AIoT Case Study

(Artificial Intelligence on thoughts)

How AI is used to decode Brain Waves !!

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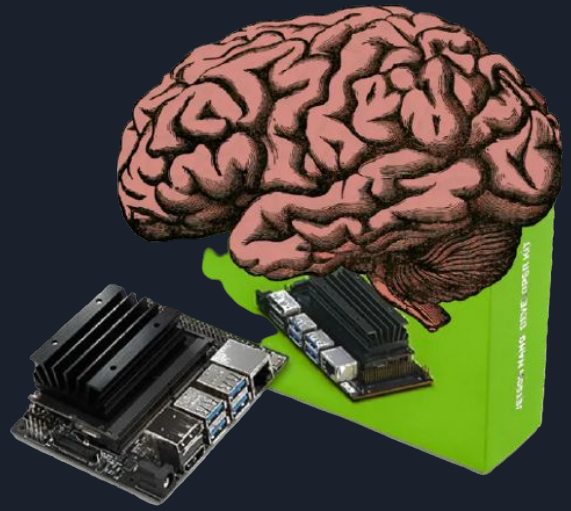
Overview



- What? (Objective)
- Why? (It's Necessity)
- How? (Brief on Implementation)
- Schematics & Working
- Applications
- Modifications (Adding many more modifications as we go ahead)

Cutting-edge artificial intelligence on the Jetson Nano used to decode brain waves on the edge for your very own brain-computer interface!

Project Objective

-To create an Artificial Intelligence (AI) powered device to directly interface our brain with our own hardware and software projects.

Why?

Deep Learning is revolutionizing many fields of Science and Technology.

By using ML , we can predict and classify natural process without building explicit models - something vital when the data is hard to interpret.

Example of such most complex object in the universe is -

Brain

The Problem

- Decoding Brain Waves is not easy!
- Out of MRI, EEG, FNIR, only EEG is accessible
- But the processing power of such devices is so low!

Implementation

We can do deep and complex analysis of EEG data, directly on a portable device connected to the Internet -- ***Jetson Nano***

Workflow

Setting up Hardware & Software

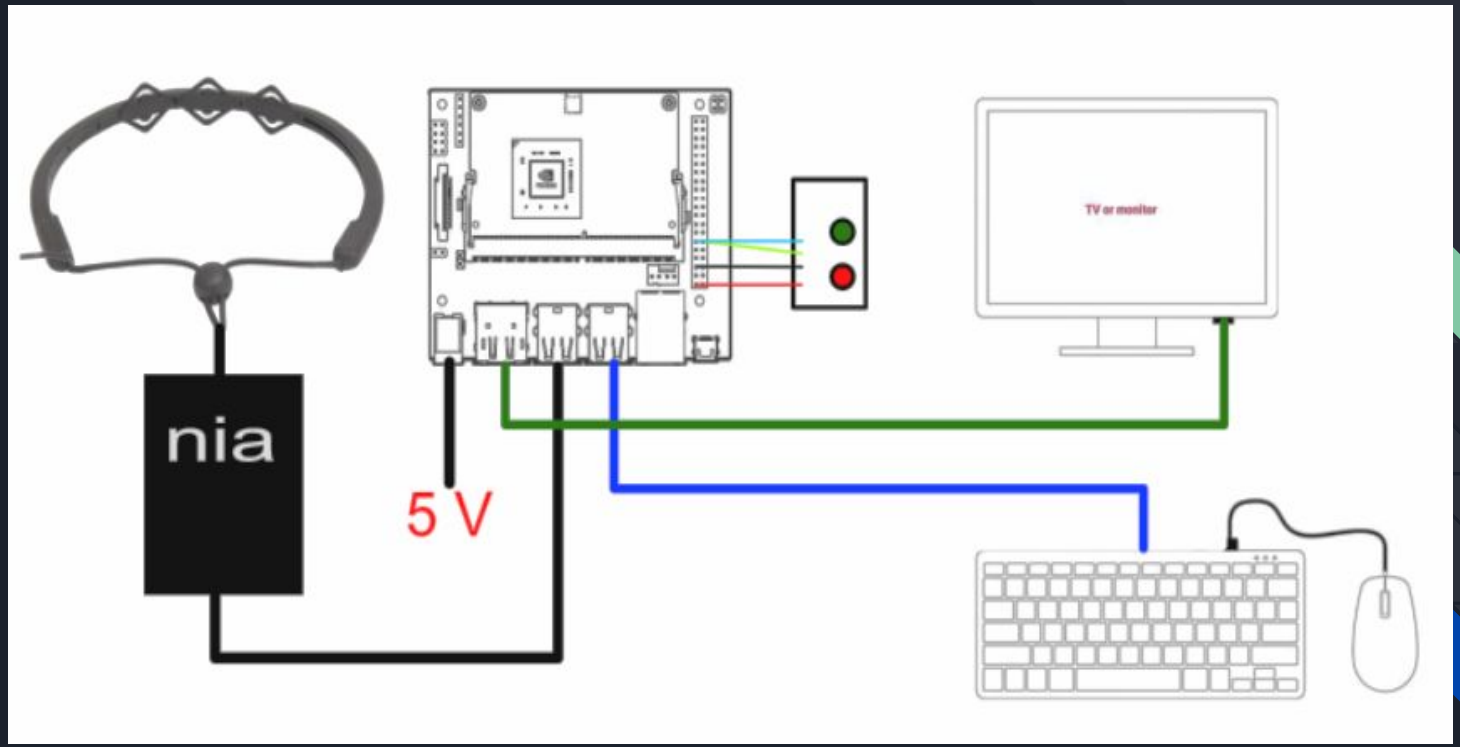
Training and Optimizing Data using Pytorch

