Needs to acquire sufficiently accurate digital representation of an EEG signal

Each device will use two differential channels of active electrodes to acquire EEG data, remove initial noise and transmit it into a system of differential and linear amplifiers and frequency filters. The clarified EEG signal is then digitally sampled by an ADC which is governed by an attached microprocessor.

Needs to transmit output wirelessly to a base station

The internal microprocessor in the device must packetize the sampled data and pass it to a wireless RF device. The device will use a system of stable mesh network routing to reliably transport the packet to a base station device which can be attached to any standard personal computer. The radio must be selected for its range, as it should be capable of transmitting over a minimum range of 20 meters indoor and 50 meters line-of-sight. It should also be capable of supporting at least three simultaneous device users on one base station with one mesh network. This will be verified through bandwidth testing. The communication between each device and the base station should allow a maximum of 1 lost packet per 1000 attempts in order to maintain a high-resolution waveform. The network protocol should self-correct for lost packets and in the worst case indicate a failed connection.

Needs to operate for at least 24 hours of continuous use on a mobile power source

The device will utilize low-power components whenever possible, including a digital board which is designed to be passive or “asleep” whenever operations are not necessary. Analog components will be selected specifically for low current drain operation. The power source will be selected based on its energy density and low charge drain. The setup will be tested for its battery life and the number of batteries required will be altered as needed. The use of a low-voltage battery will serve as an added safety measure as it will circumvent any need for connection to live main wires.

Needs to allow user to control on/off function on each device

The device will have a user control switch that allows the user to control the basic on-off operation without being physically present at the base station.

Needs to allow base station user to control and configure network

The base station software will allow the addition and removal of device nodes from the network as well as the initiation and cessation of data collection.

Needs to display visual representation of acquired data

The base station software will include a graphical reconstruction of each device's EEG data. This may or may not be accomplished using third-party open source visualization software. In either case, it will be effectively easy to invoke and understand while still containing relevant information.