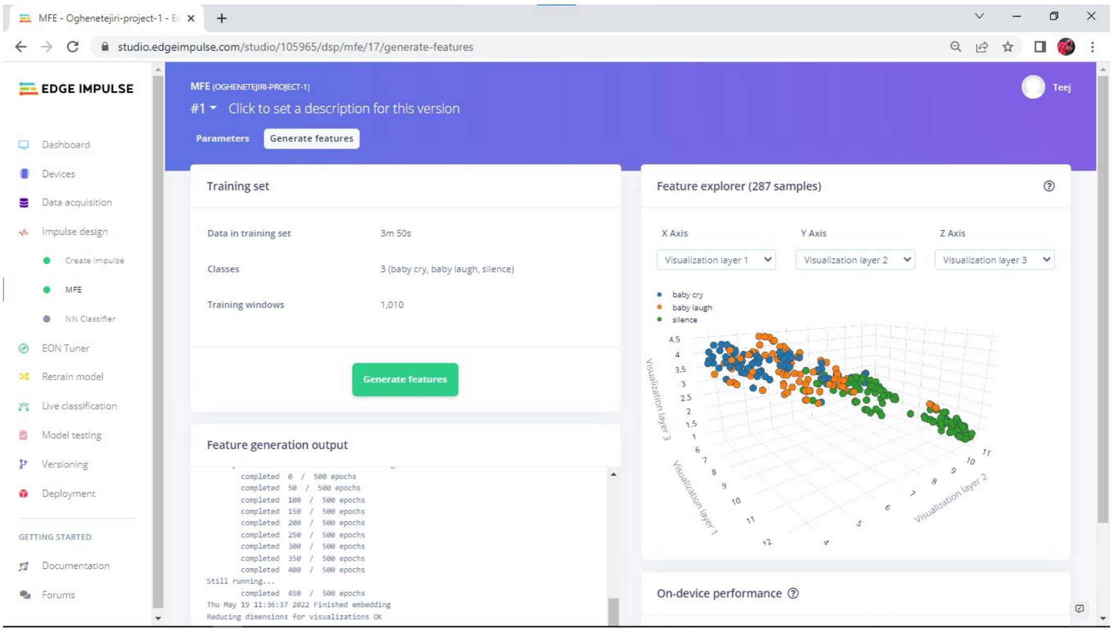

Figure 10: Mel Frequency Energy (MFE)

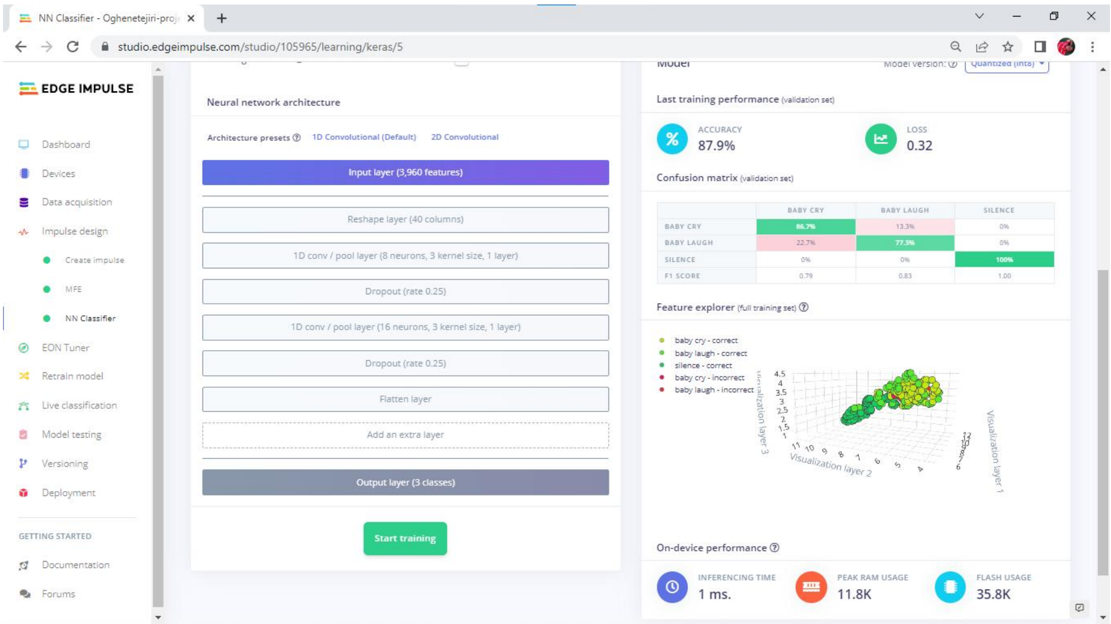

Figure 11: Neural Network Classifier

After creating the impulse I did a live classification to test it.

