



## Usage Mining Based Collaborative Assistive Tool using BCI for Differently Enabled

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**Abstract:** Many people have suffered from motor control disabilities. They are not able to access the computer using the traditional input devices. In particular, these people lose control of hand movement cannot use the standard mouse and keyboard as a pointing device. The objective of the system helps the disabled people to interact with outside environment such as browse the internet, choosing the music, type the words with the help of virtual keyboard. Double eye-blink signal or camera mouse used as a input command to process the various task. A list of user's personalized music, movies, books and web URLs are preloaded in the database using the implicit and explicit feedback method. Therefore, it could be suitable to assist disabled people. The GUI design comprises the music, movie, browsing and virtual keyboard modules. The calibration of EOG is required to track the user's eye blink detection. NeuroSky's mind waves mobile device with portable EEG sensors used for detecting the eye-blink signal. The assistive tool helps the user to select the flash button (music, browsing, and keyboard) commands by blinking their eyes twice to achieve the target activity from the personalized assistive module. The camera mouse is used to access the web pages, folder and files on the desktop. The calibration of EOG is required to track the user's eye blink detection hence, the proposed method helps the disabled to access the internet and other module based on their interest and preferences. This system improves the subject's quality of life and provides the 98% better performance and comfortable access than p300.

**Keywords:** Brain Computer Interface, Graphical User Interface, Personalized Music Player, Personalized assistive tool, ElectroEncephaloGraphy ElectroOculoGraphy.

### 1. INTRODUCTION

The Brain Computer Interface is used for extracting the double eye link signal for choose the input from the personalized assistive module. A camera mouse is a software that allows people to interact with the computer by registering any part of their body and then using that part as the pointing device to work on the computer system. The assistive tool helps the disabled to access folder and files stored on the computer and browse the internet, choosing interested movies and music from the internet using camera mouse.

Weblogs maintain the user's browsing history. Weblogs technique used to track the user's browsing patterns such as the user's visited web pages, the number of hits, date and time and this information are stored in the database[1,2].The web personalization and web usage mining techniques are used to extract frequent access pattern from the history of previous user clickstreams stored in web log files. The user's requirements are collected implicitly and explicitly and clustered based on the topics such as news, sports, music, games. Whenever the user visits the web page, the URL and keywords are extracted and stored in the database under the topics. The ranking algorithm was used to rank the frequently accesses web page as a first link under the topic. The camera mouse is used to access the links to web pages and folder and files on the desktop. The calibration of EOG is required to track the user's eye blink detection. NeuroSky's mind waves mobile device with portable EEG sensors used for detecting the eye-blink signal.

Web personalization is the process of customizing a web site to the needs of specific users taking advantage of the knowledge acquired from the analysis of the user profile and user's navigational behavior. Web mining is the application of data mining techniques to discover interesting patterns from the Web. In proposed system, intelligent agent system can be developed, which acts as an agent to the user for predicting user interest based on weblog data. Discovering hidden information from Web log data is called Web usage mining. The main objective of the proposed system is predicting user navigation patterns using clustering and ranking from web log data, which is used to retrieve relevant pages quickly.

Web users are always drowning in an "ocean" of information and facing the problem of information overload when interacting with the web. They keep noisy data in the unstructured texts which give more correlated data, making user uncomforted to find the most relevant pages on the internet. Data mining is the process automatically discovering useful information in the large dataset. The data mining tasks are categorized into two parts such as predictive tasks and Descriptive task[1,3].

To capture Brain Wave signals for a particular domain of interest from the user through EEG. To analyze the weblog present in the user's desktop for getting user's area of interest.

To develop a user interface for integrating brain signals and weblogs to create keywords depending on the user interest.

To use the keywords generated above for displaying web links through a search engine.

### **1.1. Predictive Data Mining**

The aim of this task is to predict the value of a particular attribute based on the values of other attributes.

### **1.2. Descriptive Data Mining**

Exploratory aims to derive the patterns such as correlation, trends, cluster, trajectories and anomalies that summarize the essential relation in data.

## **2. DATA MINING**

### **2.1. Different Types Web Mining**

Web mining can be divided into Web usage mining, Web content mining and Web structure mining.

#### **2.1.1. Web Content Mining**

Recommends items that are similar to items the user queried in the past, extraction, and integration of useful data in the content of web pages, *e.g.* structured text data (plain text content), semi-structured data (HTML code), pictures and downloadable files [.WCM is the process of extracting knowledge from the content of documents or their descriptions.

### 2.1.2. Web Usage Mining

In the web usage mining process, the techniques of data mining are applied to discover the trends and the patterns in the browsing nature of the visitors of the website. The data mining is the process of analyzing data and retrieve the useful information. A user profile reflects the needs, interest, hobbies, etc. about the individual user, based on these parameter web pages were personalized. Web usage mining used to find interesting usage patterns from web log data[1, 2].

