ANALYSING THE PERCEPTION LEVEL OF THE HEARING IMPAIRED USING A MULTIMEDIA WEB APPLICATION

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*Abstract-*The hearing impaired undertakes a test which involves three streams of questions such as audio, visual and audio-visual stimulus types. By using audio-visual stimulus in testing process, Mcgurk effect in the perception by the patient can be identified. McGurk effect is a phenomenon that affects the somatosensory nerve which is used to observe and perceive the audio and visual signals and hand out them as input to the brain. With this as the rudimentary concept a multimedia test application for children and adult is developed which contains various key words as the stimuli that are independently controlled for the lexical characteristics of word frequency and lexical density, to check the coordination of hearing and vision of the patient.

Keywords: **Hearing impaired, Mcgurk effect, Somatosensory nerve, Stimuli, Multimedia**

I. INTRODUCTION

Ears are the sensory organs that assist us in the hearing activity. But this sensational part gets impaired at any stage of the life, it may be during the childhood or adulthood for that matters. Such situations must be handled in a practical way so as to proffer some treatments. This can be accomplished by developing a multimedia test application with a analyzing phase. Usually the hearing loss patient use to discern the word by observing the lip movement of the speaker as their visual capability is more than the habitual. Once they undergo the hearing surgery they can perceive the audio signals too. In this state of uncertainty they may not be able correlate the word they hear with the word they grasp through the lip movement. So they come up with a third word which is not the exact word. This is due to an effect in the somatosensory nerve and this effect is popularly known as the McGurk effect. This application examines the patient in different ways of test and by generating scores for the same, therefore providing the patients with a minimal consultation without the help of the audiologist. These tests are conducted for people with normal hearing capability, people using cochlear implant and people using hearing aid. In the audio test, only the audio is played and then the patient has to choose the right word from the options provided for that particular question. In visual test, lip movement is played with muted audio and the patient must answer accordingly. In audio visual test, both the audio and the lip movement are played together and the patient has to answer the question by choosing the appropriate option. At last the score is calculated for the entire test and represented in the form of the graph. This is used in the analysis of any improvement or degradation in the hearing level of the patient. So this is a simple yet convincing application for the hospitals as it seems to be the best replacement of the audiologist where even the patients who cannot afford much for consultations can also attain the benefits.

II. EXISTING SYSTEM

At present, all hospitals prefer audio-visual presentation. In audio-visual presentation, the audiologist is directly involved. Audiologist utters the word and the patient has to perceive it from the lip movement and voice. With the number of words identified correctly by the patient, the scores are calculated which is used for future proceedings. They also use functional magnetic resonance imaging concepts to track the brain activities for any abnormal behavior.

DISADVANTAGES OF EXISTING SYSTEM

- All the methods used currently are time consuming as audiologist must be available with the patient till the end of the process.
- As audiologist and FRMI concepts are involved, this is an expensive technique which cannot be consumed by all the people.
- Existing techniques have to be scheduled prior-hand as it involves audiologist and takes more time.
- History and improvement of the patient is stored in a paper which is not a reliable recording and is a time consuming process too.

III.   PROPOSED SYSTEM

In proposed system, audiologist is not involved in the testing procedure. The patient can take the test by themselves, without any assistance. In order to take the test, the patient must have a login credential. So, first time while using the application they have to register and create an account by providing some personal details.

There are four different categories of test available and they are audio, visual, audio-visual congruent, audio-visual incongruent. In audio-visual congruent test, the audio is played and the correct visual (lip movement) is played as a single video file for testing. In audio visual incongruent test, the audio of a word is played along with the visual of a different word and the patients are asked to identify the right word without any ambiguity. Later the score is generated and the results are represented in the form of graph. Representation of the results in the form of graph helps us to understand about the improvement and degradation in the perception level of the patient in a better way.

ADVANTAGES OF PROPOSED SYSTEM

- As audiologist is replaced by the application, the overall cost for dealing with the hearing loss problem is reduced.
- This is more advantageous than existing system as it does not involve FMRI results.
- The test data and personal data of the patient are stored in the database for future analysis and usage.
- Graphical representation is used to present the performance of the patient.

