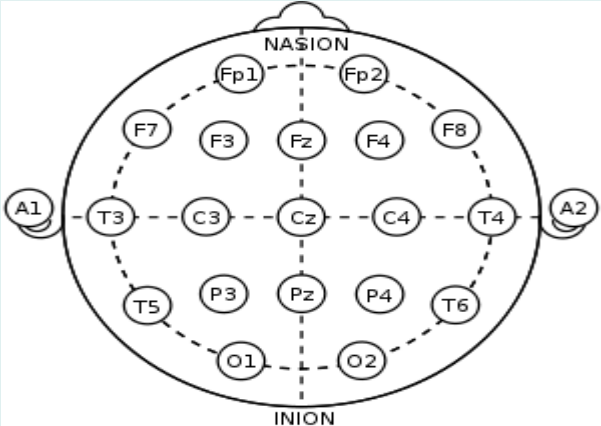


MINDSWITCH ?

A stand alone embedded system, a wearable device that will process the visualization of the person based on his/her EEG signals and interpret what action he/she wants to perform. The actions cover controlling home appliances. Our project aims at providing an aid to the such people move towards living an independent life.

Standards

The 10–20 system is an internationally recognized method to describe and apply the location of scalp electrodes in the context of an EEG test or experiment.



The letters F, T, C, P and O stand for frontal, temporal, central, parietal, and occipital lobes, respectively.

Lobe	Function
Frontal	behaviour, language and reasoning and long term memory
Parietal	knowledge of numbers and their relations, manipulation of objects and sense of touch
Temporal	emotion, new memories, retention of visual information and processing sensory input
Occipital	visual processing centre and visually stimulated tasks

The standard 802.11bgn comes into picture for the wireless communication between myRIO and wireless enabled embedded footprint for switching appliances.

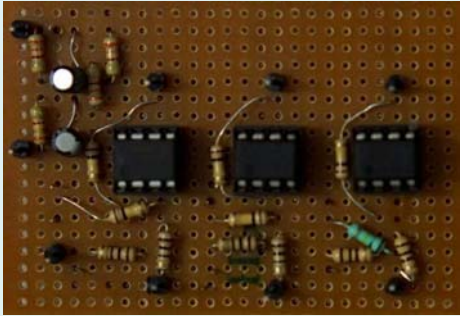
Electrodes

For our application, EEG signals are acquired from occipital lobe (O1,O2 and PZ positions). The Ag-AgCl disc electrodes were used along with an electrode gel to tap the electrical stimulus generated by the visual cortex. As per our requirement, a band consisting of three electrodes for O1, O2 and PZ position is made. Another small patch was made that can be worn on an ear as reference electrode.