### 2.1.3. Structure Mining

It is used to discover the link Structure of the web pages, which generate structured summary about the website and web page

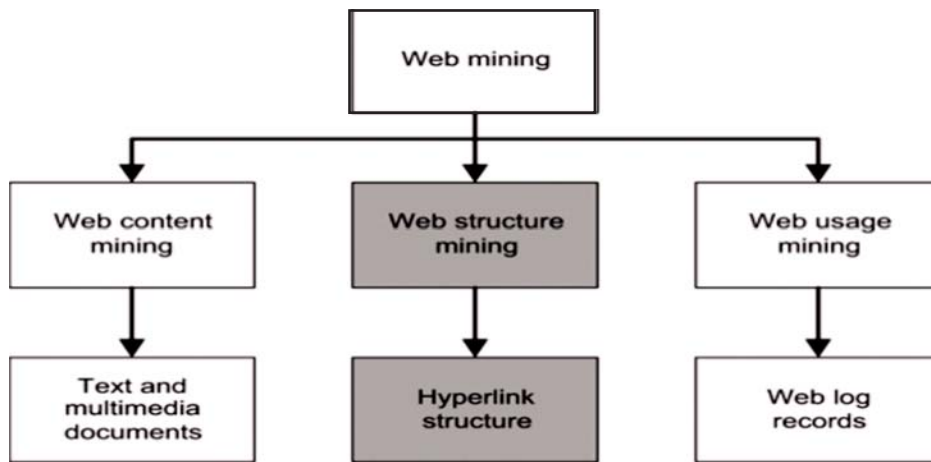


Figure 1: Web Mining Categories

## 3. WEB USAGE MINING PROCESS TASK

### 3.1. Preprocessing and clickstream

Pre-processing is the process of cleaning the data to obtain usable datasets from local log files. For this reason, a preprocessing step must be performed before the pattern discovering phase[3,4].

Web usage mining is also called as *click stream analysis*, which aggregate sequence of page visited by a particular user navigating through a Web site. The click stream data consist of logs, cookies, meta tags, and other data used to transfer web pages from server to browser. Thus, click stream data require substantial preprocessing before user behavior can be analyzed. *Data were preprocessing deals with* data cleaning, identification of sessions and reconstruction of web pages. Normally log file contains images, styles, and scripts or other files included into the page. Data cleaning aims to remove all irrelevant data from the log and store only the relevant to the user.

**The log files contain the following information:**

1. IP address or domain name
2. User ID and password
3. Date and time of the request
4. Request, including the request type, query strings, and the protocol
5. Cookie and session information.

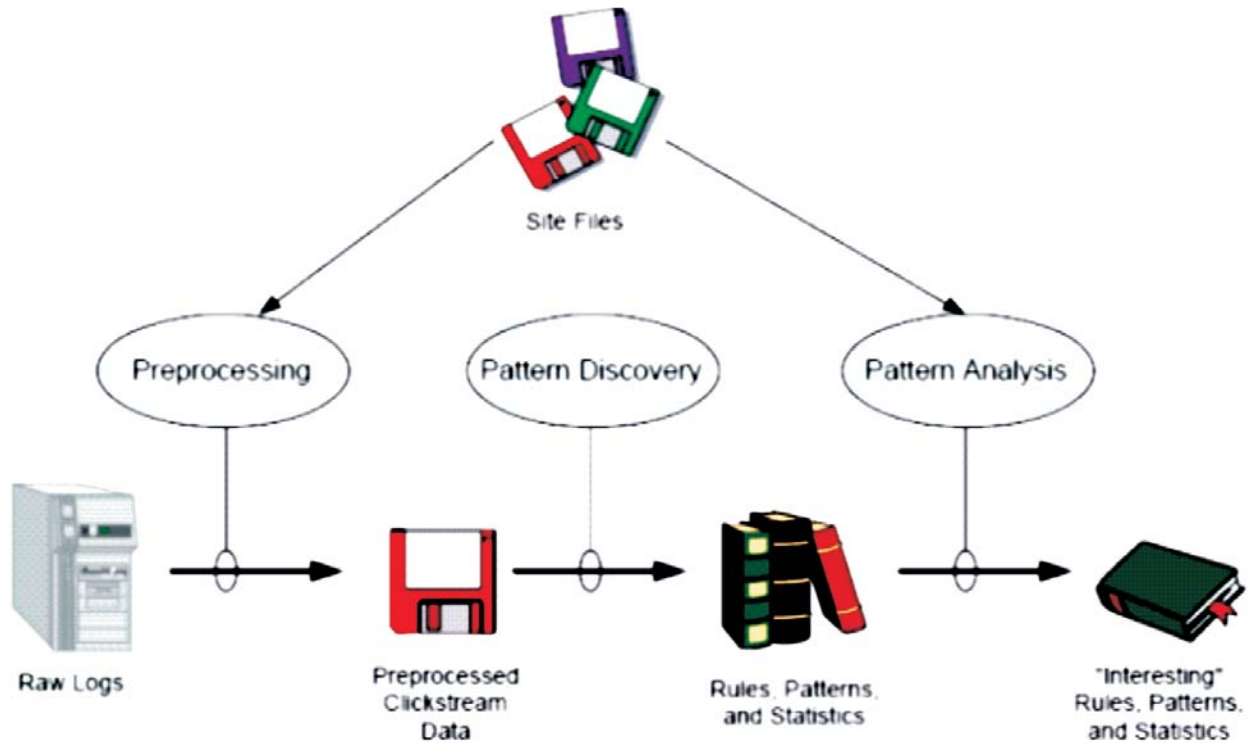


Figure 2: Preprocessing and Click Stream

### 3.2. Pattern Discovery

The pattern discovery is one of the data mining techniques like path analysis, association rule mining, clustering, classification, etc., on preprocessed log data.