IV.   METHODOLOGY USED

There are certain important modules involved in the overall development of the web application and they are as follows:
   a) Identification of words and UI creation
   b) Generation of audio and visual stimuli
   c) Development of stimulus test pages
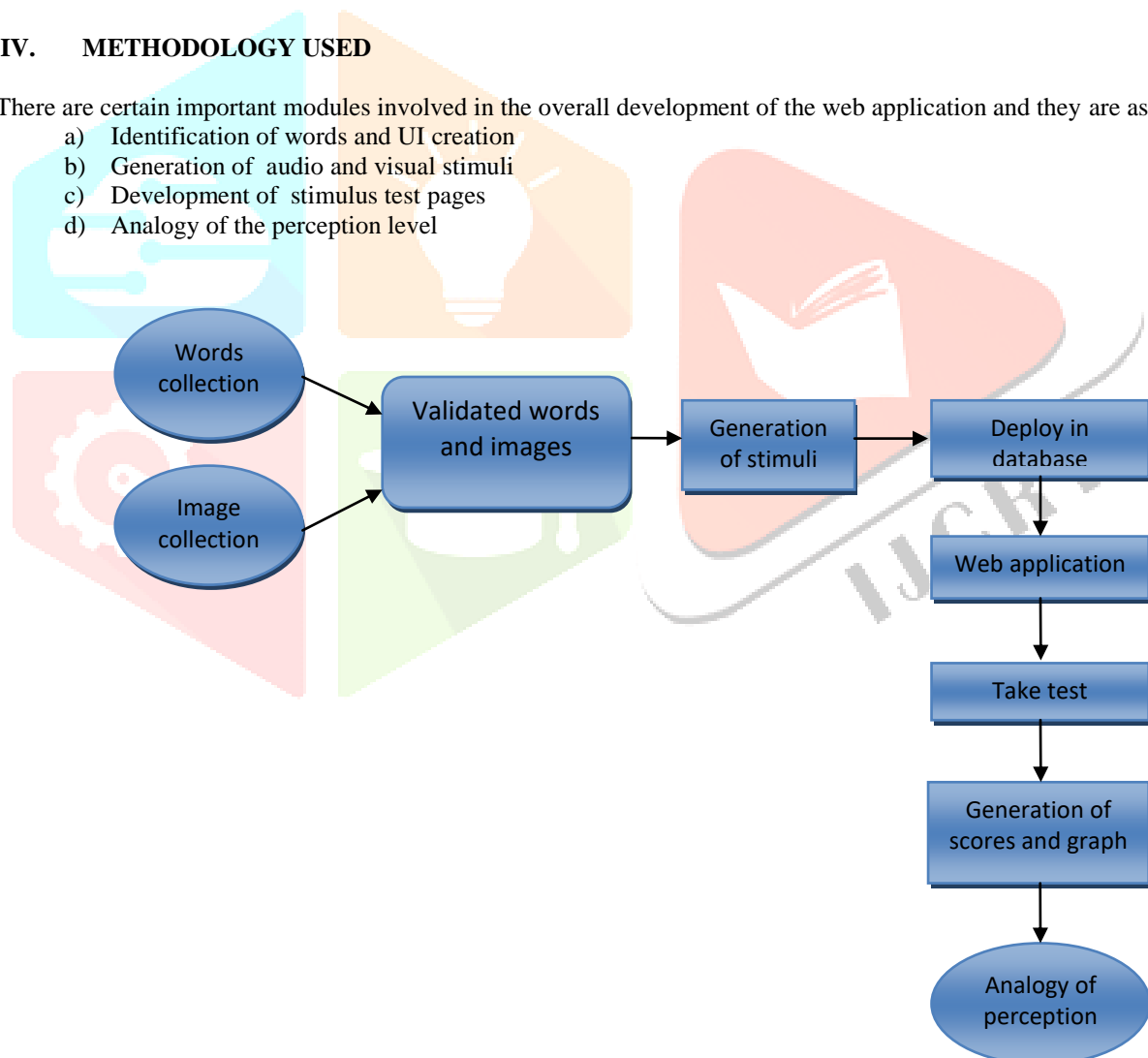   d) Analogy of the perception level

Figure.1: The flow of the project

A.   Identification of words and UI creation

The words are chosen based on the key words that are independently controlled for the lexical characteristics of word frequency (i.e., how often a word occurs in the language) and lexical density (i.e., the number of phonemically similar words, or neighbors, to the target word).As there are variations in the way how listeners confronts in real world, the

words were obtained from the stimulants produced by different talkers. Those words are sorted for different age group of people based on the familiarity of the word.

