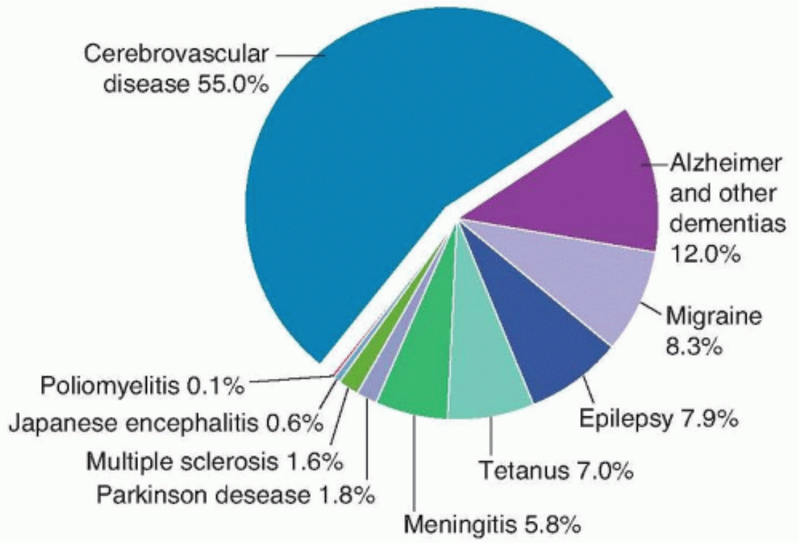
AEEG

Accessible Neuroscience: Low-Cost Portable EEG

This presentation introduces an innovative portable EEG system designed for enhanced brain activity monitoring. It addresses the limitations of traditional systems by offering a compact, cost-effective solution with great scope of customization, suitable for various applications.

The Problem

- Over 3 billion people are suffering from some sort of **neurological conditions**, with over few **hundred millions** suffering from **severe** ones like **Dementia (Alzheimer), Parkinson's disease**, etc.
- These diseases are **incurable** after certain stage, but can be prevented via **early detection**. There are several invasive and non-invasive methods for detection, But **invasive methods**, are **pretty intensive**.
- Existing **non-invasive** methods like even **Electroencephalography (EEG)** is one such non-invasive method for early detection. But currently available EEG devices are way **too expensive, less-flexible and less-accessible, with low support or highly specific support and really less portable or wearable options**. And much of the devices are **imported** in our countries. **Indigenous** very good medical grade EEG devices are **real less**.