### 3.3. Pattern Analysis

The pattern of the user interests is predicted based on the user history and frequently visited pages stored in the weblogs.

## 4. METHODOLOGY

### 4.1. Camera Mouse

A camera mouse is an open-source software available with the camera mouse official web page. The concept of the application is to allow full access to the pointer of the computer by registering any body part with the device. The device opens with the computer's camera, and on the camera, image the user is supposed to click on the body part that he wants to register as the new pointing device dipped in fig3. The system tracks the computer user's movements with a video camera and converts them into the movements of the mouse pointer on the screen. The visual tracking algorithm is based on cropping an online template of the tracked feature from the current image frame and testing where this template correlates in the subsequent frame. The user can interact with the computer by moving their cursor through eyes [14].

**Table 1**  
**Camera-based interface system for user with severe motion impairment**

<i>System</i>	<i>Action Mechanism</i>	<i>References</i>
Camera Mouse	Move Body Part. Eg: Foot, Head, Finger.	Betke, Gips, and Fleming [14] Betke [6]
BlinkLink	Control over the blink length	Grauman, Betke, Lombardi, Gips, Bradski [15]
Eyebrow Raiser	Raise Eyebrows	Lombardi and Betke [16]
Eye Keys	Control horizontal gaze direction	Magee, Betke, Gips, Scott, and Waber [17]
Finger Counter	Move fingers	Crampton and Betke [18]
Head Tilt Detector	Tilt head left or right	Waber, Magee, and Betke [19]
Symbol Design	Move Body part	Betke, Gusyatin, and Urinson [20]

From the above comparisons, we draw a conclusion that the Camera Mouse is a simpler way of using the pointing device because there is no limitation as to which part of the body needs to be registered[8]. The following figure illustrates the registration of an eye as the pointing device depicted in fig3.



**Figure 3: The Camera Mouse Interface [13]**

#### 4.2. User Interaction –DoubleEyeBlink

Neuro sky's mind waves mobile portable device used for detecting the eye blink signal. The neuro sky EEG device is the headset placed on the forehead, FP1 for extracting the raw brain data fig.(5). A notch filter is used at frequency ranges between 50-60 Hz to eliminate interference from supply lines. The acquired EEG signals are transferred wirelessly to the PC by using Bluetooth interface[15].

MindRec is the research tool is used to filter out eye blink signals from the EEG data in fig3.(a)Raw EEG signal is allowed to pass through a 6th order Butterworth band-pass filter with lower cut-off frequency 0.01Hz and higher cut-off frequency 3Hz with a ripple of 1dB. VB.NET based Graphical User Interface (GUI) are designed to help the user to select options such as a personalized browser, music and virtual keyboard with the help of flash buttons on the GUI by blinking their eyes twice in Fig (6).

Eye blink signal used only choosing the option from the personalized assistive module[6,7]. The subject can be accessed camera mouse features for accesses sub-module of browsing, music and help depicted in Figure 7(a), (b) and (c).