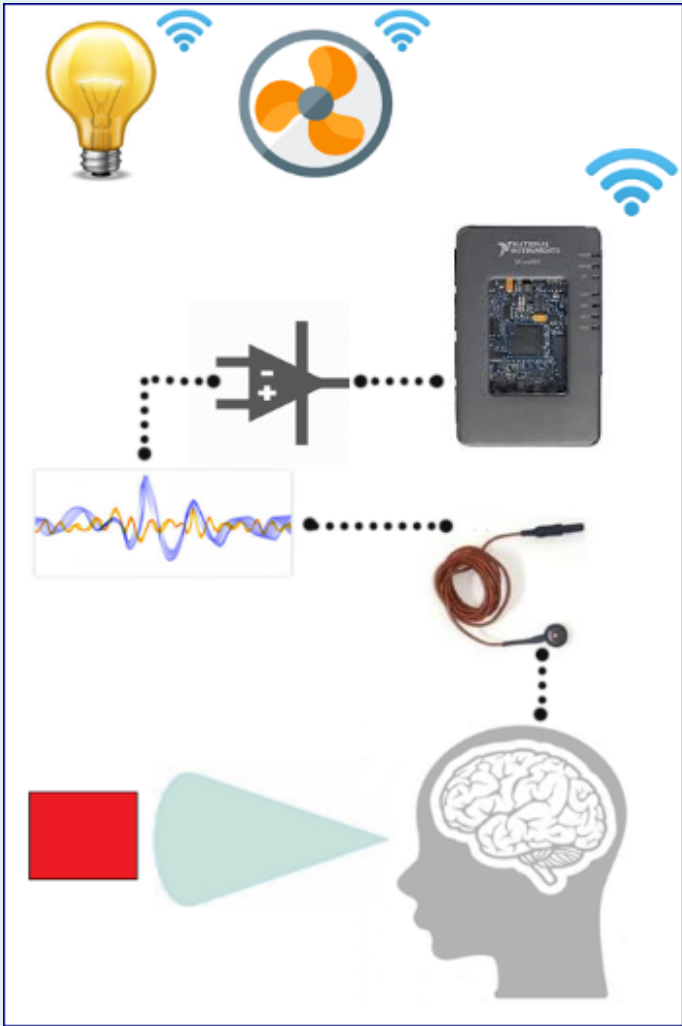


Preprocessing

Before passing EEG signals to myRIO, these signals are amplified to bring them in the voltage range for myRIO.



Proposed Design



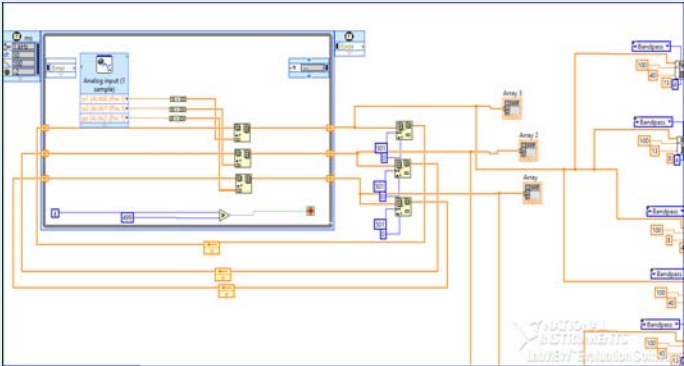
myRIO

myRIO performs the task of acquiring, filtering, processing, feature extraction and decision making in our product. The alpha, beta and theta components are obtained by filtering of EEG signals, which are further used for feature extraction. These features then aid in decision making process to find out the color viewed by the subject. The state of the appliances is toggled wirelessly through myRIO depending upon the decision made.



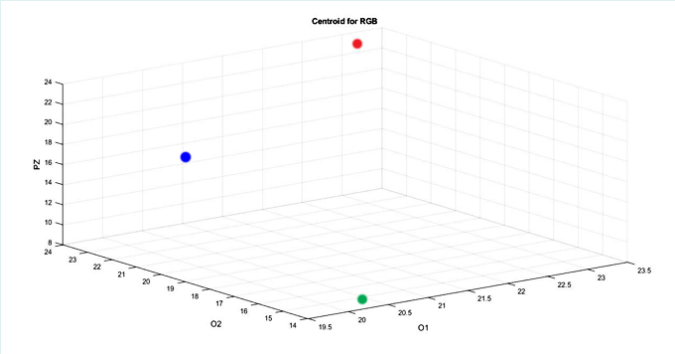
VI

Initially the acquisition was done through NI6363 DAQ which involved offline processing. In later stages, separate LabView VI's were made for real time testing and training for both NI6363 DAQ and myRIO.



Results

Successful results were obtained based on training and testing on many subjects, multiple times and with proper feature extraction. Red, Blue and green color clusters were clearly separable by the machine.



Confusion matrix showing 87 % accuracy when the system was tested with red and green color

Test Confusion Matrix			
Output Class	1	2	
	37 47.4%	9 11.5%	80.4% 19.6%
2	1 1.3%	31 39.7%	96.9% 3.1%
	97.4% 2.6%	77.5% 22.5%	87.2% 12.8%
	1	2	Target Class

Future Work

- Adding more colors (Magenta, Cyan and Yellow) to control more appliances
- Increasing accuracy in real time up to 98% with more training and testing.
- Customize the product in terms of its scalability, cost and also make it portable.
- Improving the system under improper illumination conditions

About US

We are a group from VIT Chennai exploring the domain of Bio signal processing, Brain computer interface, networking and embedded system design. We believe that only an amalgam of creativity and research can change the world for better.