

# An Intelligent System for Hearing Disorder Detection using Auditory Evoked Potential (AEP) Signals

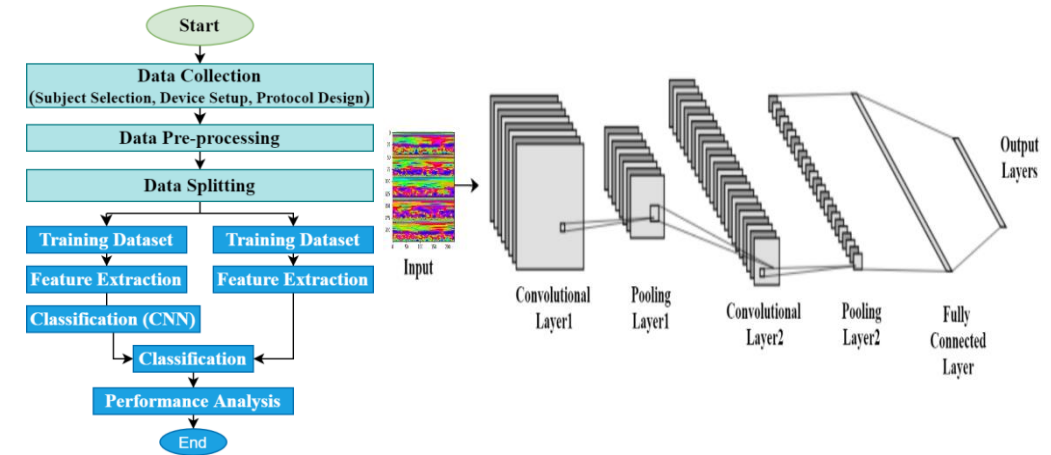
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## Product Background

- Approximately 466 million people have different kinds of hearing impairment in the world, and 34 million are children.
- Brain-computer interfaces (BCIs) are systems that link the human brain to external technology, which is the best way to address these concerns.
- Auditory evoked potentials (AEPs) are a type of EEG signal which has been commonly employed to detect early hearing disorder.

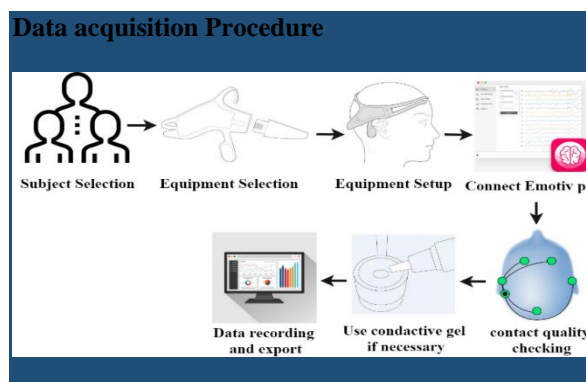
## State of the Art/ Methods



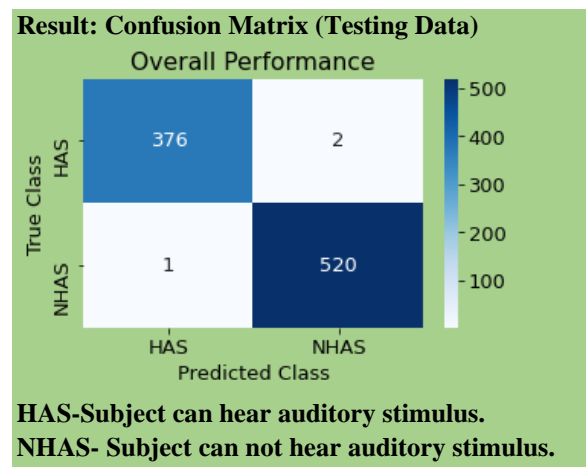
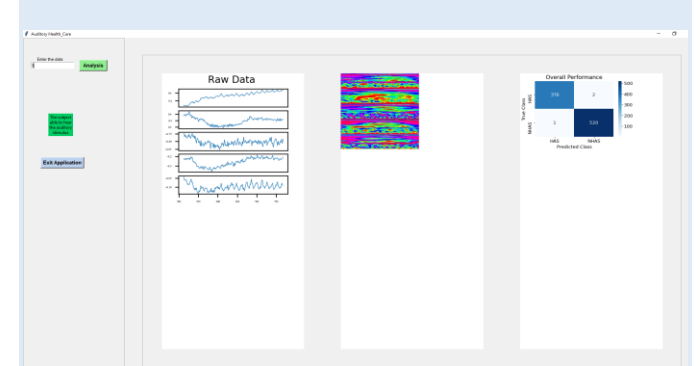
## Novelty/ Originality/ Inventiveness

- EEG-based AEP data analysis for hearing loss diagnosis system is still in research stage. No complete reliable product is not available in the market. Comparison with Available Products in Market.
- In the CWT base deep learning proposed approach, we achieved the height 99.63% accuracy, and compare to the exiting approach, this study achieved state-of-art performance.
- The graphical user interface (GUI) will make it easy to operate and test the hearing conditions.

## Product Image and Product Characteristics/Results



## Graphical User Interface for analysis of the Hearing Conditions.



## Data acquisition in a soundproof room



## Benefits/Usefulness/ Applicability

- This analysis to test the hearing's significance could be used to create more objective measurements in the form of evoked Potential (EP).
- Reasonable, User friendly, and Fast implementation.
- Save human effort and clinical time, easy to handle.
- People can test the hearing condition in the initial stage and be aware.
- This Light Weight model requires low time to test the hearing conditions.

## Environmental Impact

- This proposed method and the full system can help people to check the hearing condition in the easiest way.
- It would benefit the social and economic impacts of the nation.

## Marketability & Commercialisation

- The system is already validated and achieved the high performance.
- This research is supported by Universiti Malaysia Pahang, Malaysia with the research grant RDU180396.

## Cost Analysis

Device Name	Price (RM)
Raspberry Pi 4	240
I EMOTIV Insight 5 Channel Mobile Brainwear®	1196
<b>Total</b>	<b>1436</b>

## Status of Innovation

- With the help of collected AEP data, training the model and testing the model performance is done.
- The graphical user interface (GUI) is ready and in progress to build the real-time device for commercializing.

## Publication

- M. N. Islam et al., "Empirical Mode Decomposition Coupled with Fast Fourier Transform based Feature Extraction Method for Motor Imagery Tasks Classification," no. December, pp. 256–261, 2020, doi: 10.1109/icset51301.2020.9265370.
- M. N. Islam et al., "Hearing Disorder Detection using Auditory Evoked Potential ( AEP ) Signals," pp. 11–16, 2020, , doi: 10.1109/ETCCE51779.2020.9350918.
- M. N. Islam et al., "Analysis of Auditory Evoked Potential Signals using Wavelet Transform and Deep Learning Techniques," in the 8th International Conference on Robot Intelligence Technology and Applications. (RiTA2020).[Accepted].
- M. N. Islam et al., "Auditory evoked potentials (AEPs) Response Classification: A Fast Fourier Transform (FFT) and Support Vector Machine (SVM) Approach," in 12th National Technical Seminar on Unmanned System Technology 2020 (NUSYS'20). [Accepted].