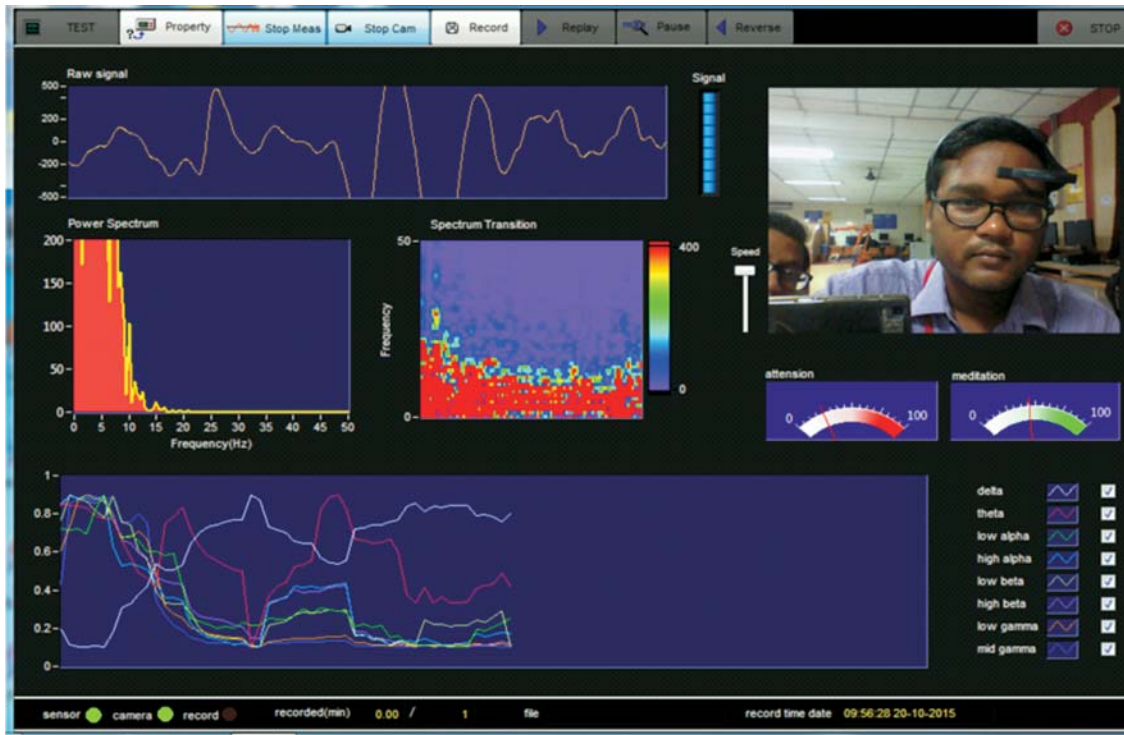


Figure 3: (a) MindRec software for extracting the data

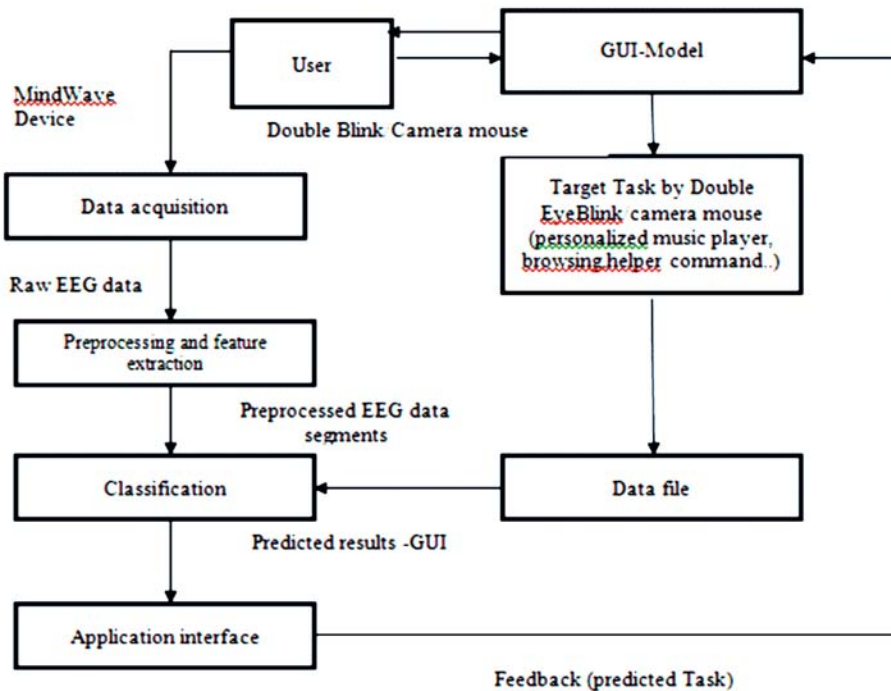


Figure 4: Architecture of Personalized Assistive Module



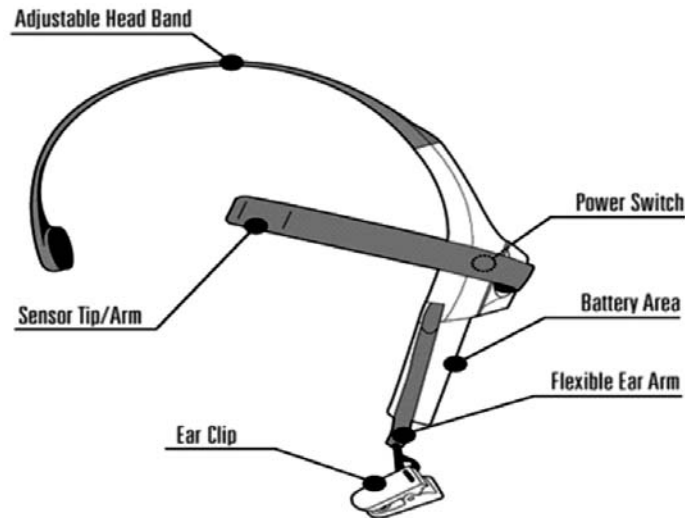