Training Classifier & Controlling hardware with Mind.

Generating Data from Brain waves using EEG and Fourier representation

Data Acquisition & Representation.

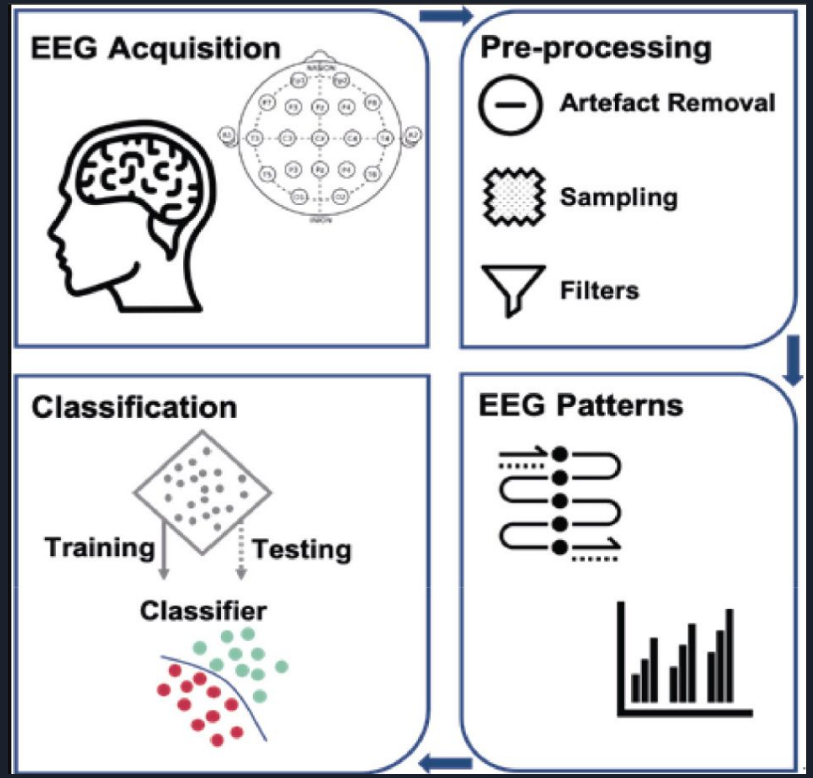
AIoT EEG Schematic



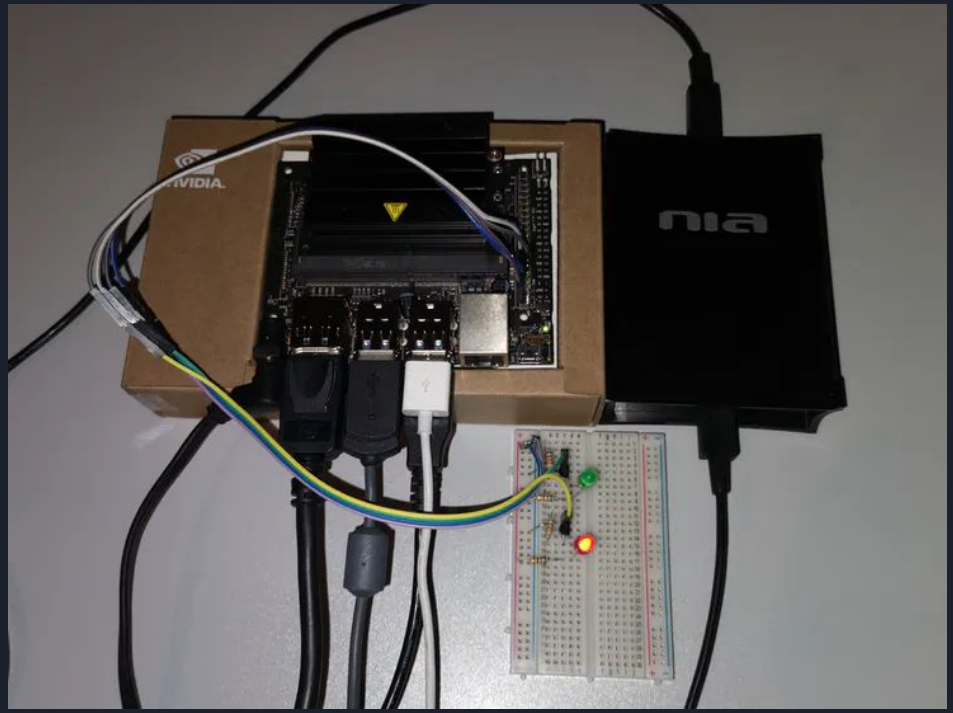
Using ML to process EEG

Machine learning, here primarily aims to automatically discover the brain patterns in a specific task without using traditional statistical methods.

