ADAPTIVE DESKTOP ENVIRONMENT (ADE) USING BCI FOR PARALYZED

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Abstract— it focuses on making a desktop computer/laptop responsive to user's state of mind using brain computer interfacing technology which will be very much useful for those who are paralyzed. Unlike commonly used programming languages like JAVA, most recent programming languages like AHK, Arduino and Processing are used. The main features include: (i) controlling the volume of the system (ii) Key press simulation (iii) Opening task manager and minimizing it. All these features are implemented by using user's brain waves captured using electrodes and incorporating EEG sensor circuit to minimize cost and to make it affordable for users. Can be further modified to a large extent to make each and every feature responsive to user's thought.

Index Terms — Brain Computer Interfacing (BCI), Electrodes, Arduino, Auto Hot Key (AHK), Microcontroller.

I. INTRODUCTION

For generations, humans have fantasized about the ability to communicate and interact with machines through thought alone or to create devices that can peer into person's mind and thoughts. However, it is only recently that advances in cognitive neuroscience and brain imaging technologies have started to provide us with the ability to interface directly with the human brain. This ability is made possible through the use of sensors that can monitor some of the physical processes that occur within the brain that correspond with certain forms of thought. Primarily driven by growing societal recognition for the needs of people with physical disabilities, researchers have used these technologies to build brain computer interfaces (BCIs), communication systems that do not depend on the brain's normal output pathways of peripheral nerves and muscles. Brain computer interface is the technology to interact with human brain to the computer or any communicating device." The impact of this work is extremely high, especially to those who suffer from devastating neuromuscular injuries and neurodegenerative diseases such as amyotrophic lateral sclerosis, which eventually strips individuals of voluntary muscular activity while leaving cognitive function intact.

II. LITERATURE SURVEY

Firstly, we learnt that BCI is a technology which can be used to interface the human brain with computer, to make it function according to his/her thoughts. The commands are acquired directly from the user's brain, so this input modality works even for people who are severely paralyzed and would otherwise be unable to communicate or interact with the outside world. Brain activity can be acquired invasively through surgical implants, or non-invasively through a variety of methods. There are many different methods for BCI among which EEG is the most commonly used method. EEG signals can be collected with electrodes placed on the scalps surface. The most widely used electrodes are silver/silver chloride (Ag/AgCl) because their low cost, low contact impedance, and relatively good stability. Using Ag/AgCl electrodes requires removing outer skin layer and filling gel between electrodes and scalp (that is why this kind of electrodes are called "wet" electrodes). These operations take long time and are uncomfortable to users. Some researchers have been exploring "dry" electrodes, which do not need to use gel and skin cleaning. The main disadvantage of existing dry electrodes is that the acquired EEG signals are worse than those acquired with conventional electrodes due to the increase of contact impedance.

The acquired signals are first preprocessed in order to remove artifacts such as power line noise, electrocardiogram (ECG), electrooculogram (EOG), electromyogram (EMG), etc. and any body movement. Features are then extracted from the preprocessed signals. Finally, the classifier translates these extracted features into commands that subjects desire to output.

For healthy users a BCI nowadays cannot act as a competitive source of control signals due to its limitation in bandwidth and accuracy compared to the standard muscular control. Healthy users could also benefit from either additional control channels or hands free control offered by BCI. Assistive robots can provide support for disabled people in daily and professional life, thus creating a growing demand for them. Some other special interfaces like sip-and-puff systems, single switches, and eye-tracking systems have been proposed. However, these interfaces do not work for some severely disabled people with illnesses such as the amyotrophic lateral sclerosis (ALS), multiple sclerosis (MS), or strokes. As a result, even autonomous robots are not yet able to transport severely disabled users to desired locations.

III. PROPOSED SYSTEM

The proposed system makes use of dry electrodes in place of wireless headset owing to the economic feasibility. These electrodes are places in the appropriate positions i.e., one on the forehead, one behind the ear and one at the nape to obtain the signals from the brain. The signals so obtained are then fed into an Arduino board which contains the microcontroller. The microcontroller has a program burned in it which converts the analog signals to digital values. These values are then sent to the laptop/PC via serial communication to the COM port. As it is difficult to get a constant reading, five different range of values have been set in the potentiometers. The values from the microcontroller are compared with each of these five levels and the functionality associated with the matching range is executed.