Figure 5: Neuro Sky Mind Wave Mobile device

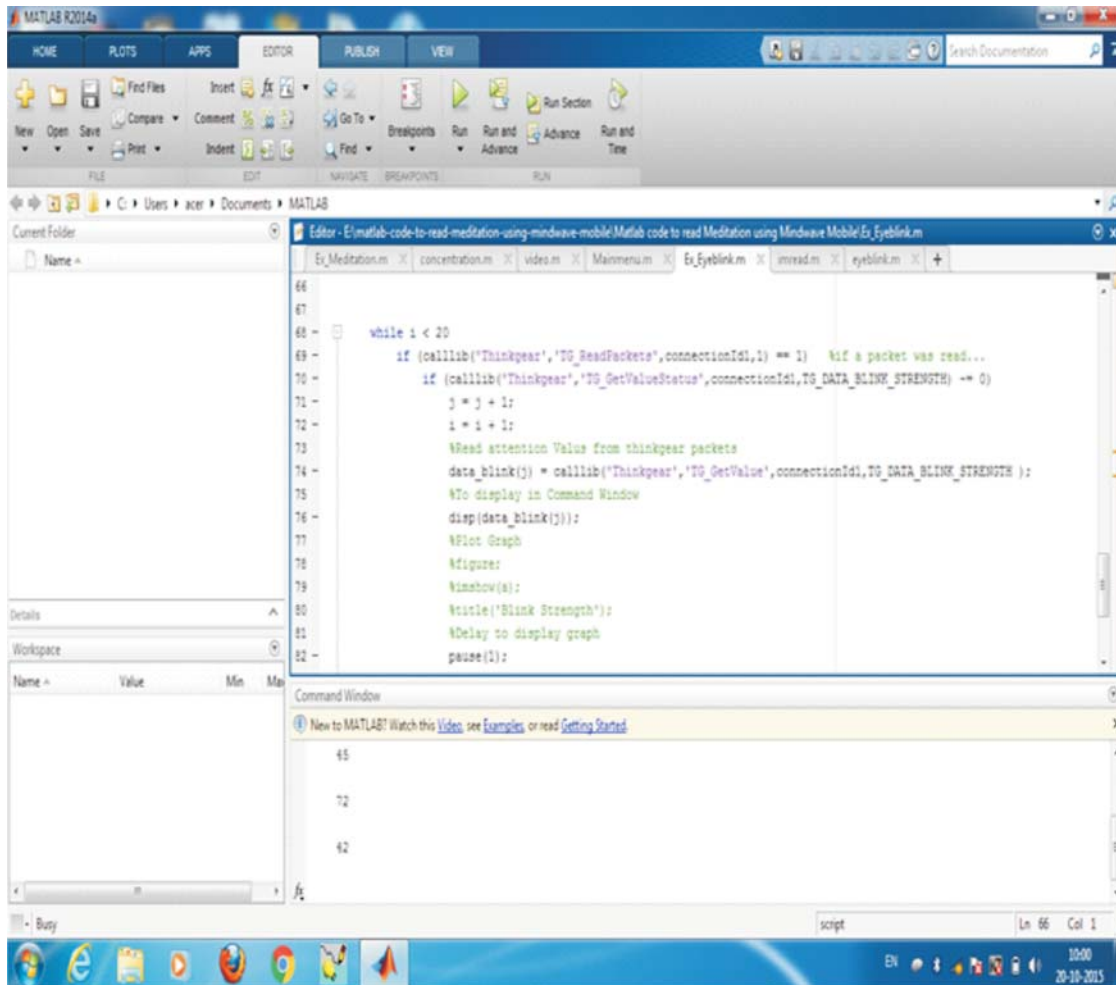


Figure 6: MATLAB code for eye blink detection



Figure 7: Personalized Assistive Tool (a) Text to speech module (b) Personalized music player (c) Personalized Web browser Module

