



Analysis of Digital Electroencephalography Signal for Indian Facial Expressions

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Abstract: The brain signals have been recorded using Digital Electroencephalograph (EEG) instrument on different human subjects under different conditions. The experimental subjects have been asked to give different human expressions and corresponding signals have been recorded through EEG. An attempt has been done to correlate these results to facial action coding System (FACS). The result can be used for recognition of facial expression in a real time computer system.

Keywords: EEG, Facial expression, FACS.

I. INTRODUCTION

The human computer interaction with face in computer application is an important factor [1]. This involves many complex issues involving psychological, neuromedical and anatomical fields [2]. This is also very much dependent on social behavior. The fundamental expression are facial expression related to happiness, sadness, fear, anger, surprise, disgust, and neutral[3]. Attempts have been made to express an expression in terms of anatomical facial action coding system (FACS), which involves anatomical aspects of the face[4]. The objective of the present work is to report the experimental work carried out in this direction .For our experiment, digital Electroencephalography system has been used to record the electrical waves from the brain for a given subject. The next section contains the description of the experiment and conclusions are summarized in subsequent sections.

II. EXPERIMENTAL

The six male and one female persons involved with the age group of 28 to 55 with non-psychiatric history have been selected for our experiment .On the brain scalp the electrode was placed on the different regions of each person[5]. The fig 1 contains details of connection for left and right portions of the brain.

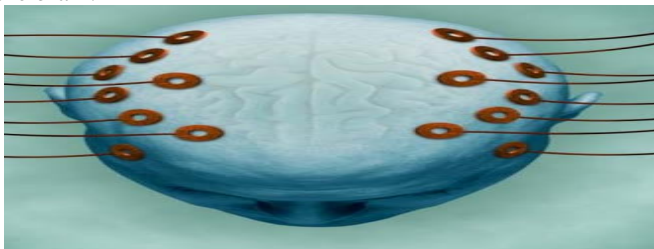


Figure 1.Electrodes connection

This test was conducted for five minutes and each participant have given the different expressions. The lower filter of the Neuroportable EEG device was set at 2Hz, High filter at 60Hz; sensitivity at 5 μ V, channels 25, sweep speed 20mm/sec, Montage set 1 for all experiment. After the successful execution the image of face expression recorded through digital camera and handy cam and simultaneously mapped the brain waves [6][7]. Fig(2) shows the different positions of electrodes connection, in fig(3) represent electrode placed on the brain scalp and fig(4) represents the recorded / mapped signal of the brain. The sound proof environment required to conduct the experiment[8].

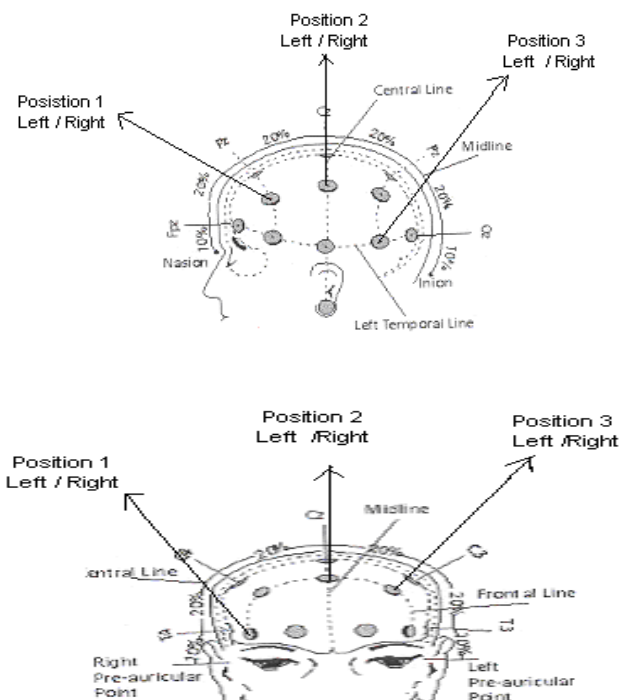


Figure 2. The different position of connection for signal monitoring.

Method and Recording EEG Signal: The electrodes attached with the scalp as follows :

Electroencephalography Recording System

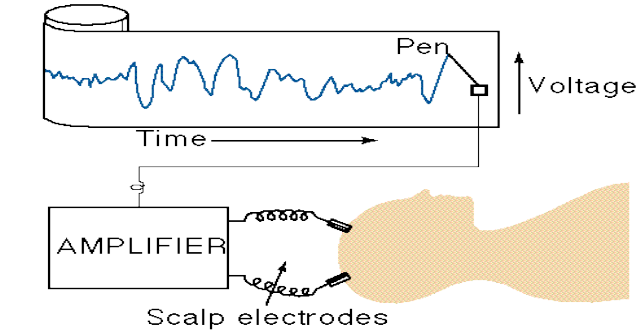


Figure.3 Recording of signal by Electrode



Figure 4 Recorded Signal

Description of Used apparatus: portable EEG machine, Laptop/ Computer, Electrodes, Cable, GND plug wire, Phonetic wire, EEG conducting paste, Absorbent cotton wool I.P., Digital Sony Camera 5x HD[9].

