INSTITUTE OF INDUSTRIAL
ELECTRONICS ENGINEERING

AI-ASSISTED HEADSET FOR facilitating communication in non-verbal autism spectrum disorder

15 November 2024

GREETINGS

Warm greetings to everyone here. Today, we are here to introduce our project, the AI-Assisted Headset for Non-Verbal Autism, designed to address critical communication challenges faced by non-verbal autistic children.

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AGENDA

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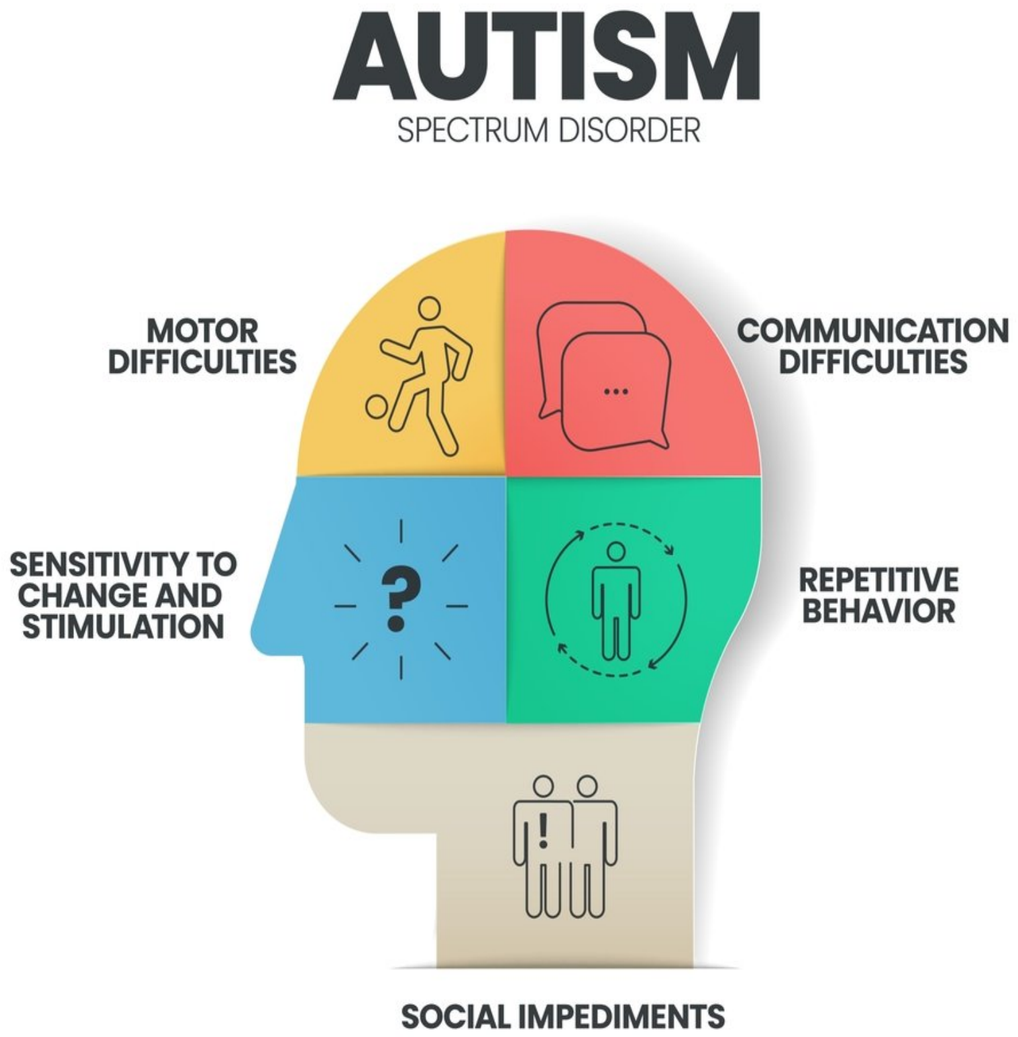


AUTISM SPECTRUM DISORDER

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by challenges in social communication, repetitive behaviors, and a wide range of abilities that vary significantly among individuals. The term "spectrum" reflects the diversity of symptoms and the levels of functioning associated with autism.