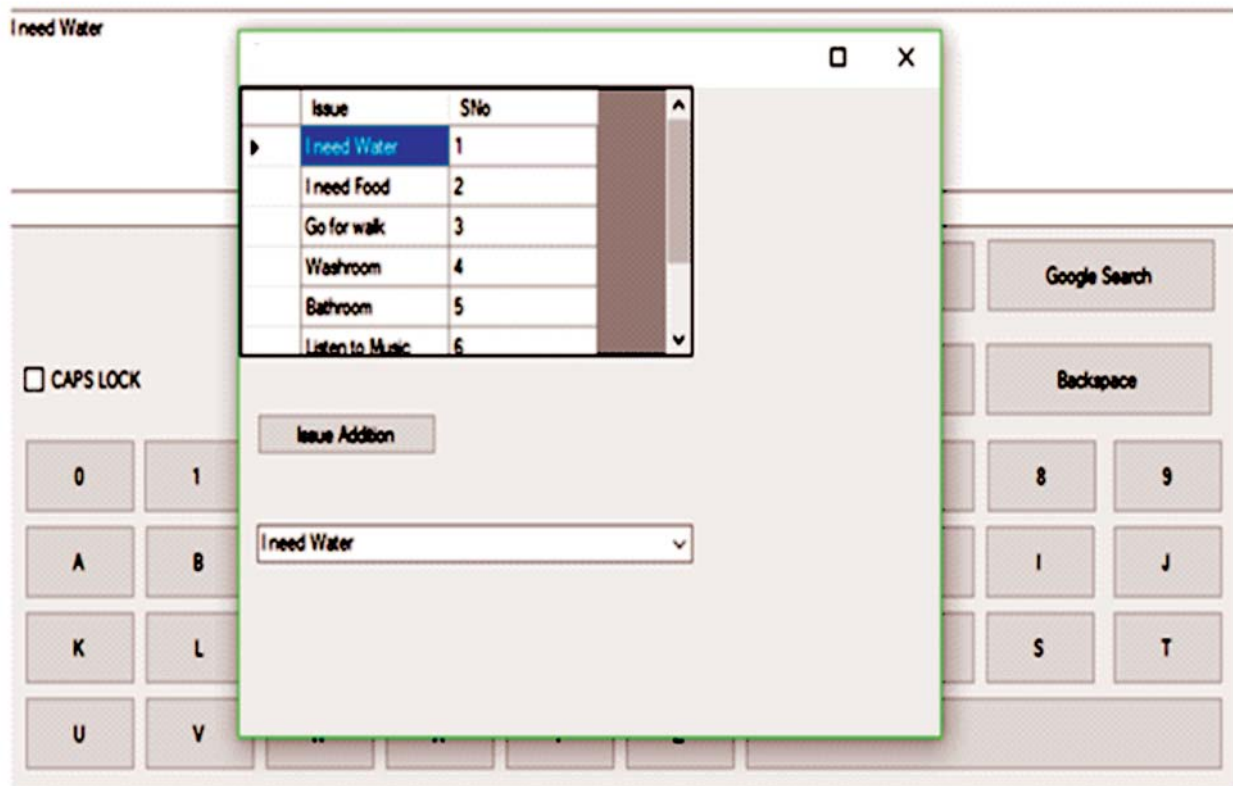


Figure 7: (a) Text to speech



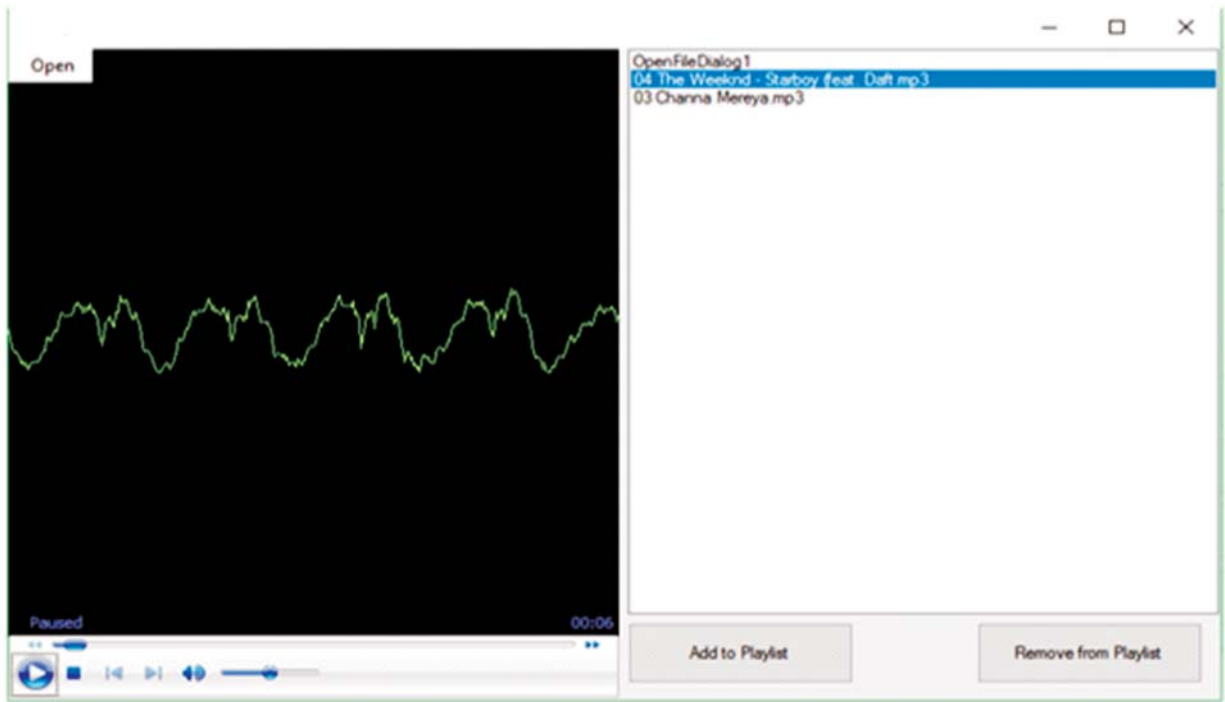


Figure 7: (b) Personalized Music

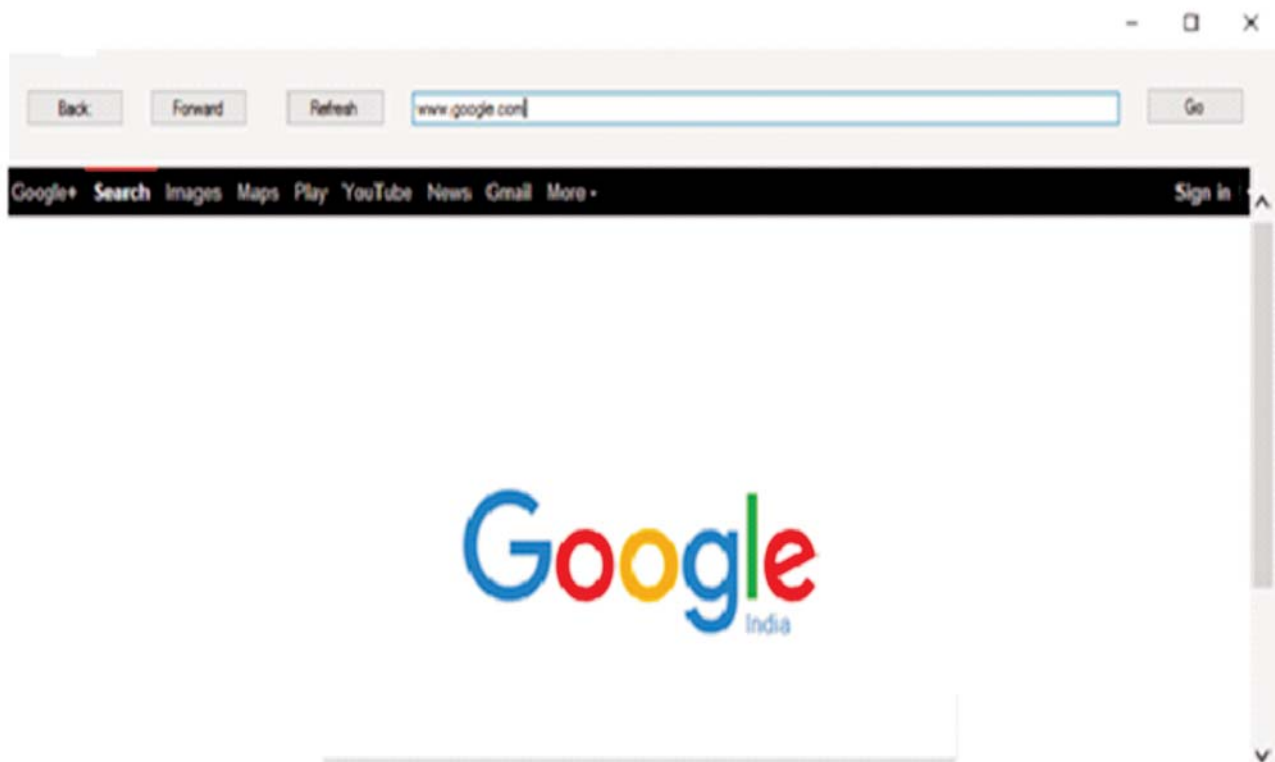


Figure 7: (c) Internet Browsing

### 4.3. User Based Personalization for Assistive Tool

User profile and user's weblogs are analyzed and personalized efficiently. Clustering and Re-ranking techniques applied for generates the personalized information in a database. The personalized web pages created in two ways, one is user profile, and another way is web log analysis. User Profile -Demographics (name, age, phone, email, country, likes, dislikes, books, movies information stored in the local repository. Weblogs data will be used to analysis the past behavior and psychographic data for a generation the dynamic content. Preprocessing may include for filtering out irrelevant