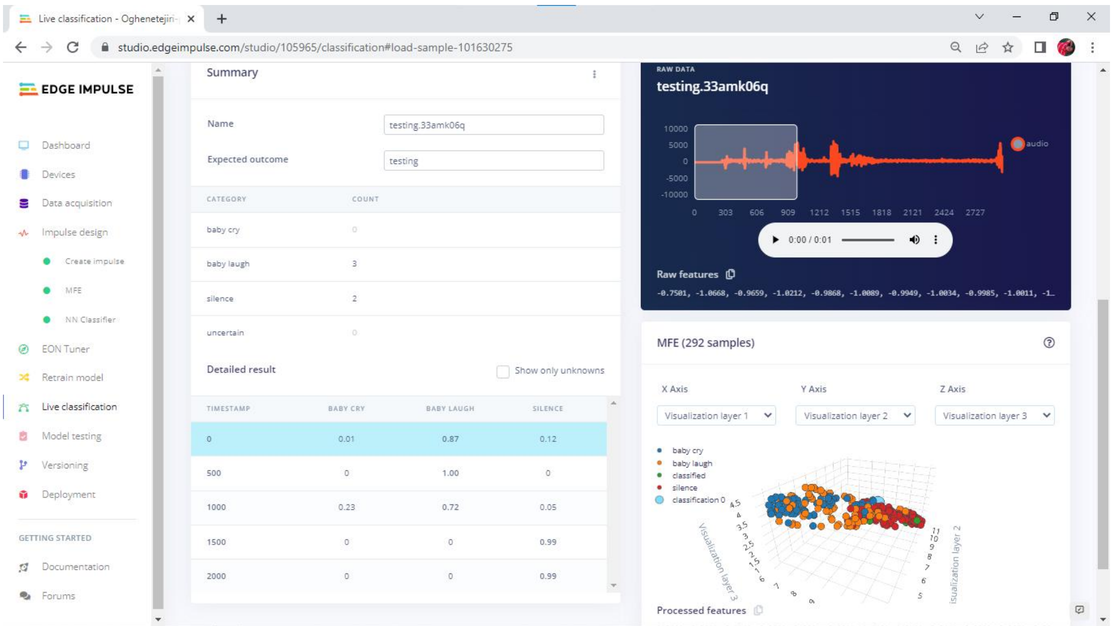

Figure 12: Live Classification

It worked!

I deploy the impulse and downloaded it as a zip file, including it as a library on the the Arduino IDE, rewrote the code giving on Moodle, restarted the Wio terminal and uploaded the code.