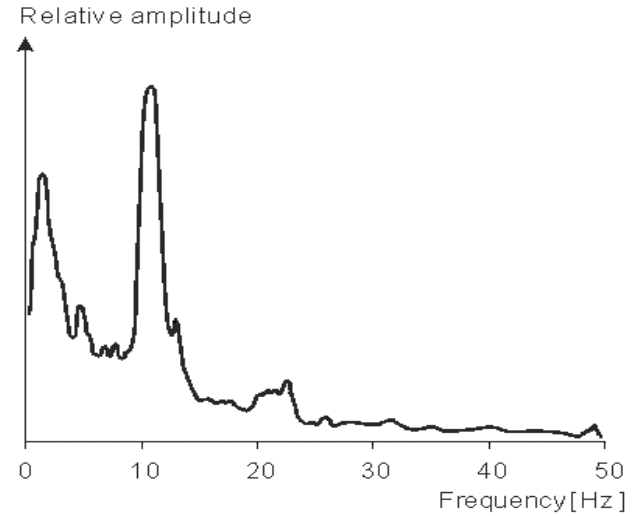


Figure 5. A typical example of signal concern to happy face.

III. RESULT AND CONCLUSIONS

The signals corresponding to different expressions were recorded and stored in the computer[10]. The two regions of brain with left and right positions are identified. Corresponding to these positions, the average frequency and the average peak voltage are determined through commercial software available with the system. The signals were recorded three times for each expression corresponding to all different seven subjects[11]. The average values reported into the Table 1.

Table1. The EEG result for different facial expression follows:

Brain Position	Position 1				Position 2				All Position Result	
	Left		Right		Left		Right			
	F	PV	F	PV	F	PV	F	PV	F	PV
1.Neutral Avg	23.5	40.1	24	33.1	21.5	34.1	21.1	39	24.5	36.6
2.Happy Avg	23	43.5	22	40.8	25.3	35.6	24.2	33.9	23.6	38.5
3.Sad Avg	20.5	33	26.9	40.3	19.2	32.3	21.1	38.6	17.4	35.0
4.Anger Avg	19.6	35	26.1	35.6	23.4	31.1	20.4	33.4	22.4	33.8
5.Fear Avg	18.7	35.7	19	34.9	17	26.6	17.8	34	18.1	32.8
6.Disgust Avg	18.5	38.6	22.1	36.2	17.5	29.4	18.8	36.2	19.2	35.1
7.Surprise Avg	14.2	30.4	16.9	33.1	14	33	14.1	32.5	14.8	32.2

The photographic expressions for the each experiment are shown in fig (4) as a typical example.



Figure 6. Facial Expressions.

The fig (7) summarized the graphical representation of the result. However, there is a need to include the detail

information from signals each region of brain to enhance reliability[12].

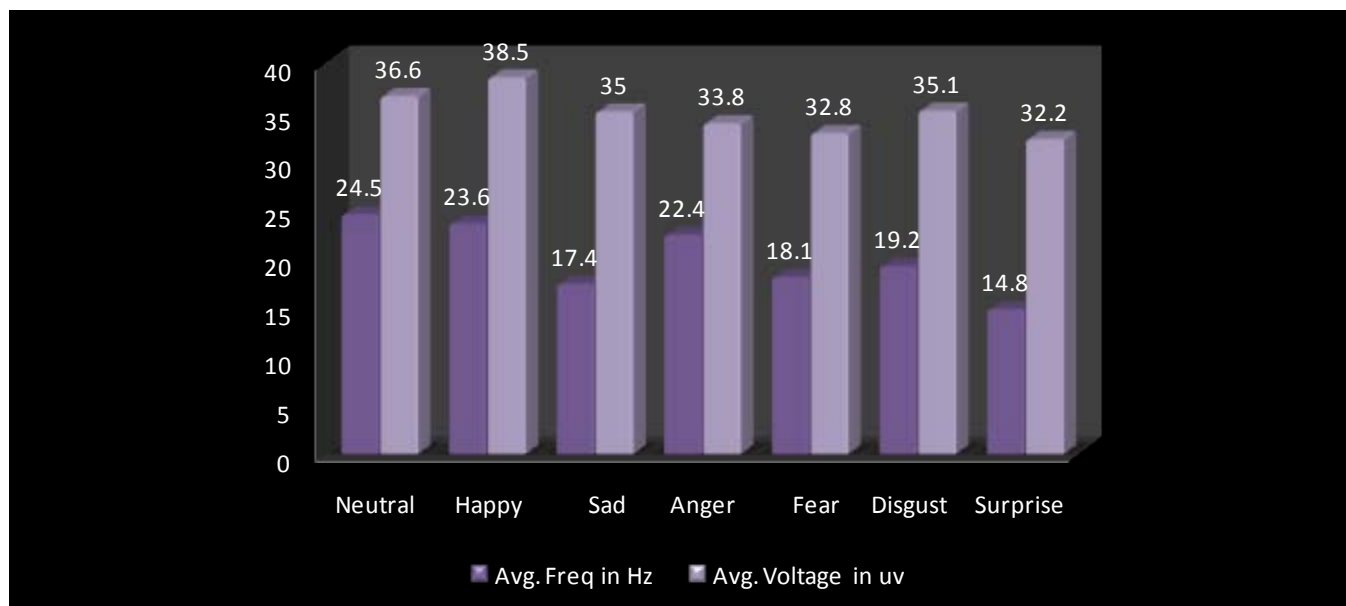


Figure 7. Graphical representation of the Table1

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