The ML technologies in EEG-based brain computer interface (BCI) applications are usually classified into two major categories: classification, and individual adaptive tasks.



Circuit & 3-D Model of the System



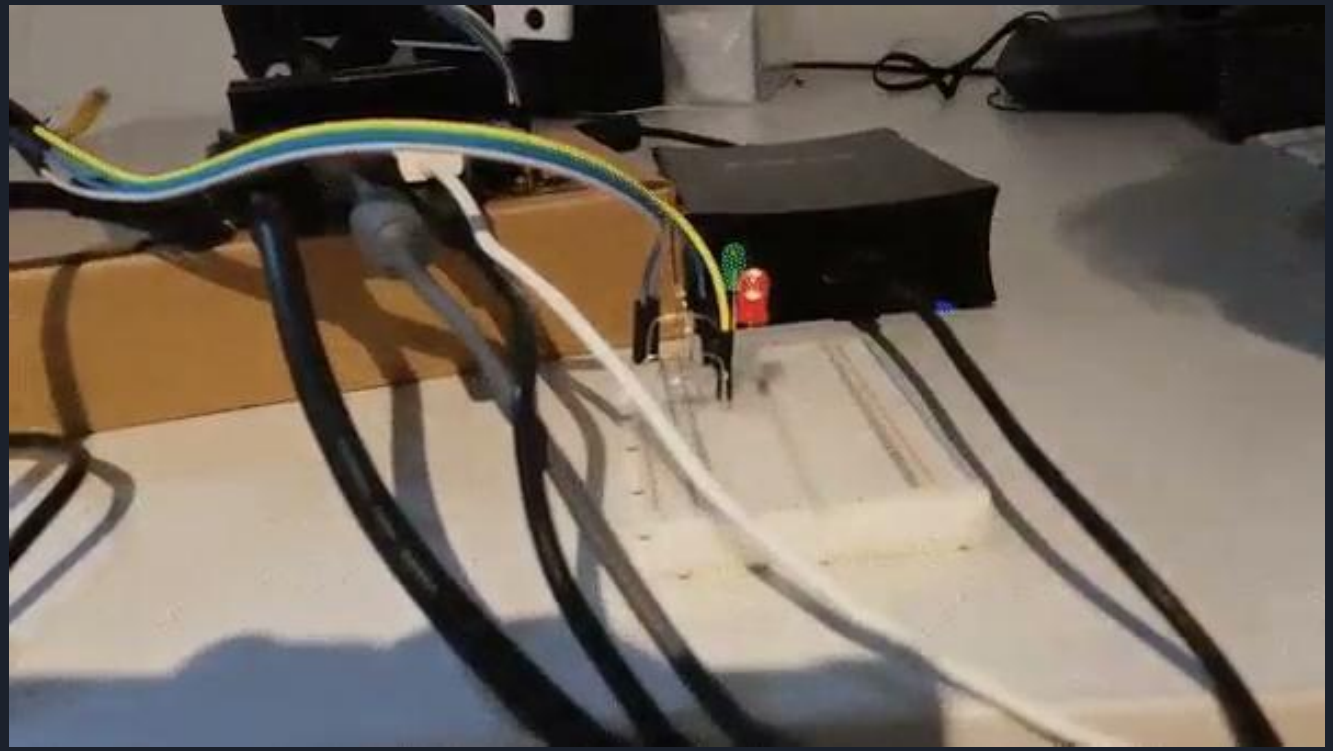
Sticking the electrode band on his forehead

Controlling hardware with our mind

Our goal is to-

- ➔ Analyze our brain waves through the Autoencoder
- ➔ USe the compressed vector to train a K-Means clustering Algorithm
- ➔ Use the classification results to control physical hardware!

We will control two LEDs, green and red using values output from a trained K-mean model which is fed Autoencoder data. We can use this as a biofeedback mechanism to learn to control the LED with our minds.



Video Representation of Project

Applications

- Can be used in sentiment analysis.
- Monitoring the function of brain for higher analysis.
- Further application in brain wave automation system.
- Using certain vibrations and EEG technique to relax the mind, reduce stress, increase attention and even help with learning.

Modifications

We can extend the project to-

- Analyse human emotions based on brain waves received
- Use the thoughts in brain to make any robotic movements.
- Can provide real time notification on user's state of attention.
- To diagnose and analyse the stress level in the person.
- Can be used for performance enhancement.

Conclusion

We learnt:

- how to read and signal process brain-waves
- how to build and train an autoencoder to compress the EEG data to a latent representation
- to classify the data to determine brain state using K-Means algorithm
- and used the above information to control physical hardware!

THANK YOU!

Q/A