information. Weblog helps to deliver more personalized search results based on the things you've searched for on Google and the sites you've visited. Page Re- rank algorithm computes a recursive score for pages, based on the weighted sum of the Page Ranks of the pages linking to them. Page Rank is thought to correlate well with human concepts of importance. Cluster techniques are used to cluster different domains like books, news, and music. User's frequently visited URLs and keywords stored under the domain. Personalized web browser architecture depicted in fig(8).

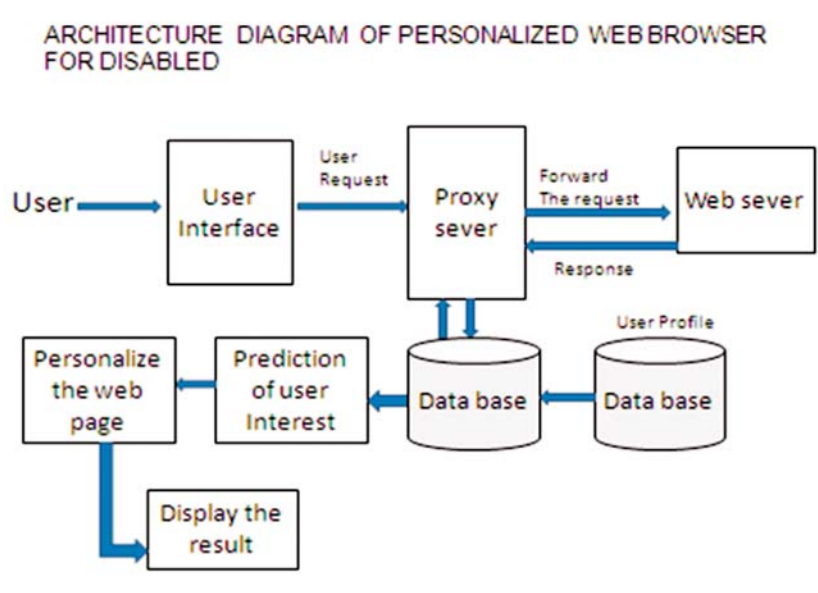


Figure 8: Process of Personalized Web browser

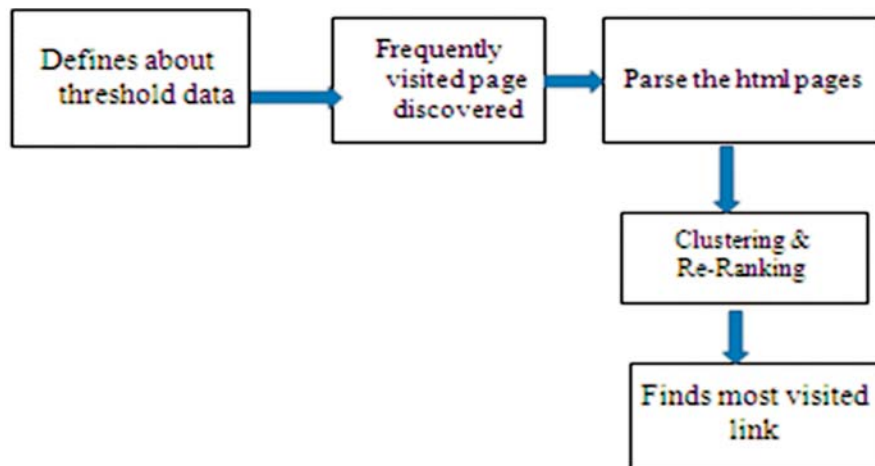


Figure 9: Prediction of User Interest

**USER PROFILE :** Demographics information are collected and clustered according to the interested topics and stored in the local repository.