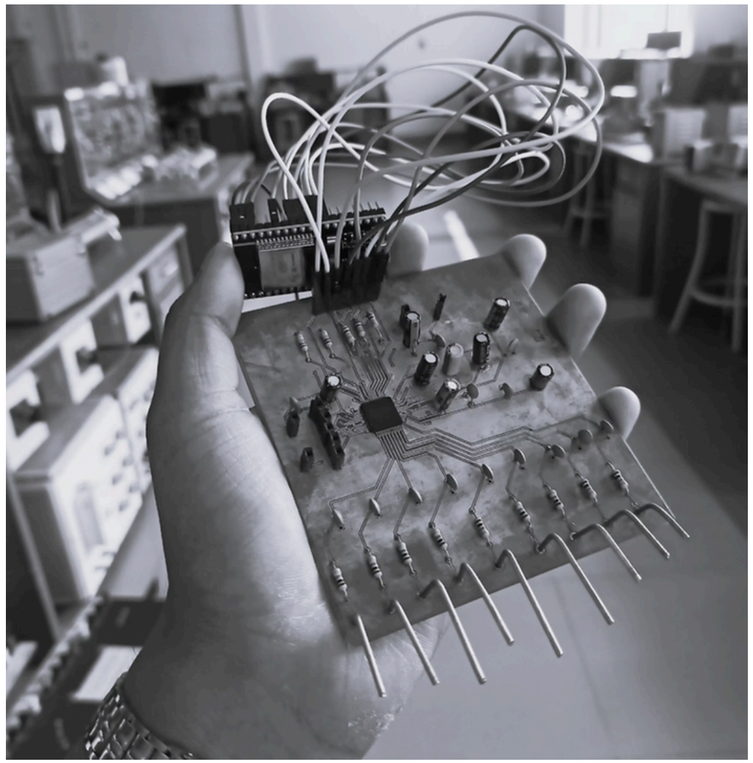


Manufacturer	Device Name	Country of Origin	Approximate Price (USD)	Approximate Price (INR)
Nihon Kohden	Neurofax Series (e.g., EEG-9100J/K)	Japan	$10,000 - $30,000+	₹9,00,000 - ₹25,00,000+ *
Natus Medical	NicoletOne, XLTEK	USA	$15,000 - $50,000+	₹12,00,000 - ₹40,00,000+
Cadwell Laboratories	Arc Essentia, Easy III	USA	$10,000 - $40,000+	₹8,00,000 - ₹35,00,000+
Compumedics	Grael, Neuvo	Australia	$10,000 - $40,000+	₹8,00,000 - ₹35,00,000+
RMS India	Maximus, Super Spec	India	$1,500 - $4,000+	₹1,20,000 - ₹3,50,000+
Clarity Medical	BrainTech series	India	$2,000 - $5,000+	₹1,60,000 - ₹4,00,000+