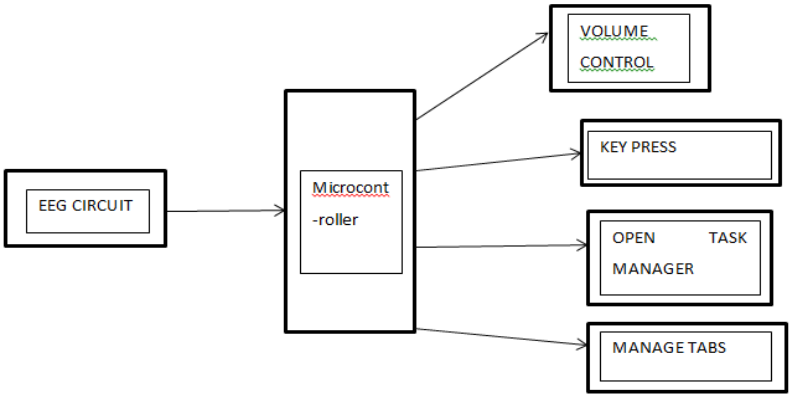

Fig 1 Block diagram

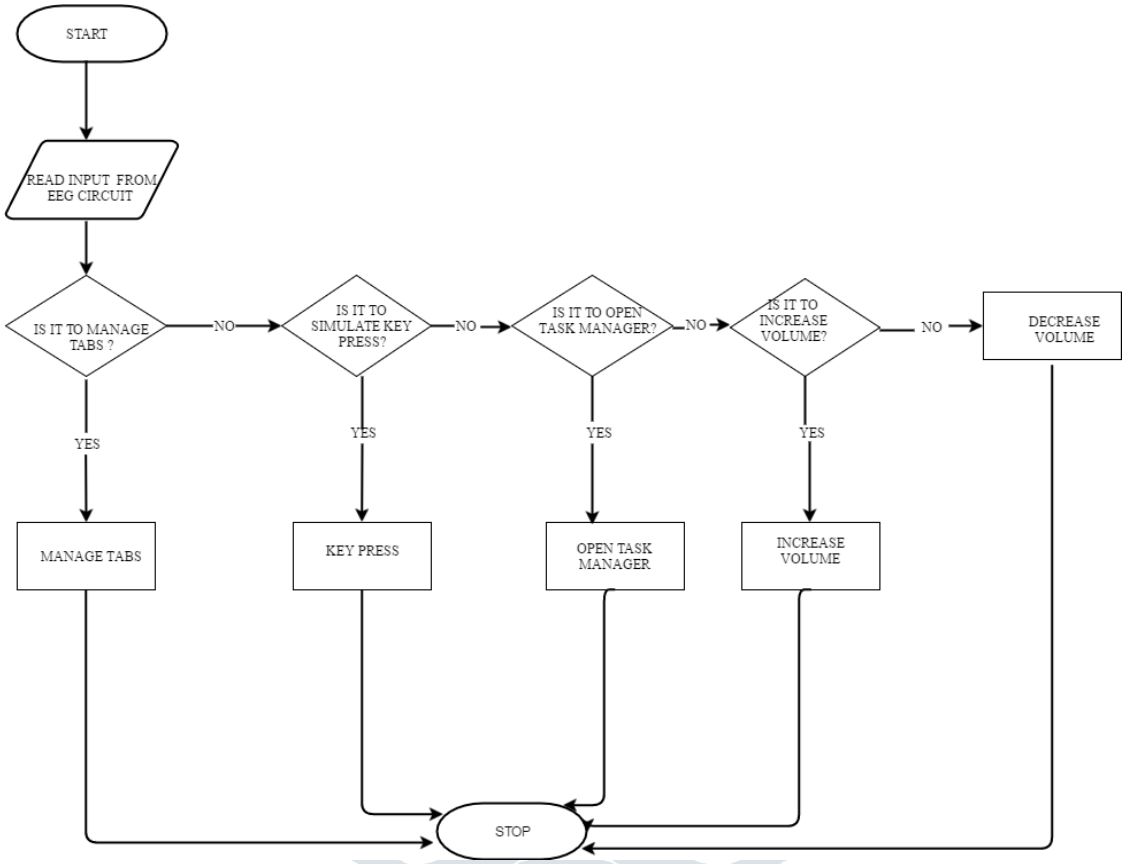

Fig 2 Flow chart

IV. CONCLUSION

The notion of brain computer interfacing is to interface the human brain with computer so that the system works according to the user's thoughts. As a proof of this concept, we have implemented a project to make the desktop responsive to human thoughts especially for paralyzed where he can control the volume of the system, open and close an application window and simulate a key press to make the system more interactive using programming languages like AHK and processing. We are also going to conduct several experiments to enhance security and to add more features to it.

V. REFERENCES

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