**WEB LOG ANALYSIS :** Web log analysis includes analysis of web server log files that contain records of web server activity.

These information are used for discovering the frequently visited pages and their interest.

Preprocessing may include for filtering out irrelevant data.

**PERSONALIZED WEB PAGES:** User profile and web log information of the user will be analyzed and personalized efficiently. Clustering and re-ranking techniques will be applied for generating the web pages based on their interest and preferences

## 5. RESULT AND DISCUSSIONS

**Table 1**  
Experimental result of a healthy person without training using camera mouse

Task	Time taken (Sec)	Accuracy (%)	Time taken (Sec)	Accuracy (%)
Music	0.25	85	0.50	98
Wheelchair	0.25	86	0.50	98
Type keyword water	0.25	78	0.50	98
Web	0.25	88	0.50	98

Some tasks were assigned, and the user took the number of session and time for each task is observed. Before training the user achieved 81% accurate control over the system. The observed results depicted in Table.1

**Table 2**  
Experimental result of a healthy person with after taken few training sessions using camera mouse

Task	Time taken (Sec)	Accuracy (%)	Time taken (Sec)	Accuracy (%)
Music	0.25	98	0.50	100
Type keyword water	0.25	99	0.50	100
Web	0.25	98	0.50	100

Some tasks have assigned to the user and number of session and time taken by the user for each task was observed. After few training session, the user achieved 98% with 0.25 sec accurate control over the system. The observed results depicted in Table.2.

## 6. CONCLUSIONS

The proposed Usage Mining based Personalized Assistive Tool provides ease of access to the external world. The system is flexible, user-friendly and easy to operate. The system control is provided by using Eye Blink brain signals recorded in real time. NeuroSky's mind wave mobile portable headset used for the data acquisition, and MATLAB based programming used for detecting the Eye blink action whenever they feel to use camera mouse they can easily switch over the option. The sub-modules are implemented using vb.net. The newly developed system helps the user to access a web browser, communication with caregiver through the help commands. The user can operate each module independently. The real time experiment is carried out by allowing healthy subjects to use the system. The result shows that they can easily access the system without any misselection and within a good time. Music, news, books URL are stored based on the user's interest. In the proposed system, camera mouse and eye blinking were used. Eye blinking module used only for choosing the various tasks from a personalized assistive module. In future, the assistive tool will be developed using eyeblink signal to assisting the severely paralyzed patients.

## REFERENCES

- [1] International Conference on Computational Science, ICCS 2010 Data Preprocessing Evaluation for Web Log Mining: Reconstruction of Activities of a Web Visitor Michal Munka, Jozef Kapustaa, et al
- [2] Data preprocessing evaluation for Web Log Mining, Reconstruction of activities of a web visitor Michal munka,jozet kapustaa, peter sveca a Constantine the Philosopher University in Nitra, Department of Informatics, Tr A Hlinku 1,949/4 Nitra, Slovakia
- [3] Web Usage Mining to Discover visitor group with common behavior using DBSCAN Clustering Algorithm Shaily G.Langnoja, Mehul P.Barot, Darshak, B.Mehta.
- [4] Christopher W.Kwan , I Paquette, J.J.Mgee, M.Betke, Adaptive sliding menubar make existing software more accessible to people with severe motion impairments, Univ Access Inf Soc(2014)
- [5] Betke, M.: Intelligent interfaces to empower people with disabilities.In Nakashima H., Augusto J.C., Aghajan H. (eds.), Handbook of Ambient Intelligence and Smart Environments. Springer, New York (2009)
- [6] Mcmurrough, C., Ferdous, S., Papangelis, A., Boisselle, A., Makedon, F.: A survey of assistive computing devices for cerebral palsy patients. In: The 5th ACM International Conference on Pervasive Technologies Related to Assistive Environments (PETRA 2011),Heraklion, Crete, Greece, pp. F1:1–F1:8. ACM, June (2012)
- [7] Christopher W.Kwan ,I Paquette,J.J.Mgee,M.Betke, Adaptive sliding menubar make existing software more accessible to people with severe motion impairments, Univ Access Inf Soc(2014)[GUI ]
- [8] Camera Mouse (2008) A video-based mouse-replacement interface for people with severe motion impairments. <http://www.cameramouse.org>
- [9] Margrit Betke,Intelligent Interfaces to Empower People with Disabilities, Springer Science, 2010.
- [10] Keates, S.: Motor impairments and universal access. In: Stephanidis Constantine (ed.), The Universal Access Handbook. CRC Press, Cleveland, pp. 5–1–5–12 (2009).
- [11] Anwasha Banerjee et al., Voluntary eye movement controlled electrooculogram based multitasking graphical user interface, vol,18, No,3,2015.
- [12] Margrit Betke, Member, and Peter Fleming Features to Provide Computer Access for People With Severe Disabilities, IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING, VOL 10, NO 1, MARCH 2002.
- [13] Margrit Betke, Member, and Peter Fleming Feature to Provide Computer Access for People With Severe Disabilities, IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING, VOL 10, NO 1, MARCH 2002.
- [14] P.Priyan, M.Uma, S.Prabhu, Analysis of Brain-Computer Interface Based Robot Wheel Chair Control, International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 7 (2015) pp. 17171-17179.