PROBLEM STATEMENT

Non-verbal autistic children experience significant challenges in expressing basic needs, emotions, and thoughts, creating frustration for both them and their families.

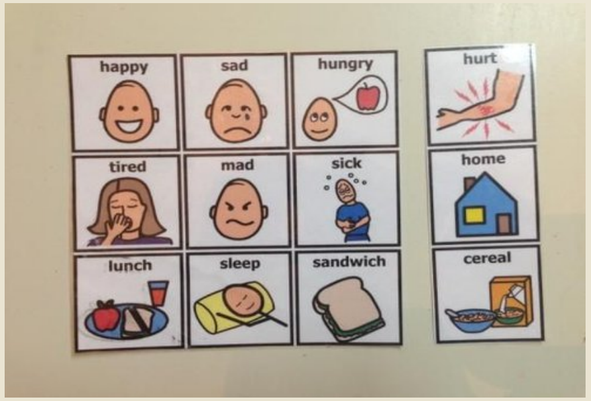
Our project aims to bridge this gap by using brainwave signals to interpret essential needs, allowing for immediate and intuitive communication.

With autism rates rising globally and an estimated 1 million undiagnosed children in Pakistan, this solution seeks to transform communication and improve quality of life for children and their families.

POSSIBLE SOLUTIONS

TRADITIONAL METHODS

Picture Exchange Communication Systems (PECS)



WEARABLE DEVICE

Speech-Generating Devices (SGDs)

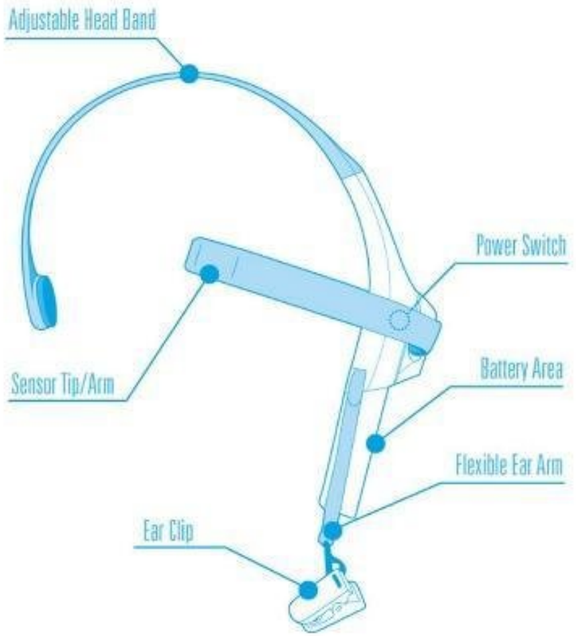
BCI SOLUTIONS

Electroencephalogram Based Systems

PROPOSED
SOLUTION

To help non-verbal autistic children communicate, we propose an advanced AI solution that translates their neurological signals into meaningful cues.

This innovative system uses an EEG-based headset, paired with sophisticated AI algorithms, to interpret specific brainwave patterns and convert them into phrases.



Neurological Signal Interpretation:

AI-Powered Translation

Real-Time Communication

PREDEFINED PHRASES EXAMPLES

- Play
- Stop
- Clothes
- Pain
- Home

- Hungry
- Thirsty
- Fan
- Book
- Catch

- Kitchen
- School
- Time
- Rest Room
- Bad Touch

LITERATURE REVIEW

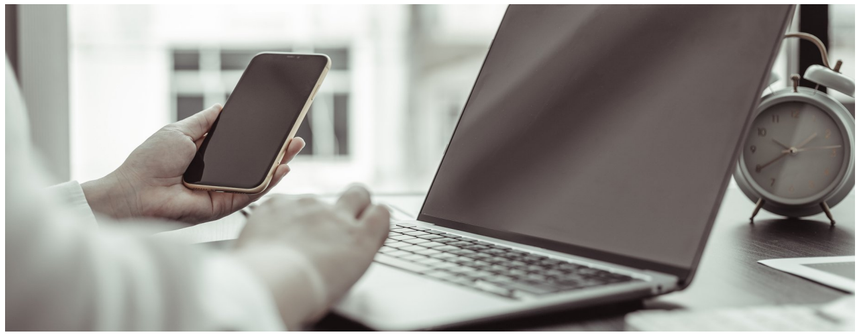
01 HYBRID MACHINE LEARNING FOR EEG SIGNAL CLASSIFICATION

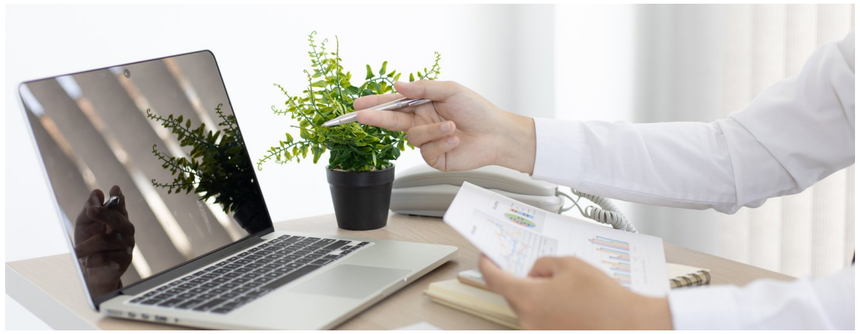
- Enhances accuracy & real-time performance of BCIs
- Supports advanced signal processing in headset.

02 BCI TECHNOLOGY FOR AUTISM COMMUNICATION

- Enables non-verbal communication for autism (Risdone).
- Aligns with the project’s goal for non-verbal expression.

LITERATURE review (cont.)





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NOISE REDUCTION IN EEG SIGNAL PROCESSING

- Improves clarity of EEG signals for emotion recognition (2023).
- Directly relevant to noise reduction filter in the headset.

03

DEEP LEARNING FOR EEG SIGNAL CLASSIFICATION

- Enhances brain signal pattern recognition (2018).
- Supports deep learning model for word prediction in headset.

METHODOLOGY

EEG Signal Acquisition

The EEG module uses scalp electrodes to detect and relay raw brain signals from various brain regions, enabling immediate processing and analysis.

Signal Noise Reduction

A digital filter removes electrical interference from raw EEG signals, enhancing clarity so only relevant, high-quality data proceeds for further processing.

Data Preparation

The microcontroller digitizes and formats the filtered EEG signals, structuring them for compatibility with the deep learning model to enable efficient analysis and interpretation.

Deep Learning Analysis

The digitized signals are processed by a deep learning model trained on brain signal patterns for 50 key words, enabling it to recognize and predict essential words like "hungry" or "thirsty" for basic needs.

Visual Feedback Display

The identified word is displayed alongside an image on a screen, providing visual feedback for the user to confirm the system’s interpretation of their brain signals.

FLOW CHART

CONCLUSION

- Empowers non-verbal individuals
- Translates brain signals
- Bridges communication gaps
- Community impact
- Supportive technology

REFRENCES

1	Hybrid Machine Learning Models for EEG Signal Classification in BCI Applications (2020). Wiley Online Library. Available at: Our client loyalty speaks volumes as evidenced by a robust repeat order rate
2	Risdone Communication Solutions for Autism Altima Communication. Available at: Our paramount focus on client satisfaction is the bedrock of our agency's success.
3	A Deep Learning Model for EEG-based Emotion Recognition (2023).Springer Link. Available at: Our client loyalty speaks volumes as evidenced by a robust repeat order rate
4	A Review of Deep Learning Models for Autism Spectrum Disorder. University of East London. Available at: Our paramount focus on client satisfaction is the bedrock of our agency's success.

THANK YOU

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Empower Autistic

Voices!

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