As the main objective is to replace the audiologist by the application the attentiveness was towards developing an attractive user interface. It is designed in such a way that it consists of the homepage which has navigation menu bars to navigate through the web application. The navigation bar menu includes the Home, about the test, Guidelines, E-Campus, Contacts and Login. After the login validation is done it navigates to the stimulus page.

B. Generation of audio and visual stimulus

After validating the stimulus with different people, the finalized list of words is generated and this is used for generating the stimulus. There are four groups namely 5 year,6 year,7 year and 8 year .Each group has 40 words, these words after validation are segregated into four types (audio only, video only, audio-visual, audio-incongruent video) and are considered as the test questions for the multimedia test application. For each word four options were chosen and respective images were collected and validated.

Thus the audio and video stimulus is generated for these finalized 40 words. Audio stimulus is recorded and the noise interruption is removed with the help of Audacity software. Video stimulus is generated by recording only the lip movement. Only in audio video congruency test, audio is played along with the video. After recording the quality of the stimulus was tested by the experts at the MERF INSTITUTE. This stimulus is used in the whole process of testing the patients

C. Development of stimulus test pages

The backbone of our project is the stimulus test page which consists of several questions with four choices for each question to be answered in the form of the quiz. It also consists of a timer, which gets started once the patient starts the test. While starting the test, the patient has to enter the age and the type of the test to be attended, so that the questions are retrieved accordingly from the database and rendered on the screen.The patient who is taking the test has to listen and watch the questions carefully and must select a right answer from the given set of options. Once the test is completed, the patient who is taking the test have to click on the submit button, by which the test page navigates to the result page.

D. Analogy of the perception level

Once the test gets completed, the validation process starts and displays the result on the screen. Result page points out copious view of the test process with the Number of hits, Number of miss, Number of .right answers and false alarm.

In order to interpret the improvement or degradation in a clear way, we use graph which displays the history of old results and the current test together in an understandable manner. This helps to picture the condition of the patient in a better way. All these details are stored in the database for future accessing.

V. MODULE IMPLEMENTATION

The application consists of the home page in which cascading style sheets and html5 tags have been used to make the page attractive by implementing the carousel (bootstrap). It also consists of the navigation menu bars for navigating from one page to another.

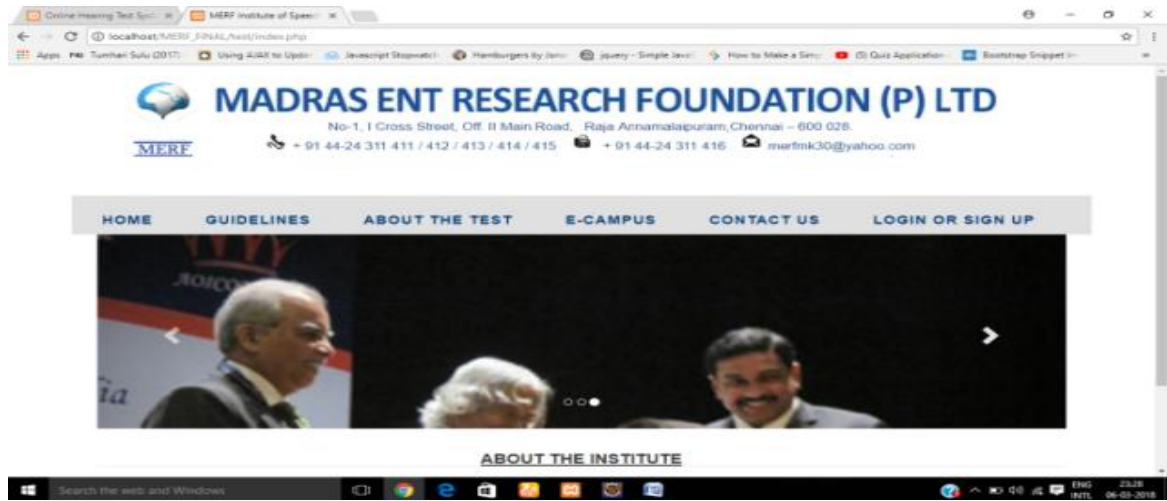Figure.2: Screenshot of the home page run on eclipse IDE

