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Mind Controlled Alarm

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Abstract: In a human brain there are thousands of neurons that interact with each other producing electrical signals. These continuous signals produce a wave which can be measured by using EEG. Concentration value for processing can be obtained from EEG sensor using the arduino micro controller. The main focus of our system is to provide an application based on mind control to people who are paralyzed from neck down and cannot speak and thus catering to their basic needs based on requirement.

Keywords: Electroencephalogram, Arduino, Accelerometer, GSM.

I. INTRODUCTION

Human brain consists of many neuron interconnections, which varies with their emotional states. The interaction between these neurons produce thousands of concurrent electric discharges which aggregates into waves which can be measured. Waves of different amplitudes and frequencies are produced as a result of different brain states. Thus these wave patterns give a clear indication of the emotional state of brain. The system uses the attention level of the brain by measuring the wave patterns produced by various neuron interactions to understand the requirements of the paralyzed people.[[1] Among the different waves produced as a result of different brain states, the most important are the following:

1. Theta Waves: These waves are of frequency 4-7Hz and are associated with drowsiness.
2. Alpha Waves: These waves are of frequency 8-13Hz are present during wakeful relaxation.
3. Beta Waves: These waves are of frequency 14-30Hz and are associated with active thinking.

The Electroencephalography (EEG) technology is used in this system. An EEG sensor comprising of electrodes which makes contact to scalp and forehead, collects the brainwaves. The signal obtained from EEG sensor is processed by a microcontroller to measure the level of alertness. The quality of EEG signal can be affected by muscle movement and excessive environmental electrostatic noise.

The orientation of head is also measured using an accelerometer in order to fix various conditions in accordance with the attention parameter from Brain signal. The system include both software and hardware. It is impossible to know the needs of person paralyzed from neck down who cannot speak.

Thus their basic needs such as food and other personal requirements are taken care based on time. By the implementation of this system, we provide a low cost means for such patients to communicate their needs to their caretakers.

II. LITERATURE SURVEY

A. Brain controlled wheel chair:
This technology uses a non-invasive brain actuated wheelchair which works based on P300 neuro physiological protocol and automated navigation. Here, the subject concentrates on the area to be reached, on a screen with a real-time virtual reconstruction of the scenario. The autonomous navigation system drives the wheelchair to the desired location and avoids collisions with the obstacles detected by the laser scanner. [3]

B. Brain Driver:
Brain driven car rely only on an individual's thoughts and hence does not require any physical movement on the part of the individual, which would aid the physically disabled. The car uses signals from various sensors like video, weather monitor, anti-collision and also possess an automatic navigation system in case of emergency. [2]

C. Neuro Phone:
Neuro Phone system utilizes neural signals to drive mobile phone applications on the I Phone using wireless electroencephalography (EEG) headsets. It consist of a brain-controlled address book dialing application. The phone flashes the photos of contacts from the address book and a P300 brain potential is generated when the flashed photo matches the person whom the user wishes to call. The EEG signals from the headset are wirelessly transmitted to an I Phone, which runs a lightweight classifier to distinguish P300 signals from noise. When any contact photo stimulates a P300, a call is made to his/her phone. [4]

III. SYSTEM OVERVIEW

The proposed system can be easily implemented in rural areas and the cost is affordable for the common people as the overall system cost is less than 75.035 USD. The electric discharge s from the brain are aggregated together to form brainwaves. The brainwaves are collected using EEG sensor which is in Bytes. The attention value is retrieved from the wave and is converted to ASCII value. With this attention value we can perform various actions.

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There is no difference in the concentration level of a paralyzed person and a normal man. Any variations in the concentration level takes place only due to stroke, tumor or spinal code injury which results in consistently reduced brain wave activity in 8-13 Hz component of EEG. Accelerometer is used to find the orientation of the head. Based on the attention value and head movement, the buzzer and LED is switched on. In addition a call is also made to the caretaker using a GSM module Fig 1.

Here we focus on the food and other personal requirements of the paralyzed person. We set a threshold concentration value by considering different concentration values of the person and taking the average and the orientation of head is measured by calculating the deviation from the reference position and then we check whether the given conditions are satisfied or not. Also, we tried to automate the fan and light by considering the temperature and time. The four conditions set are:

Condition 1: This condition is for the food requirement of the patient. In this case if the attention value is more than 55(experimental value and it can change from person to person) and the orientation of head is between 50 and 100 degree, the corresponding LED and Buzzer turns on and a call is made to the care takers phone. This Buzzer and LED is kept in a place where the members of family will be mostly present and can know his/her needs without being in the patient's room always.