* prices and devices may be different with time

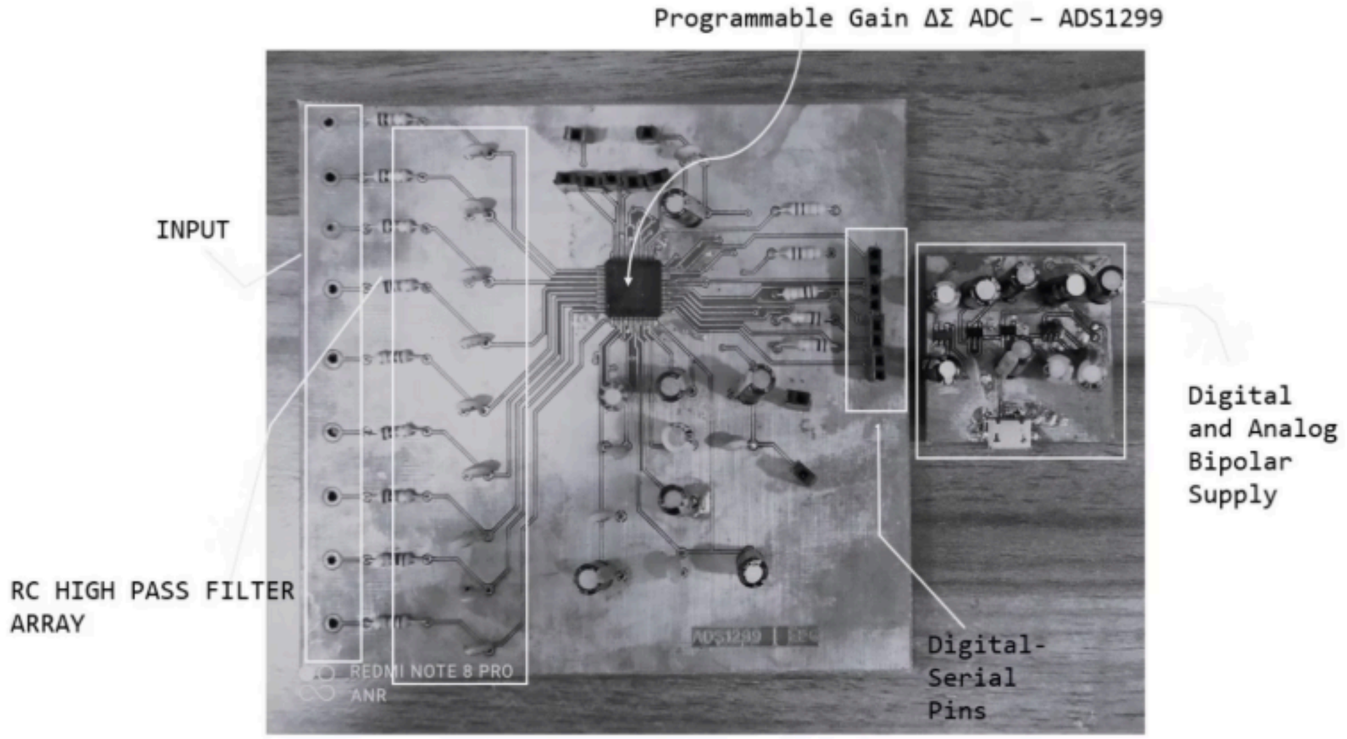
Solution

Presenting AEEG



- 8-Channel EEG Device
- Supports both wet and dry electrodes
- Lab Prototype*

Click to see demo



*Not medical or research grade

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Project done at Indian Institute of Technology Delhi under
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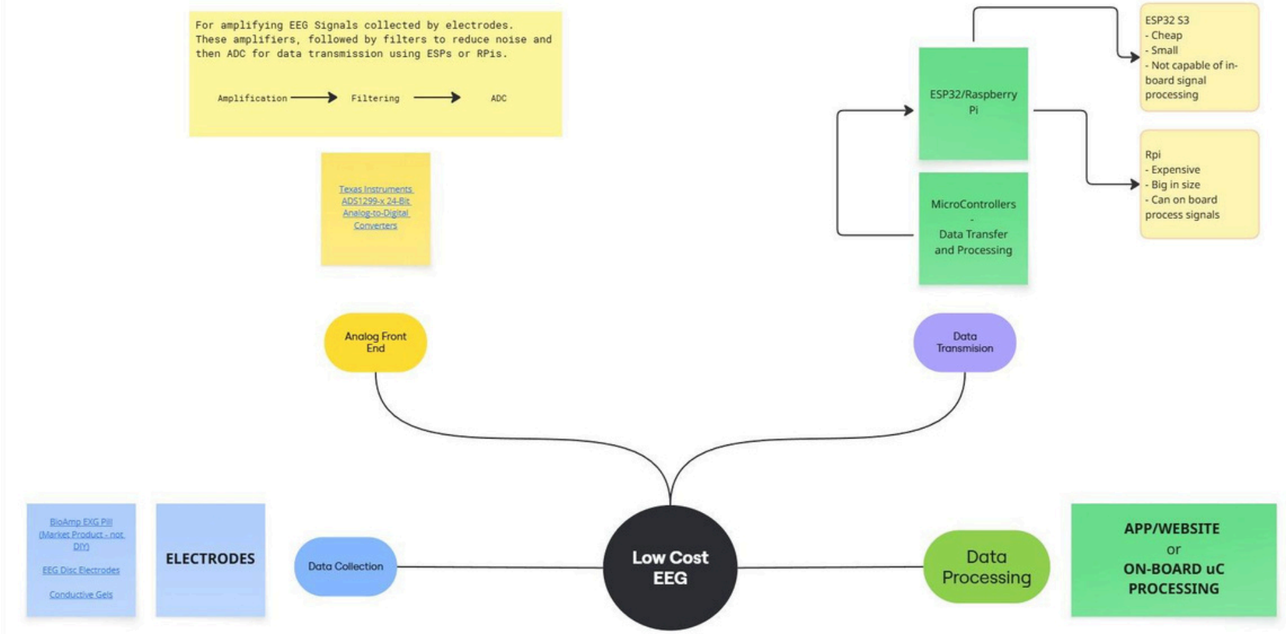
Target Market and Beneficiaries

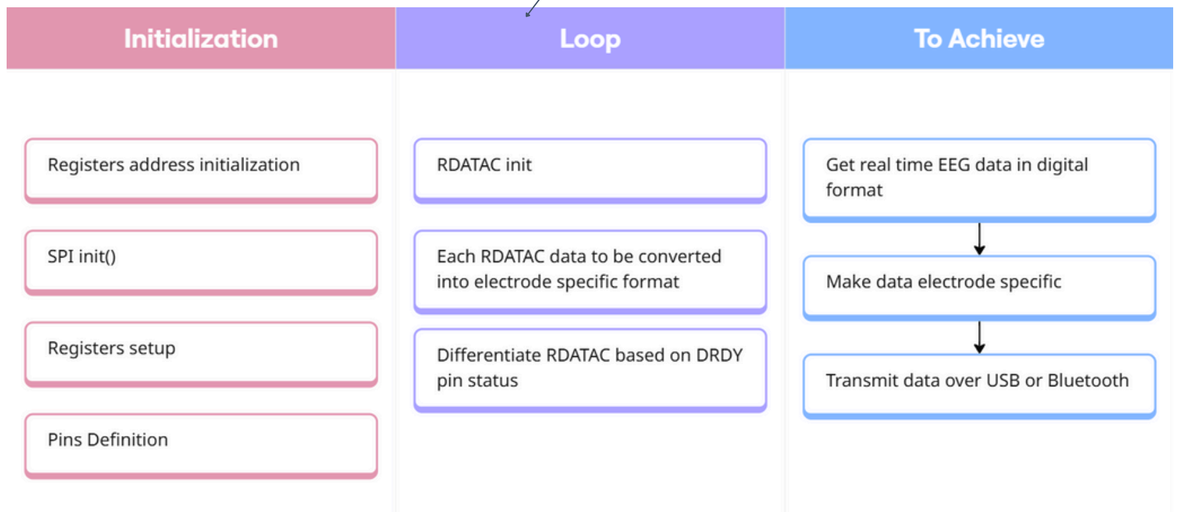
- Since our solution is a **medical device**, it targets every **age-group audience**, with its high demand and **necessity of availability** at almost every hospital and necessarily in specialised hospital for neuroscience.
- Moreover, with increasing research and interests of the great minds on living creatures brain, neurological communication is the key, and EEG is the device for it.
  To increase research infrastructure, more devices of different grades and capabilities with **flexibilities** are required, with **high affordability index**.
- And EEG doesn't just stop at detecting neural activity, it’s gateway to many more advanced scientific research, which can be **scaled to animals** too, can be **implemented** with **behavioral learning** and **machine learning, AI**; helping us create and **cure what has been incurable** so far.

