DIY - Hat for measuring EEG with dry electrodes for PiEEG

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Source https://github.com/Ildaron/EEGwithRaspberryPI

Keywords: PiEEG, EEG, BCI, machine learning, RaspberryPi

Introduction

This document provides step-by-step instructions on how to create a custom Hat for measuring electroencephalography (EEG) signals using dry electrodes, specifically designed for use with PiEEG [1,2,3]. Creating your own Hat for measuring EEG signals with dry electrodes is an affordable and customizable solution for capturing EEG data. This datasheet provides detailed instructions and a list of materials needed to create your Hat, as well as information on how to assemble and use it with your PiEEG. With this DIY approach, you can save costs and have more control over the design of your EEG measurement system. We used available materials without any special skills or tools.

Materials

The electrodes used in this work are Ag-AgCl - Silver chloride electrodes with a hole in the center for installation, Fig.1.

Fig.1. Examples of valid Silver chloride electrodes

To attach the electrode to the hat, a bolt can be used, the diameter of which should be smaller than the hole in the center of the electrode. It is necessary to use bolts with length 3-5 centimeter, washer, nut - M1, Fig.2.

Fig.2. Parts for attaching the electrode to the hat

It is recommended to use Copper cables (stranded, 1-3 mm) as wires, the length is set depending on the needs, Fig.3.

Fig.3. Wires for attaching to the electrode

Strap can be used as hat, for example strap for Camera Mount hat. Electrodes can be located in line international "10-20" electrode placement system, Fig.4.

a b

Fig.4. a - Camera Mount hat, b – arrange the electrodes according to the international "10-20" electrode placement system

Instructions

Prepare cables. Strip the wires of isolation, a few centimeters, as showed in the Fig. 5.

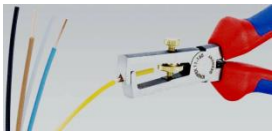

Fig.5. Cable preparation

To connect the electrode to the cap, it is necessary to take the bolt, nuts, washers, cable - 1 and the EEG cap - 2. First clamp the cable between the nut and the bolt, then thread the bolt through the cap and fix it on the other side with the nut, as shown in Fig.6.

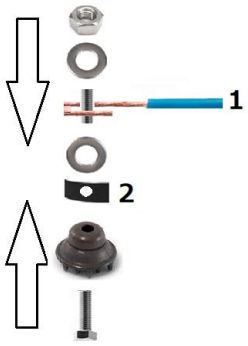

Fig.6. Scheme of connecting the electrode with a hat

As a result, the prepared electrode should look like shown in Fig.7.

Fig.7. Electrodes prepared for installation in the hat

Next, it is necessary, in accordance with according to the international "10-20" electrode placement system, make holes for electrodes in the hat, insert the electrode and fix it with a bolt from the other side of the hat, Fig. 8.

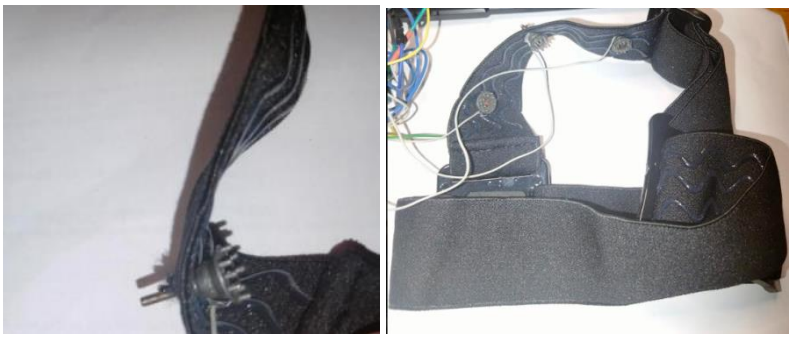

Fig.8. An example of installing electrodes in a hat

The pressure of the electrode on the head is adjusted independently as far as is comfortable, the clamping force depends largely on the cap material used, and each electrode must be adjusted manually after the cap has been fitted.

The connection of the electrodes to the PEEEG board is shown in Figure 9. Even to measure one EEG channel, 4 electrodes are required, 1 - the EEG electrodes themselves, 2 - the reference electrode, 3 - the ground electrode and 4 - the bias electrode to eliminate common mode interference.

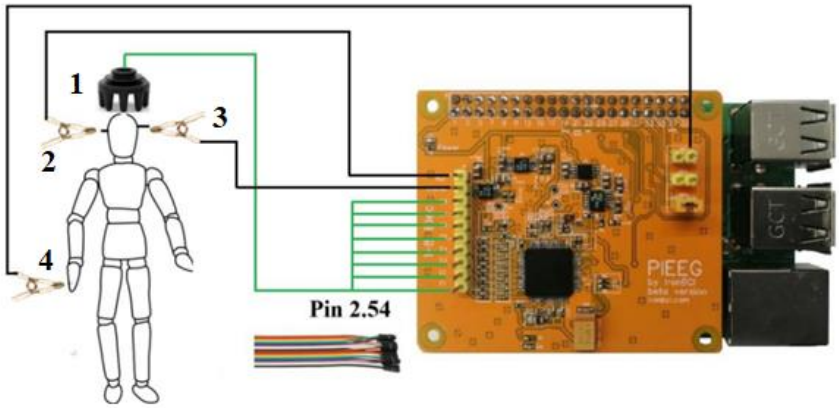

Fig.9. Scheme of connecting electrodes to the PEEG plan: 1 – EEG electrode, 2 – reference electrode, 3 – ground electrode, 4 – bias electrode

Conclusion

This paper presents one of the simplest ways to make a cheap alternative to a hat for adjusting EEG signals. The main advantage is the low cost. This cap is largely designed to work in conjunction with the PIEEG board and is only intended to be a first step into the world of neuroscience. This is only an example, the ideas proposed in this work can be improved, supplemented, and modified.

Additional Information

- Overview of dry electrodes [4]
- Additional Information Machine learning to identify alcoholism [5]
- Signal processing [6]
- Machine learning for [7]

Conflicts of interest: none
Funding: none

Ethical approval: not required

References

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