# Monitoring Imbalance of Excitation & Inhibition in Epileptic Patients

## Background, Motivation, and Need

Epilepsy is a chronic disease characterized by seizures of increased electrical activity in neural networks in the brain. In terms of neural basis, epilepsy is associated with the imbalance between the factors that stimulate neural activity and those that inhibit neural activity. As a result of uncontrolled brain activity, seizures are caused by various organs in the body.

Measurements of brain activity using electroencephalography (EEG) are a major diagnostic tool in the treatment of epilepsy patients. During epileptic seizures, dramatic changes occur in electrical activity patterns measured by EEG. In the period between inter-ictal periods, we can see momentary events of sharp change in EEG, called spikes. To date, most of the diagnosis performed by neurologists is based on a visual examination of the measured EEG waves, and no advanced analysis tools have been used to extract informative measures from the raw activity. In addition, there is currently no EEG-based tool that provides advance warning and indication in the patient's home about the occurrence of an epileptic event in real time so that the patient can prepare in advance from a therapeutic and behavioral standpoint.

## Product, Contribution and Innovation

Developing a mobile EEG system that tracks indicators of brain activity in epilepsy patients and enables us to evaluate the effects of drugs and to predict approaching seizures. The system will be used in the patient's home and will transmit the information measured via the Internet for more thorough diagnosis by the attending physician and for optimizing the type, dosage and frequency of the drugs given to the patient.

The project included measurements of brain activity and data collection from epilepsy patients, where each patient is given a portable personal system for continuous use over a period of time. One aspect of the project was to focus on characterizing the effect of different drugs on the individual patient. Tracking the EEG parameters at the time of administration will allow predicting the effectiveness of the drug, and these predictions will be compared to the accepted estimates of neurologists. A second aspect of the project was to focus on predicting epileptic seizures. The proposed EEGs is incorporated into machine learning algorithms that is trained by predictive of impending seizures to be customized to each patient and take account of behavioral and therapeutic parameters. The project allows to examine the application of the system and its ability to assist both neurologists in streamlining the treatment process and adapting the drugs, as well as in patients preparing for an attack.

## Product and Its Potential Market

A home diagnostic device for monitoring brain waves for epilepsy patients. The expected product in the R&D process will include a wearable and portable system that will be mounted on the patient's head and monitor brain wave activity. The system will be convenient to the user and will not interfere with his daily activity. The data obtained in the test will be transmitted via a smart phone to a cloud-based database and will be analyzed using the algorithms developed in the study. The information will enable the doctor to determine a more effective adjustment of the drugs for follow-up treatment.
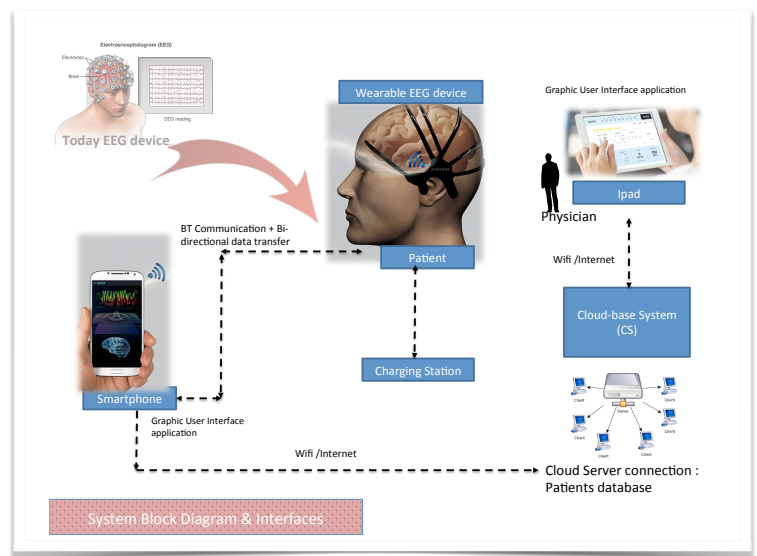


## Project and Patent Status

The algorithms have already been designed, implemented, and tested.

## Leading Researcher

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