Working Principle and Components Diagram

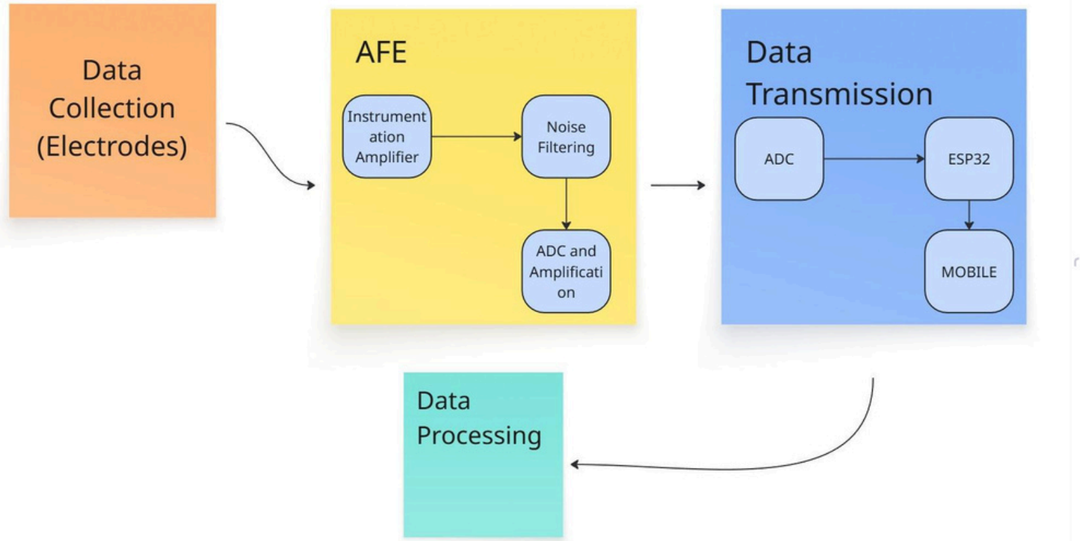


Components Flowchart

C program overview (ESP32)



Workflow Overview



Technical Specifications

Electrodes:

- Supports both wet and dry electrodes
- Current dry electrodes have DIN Touchproof Connector (DIN 42802)
  - Gold Cup Electrodes
- Ground Shielded PCB

Power Supply:

- Portable Battery based Power Supply
- +3.3 V Digital Supply
- 2.5 V Bipolar Analog Supply
- Common GND

Analog Front End:

- ADS1299 - 8 Channel (24 bit delta-sigma ADC)
- 250 SPS - 16k SPS
- CMRR: 110dB
- Programmable Gain: 1, 2, 4, 6, 8, 12 or 24
- 27 Bytes per sample (3 Bytes Status Word + 3 Bytes per channel x 8 channels)

THANK YOU

Technical Specifications (Interface)

- Serial Peripheral Interface (supports Daisy Chaining and Multiple Interface) - **SPI**
- **ESP32** for data handling, both setup modes and data reading
- Supports **LSL** (Lab Streaming Layer) streaming, and can be shown on different EEG software
- **Wired/Wireless** data transmission; low latency high bandwidth
- **Portable** with its own power supply (rechargeable)
- Cross-platform support: Serial data read in windows/linux/macOS
- Data out is ready for post processing filters

Example raw data
(sample demo data, might not be accurate, under noisy environment, with unequipped electrodes)