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The Inner workings of the Electronencephalogram brain scan, and the circuitry components that are used

Daniel Flattum

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By: Daniel Flattum

Abstract:

In the medical field, the past century has become a golden age for technology to be combined with medical instruments. The earliest Brain scan was the MRI created around1961, but the EEG, or the Electroencephalogram, brain scan has been around in 1924. The EEG technique has been improved drastically over the past 80 years, and now remains essential for solving medical cases such as epilepsy, brain tumors, and head injuries.

Objective:

The EEG Machine is constructed of several different sensory wires that are attached to the subjects head. The EEG machine can get a reading of electro magnetic waves in the brain and can trace them using different computer components. The major computer components that allow for sensory input, are the electrodes, amplifiers, computer control module, and the display device. Although there are more components then these four, they make up the main components that work in sync to accomplish the brain scan. The article will inspect the components each thoroughly and the circuity that makes up these components. The article will then go into the importance of the different filters located in the Amplifiers, and the importance of the digital converter located in the computer control module. The purpose of this article is to further the readers understanding of major computer components and the communication they have in order to produce a accurate measurement of Electrodes.

System Architecture

The EEG machine is made up of many different components. Before diving into each component and their role, this article will first look at the system architecture as a whole. The major components of the system are the analog system and the digital system.

The Analog System

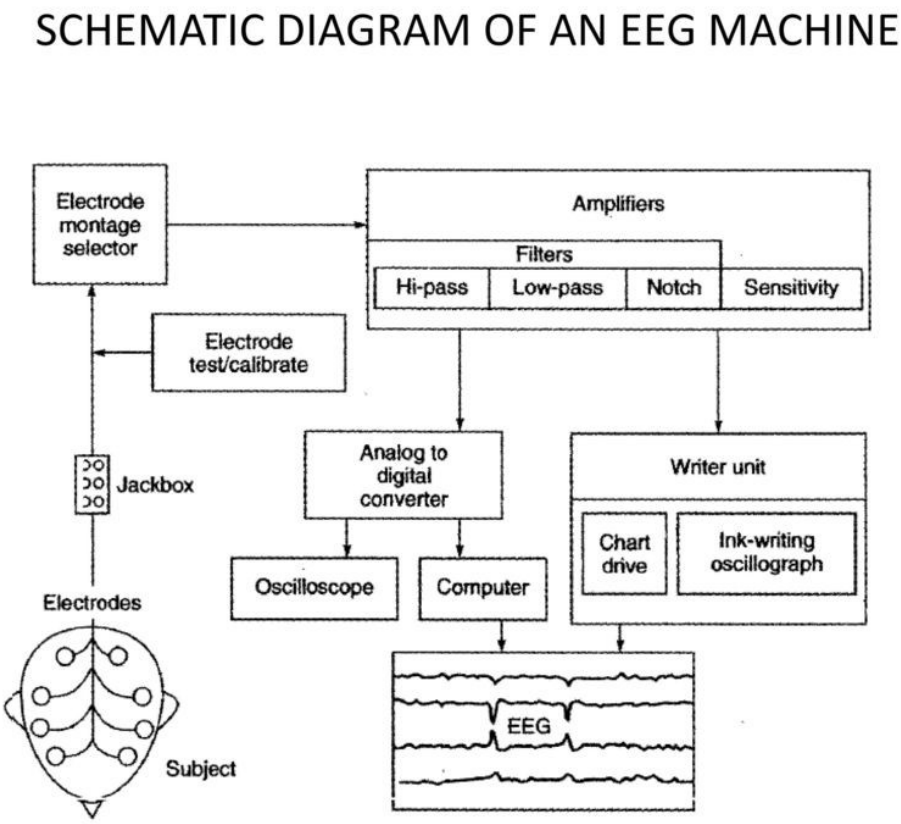

Figure 1

Method:

The analog system is made up of many different components, such as low pass filters, highpass, buffers, ect… There are four major input components that allow for our analog system as a whole to operate[3]. The two major ones are the REF circuit and the DRL circuit. The DRL circuit is used because unlike the REF, it can avoid the interference of the power supply, and effectively reduces DC bias [1]. This is important, because the REF circuit is initializing the signal, but the DRL is used as a protection. The DRL and REF circuit's outputs are to the same location because it allows for a single pole connection and provides a common gain which is more than 120dB in a60 Hz environment [1]. This is why the analog system is equipped with filters, because, the signal at this point is noisy, and the user needs a good noise suppression in order to have a good read of the machine. The analog system then sends its signals through clamp circuits into the digital system.

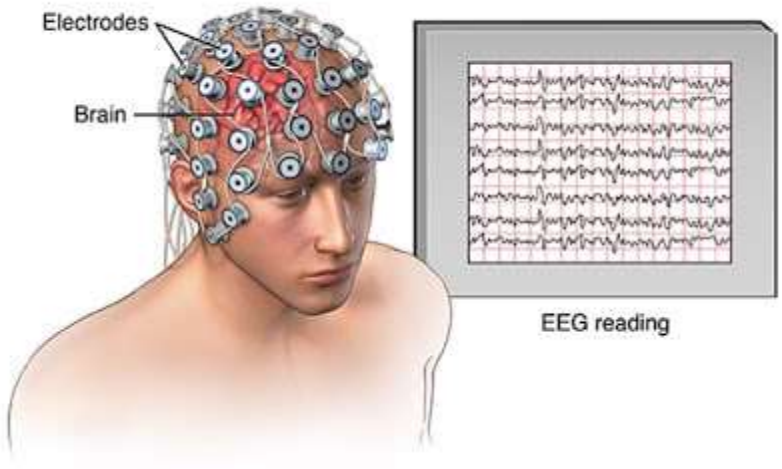

Figure 2.

Significance:

The signals that are entering into the analog circuit are large, noisy, and unreadable. From the previous paragraph, we looked into the many different parts of the EEG machine, but this paragraph is going to dive into the filters. The filters for the EEG machine, in the analog system ,are the 100 Hz low pass and the .16 Hz 2 order high pass filter's[2]. A 100 Hz low pass filter and the .16 2nd order high pass filter, in series creates a BPF[1]. A BPF is a Berkely Packet Filter, which is a filter for computer operating systems that have high levels of network traffic. The engineers had a standard from the IFCN or (international Fact Checking Network), so the reason for the second .16 Hz high pass filter is used to reduce error occurrences as well as prefilter the DC bias caused by the front-end of the analog circuit.[1] The filters are organized in a series, path in order for the EEG readings, to pass into the digital system, to be transferred into a reading. The digital system, refines the signals, that have already passed through the analog, in order to amplify the signal to be read, as well as continues to loop the signal, until the signal can be transferred and read on the PC interface. The EEG machine, could not work without both parts, however; the analog system plays the most important role in the machine[3]. The double filters, refine the signal to be interpreted and read, as well as it qualifies for the IFCN precision requirement for a regulated EEG machine.

Conclusion:

The article has examined each of the components of the machine, and has explored the design of each the EEG machine and how each component communicates with one another. Each component in the EEG machine has its own intercept designs that allow for the machine to read electromagnetic waves. After examining each component and their purpose to the machine, the reader should have accomplished these things: A understanding of the Amplifiers and their increase in efficiency over time, a understanding of the display module and how the Analog to Digital Converter displays the waves, as well as a understanding of the computer control module and its importance in the process of the machine, and lastly a thorough understanding of the whole machine, and how each component works with each other to produce the desired outcome.

Works Cited

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