Condition 2: This condition is for the personal needs of the paralyzed person. In this case if the attention value is more than 55 and the orientation of head is between 300 and 360, the buzzer and LED is turned on and a call is made to the care takers phone.

Condition 3: An LM35 temperature sensor is used to measure the room temperature. This temperature value is then compared with the pre-specified value and if the condition is satisfied, the fan turns on.

Condition 4: A low voltage light is turned on when specified time condition is reached.

Pseudo code

1. Start
2. Check If data available from the headset
If true then go to step 2
Else go to step 1
3. Get attention value
If attention value is greater than 55
Then get orientation value of head
If orientation value is between 50 and 100
Then go to step 4
Else go to step 5
4. Turn on buzzer and LED for food and call caretaker on Phone
Go to step 2
5. Check If orientation value of head is between 300 and 360
Then go to step 6
Else do nothing and go to step 2
6. Turn on buzzer and LED for personal needs and call Caretaker on phone
Go to step 2
7. Stop

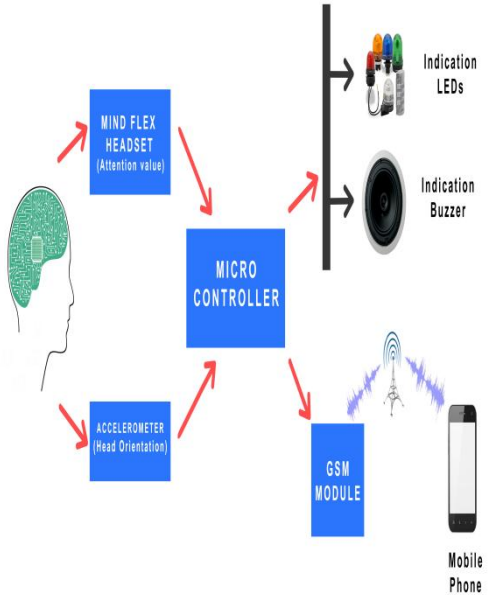

Fig 1: Block Diagram of the system

Age Group	Gender	Relaxed State	Concentrated State	Average Concentration Value
20-35	Male	50-20 Hz	58-100 Hz	60 Hz
	Female	10-30 Hz	55-95 Hz	59 Hz
35-45	Male	10-20 Hz	57-95 Hz	60 Hz
	Female	15-35 Hz	52-90 Hz	55 Hz
45-55	Male	10-20 Hz	56-90 Hz	56 Hz
	Female	12-30 Hz	55-85 Hz	60 Hz
55-60	Male	9-30 Hz	56-95 Hz	59 Hz
	Female	12-35 Hz	50-80 Hz	55 Hz

Table I: Experiment Values

IV. EXPERIMENT RESULTS AND ANALYSIS

To test the efficiency of the system, we conducted various Experiments. People of different age groups, both male and female, were chosen and their relaxed state and concentrated state frequency values were obtained. The average concentration value was computed using these two values, as shown in TABLE I and was found to be above 55 Hz. The average concentration value was found

to be in the range of 50-60 Hz for people of both genders and all age groups. This level of efficiency was visible for paralysed individuals who are paralysed from neck down and cannot speak. However, the system showed changes in the values when tested on patients who are paralysed due to spinal cord injuries or due to problems in brain like stroke or tumours.

This is because in paralysed patients due to problems in brain like stroke or tumours there will be EEG changes as compared to normal people like slowing of EEG waves. In Paralysed patients due to spinal cord injuries, compared to normal individuals, consistently reduced brain wave activity occurred across all regions of the brain. Thus except for the exceptional cases mentioned above, our system has been found to be very reliable.

V. CONCLUSION

Our system is ready to be implemented on paralysed people to provide an automatic alert to the caretaker. The concentration and orientation values are collected and further processed for the working of this system. Our system can be expanded by using Wi-Fi to extend its usability or by connecting to IOT, all appliances can be controlled using this system. To increase the effectiveness, eye movements can be taken into consideration instead of the head orientation. One may also use a webcam to capture the visuals when the phone rings for help.

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