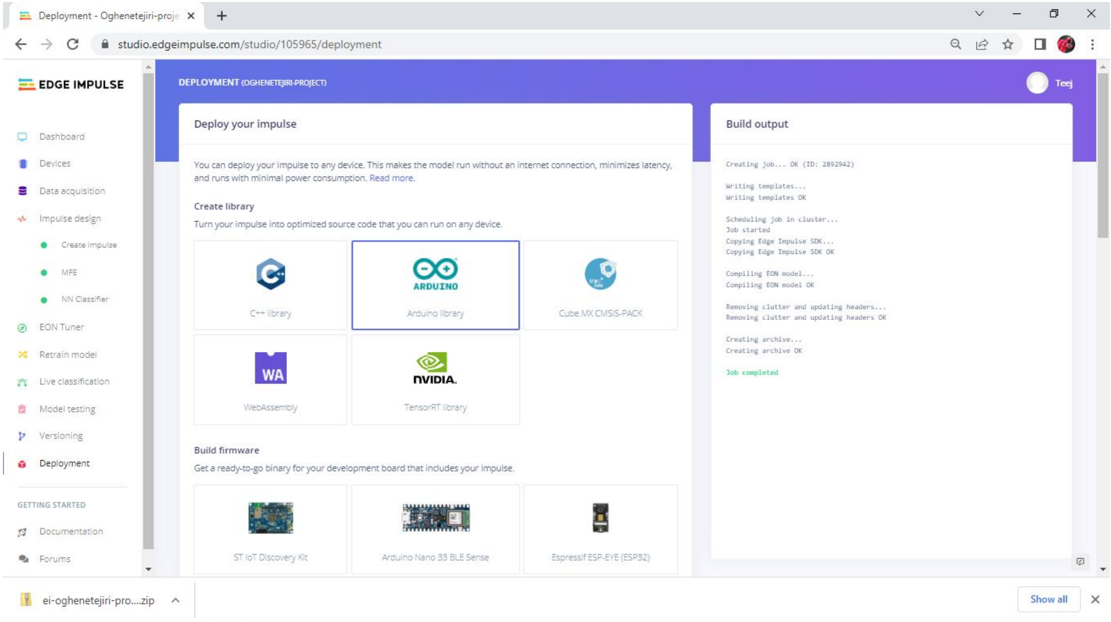

Figure 13: Deployment

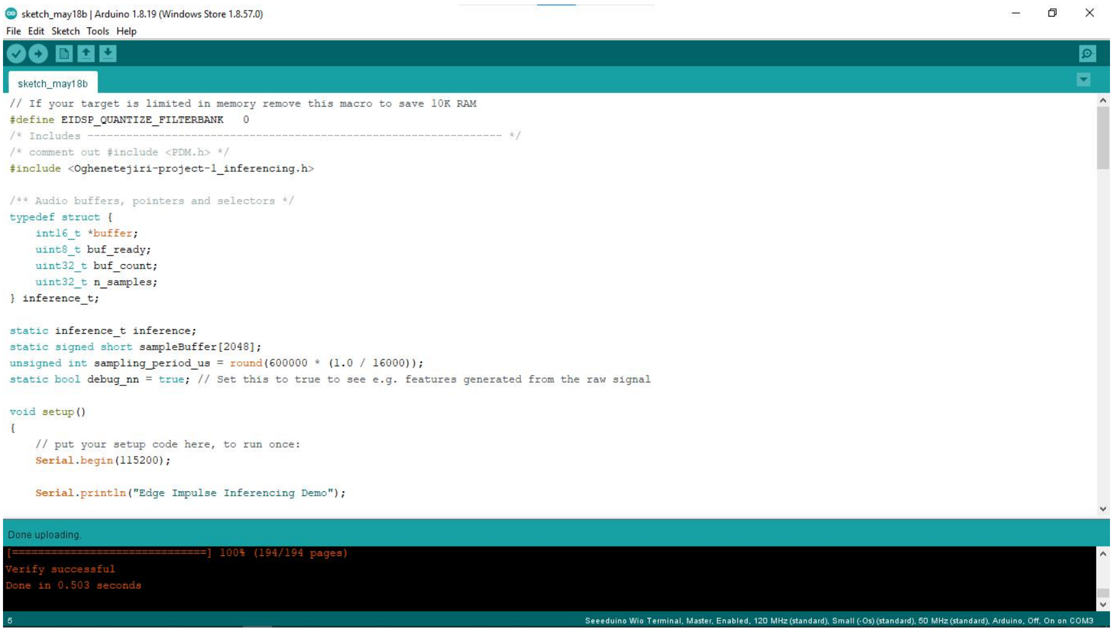

Figure 14: Code

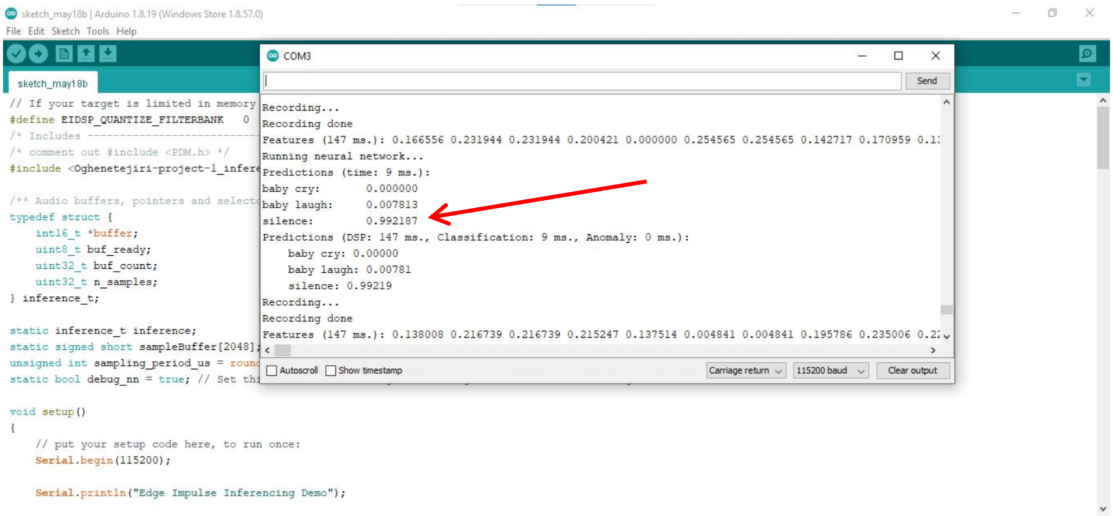

Figure 15: Silence

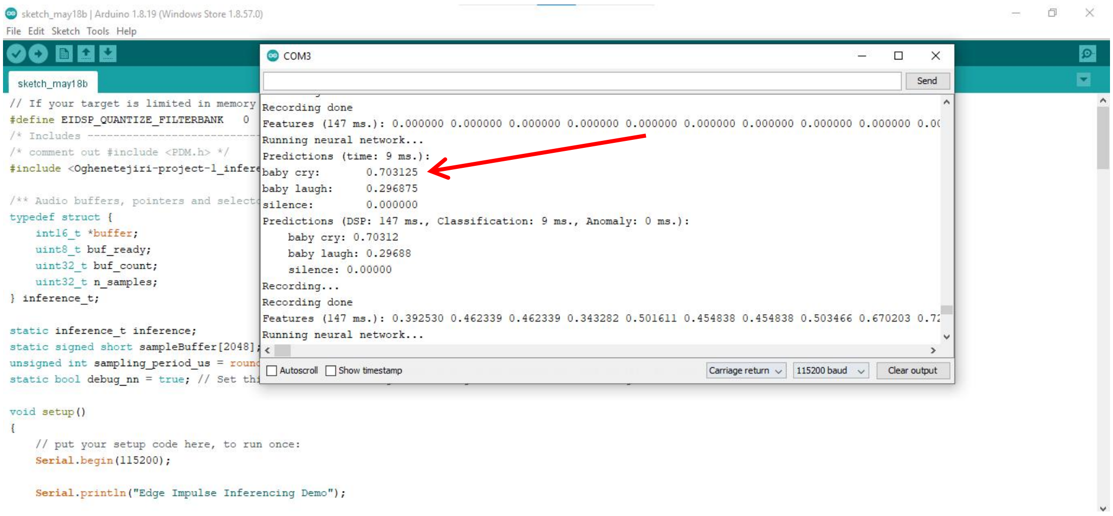

Figure 16: Infant Cry

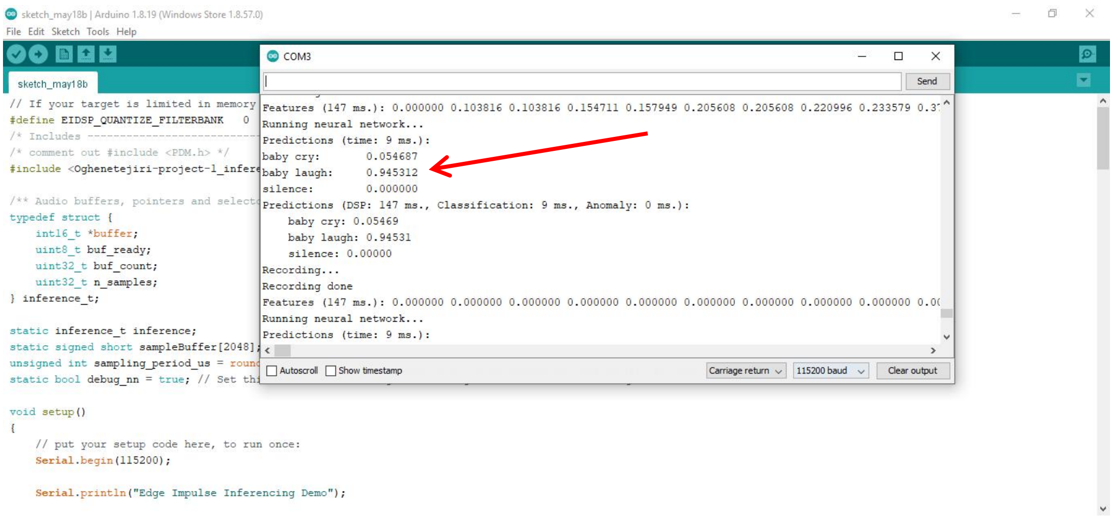

Figure 17: Infant Laugh