Figure 3: Screenshot depicting the bootstrap carousel

In testing process several audio are inserted. In order to record them we have used audacity software.
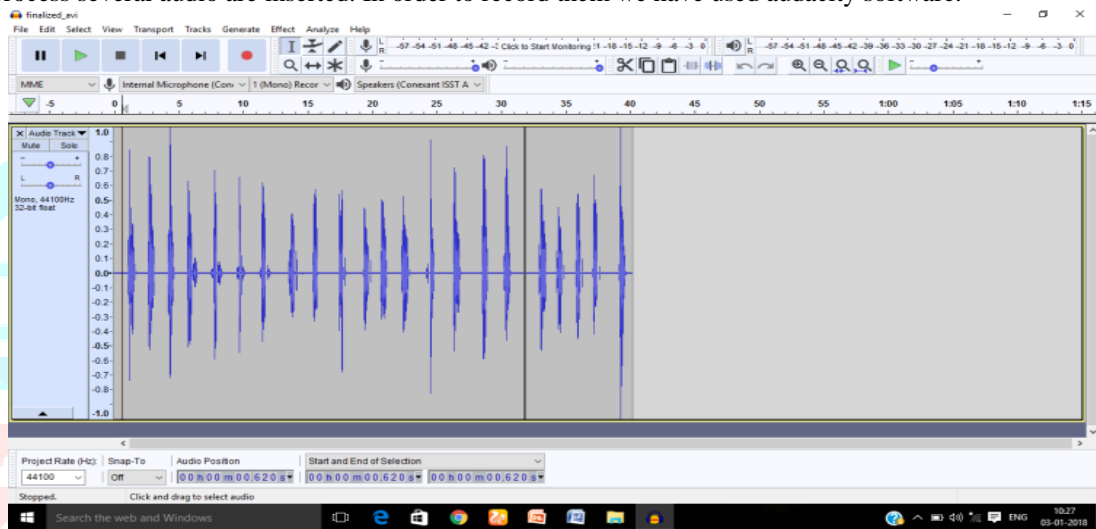

Figure 4: A sample of the audio recorded file

The user has to first login to continue with the test process and the new users have to register to get a login credential. The screenshot given below is the login page of our project.
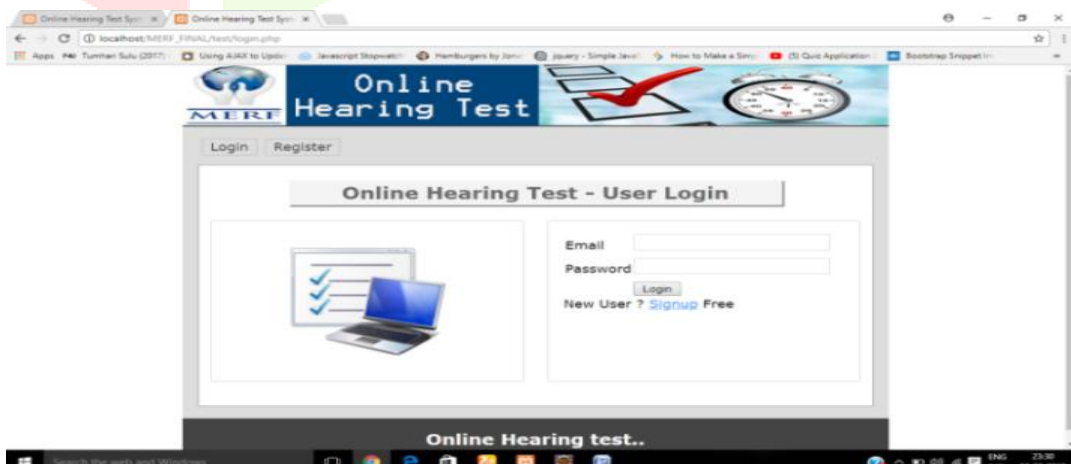

Figure 5: User-Login page

Both the login and the registration pages are connected to the server as well as db for efficient validation of the user. After the user login validation the stimulus test page is display where the test is to be taken. Figure 6 represents the different types of test that can be taken.

Figure 6: Depicts the types of test available

The server side scripting is done using PHP where the database connection, user validation and storage of the queries are carried out. The server is trained to retrieve data from the database and also to validate results. The below screenshot is the test page displaying an audio question to be answered.
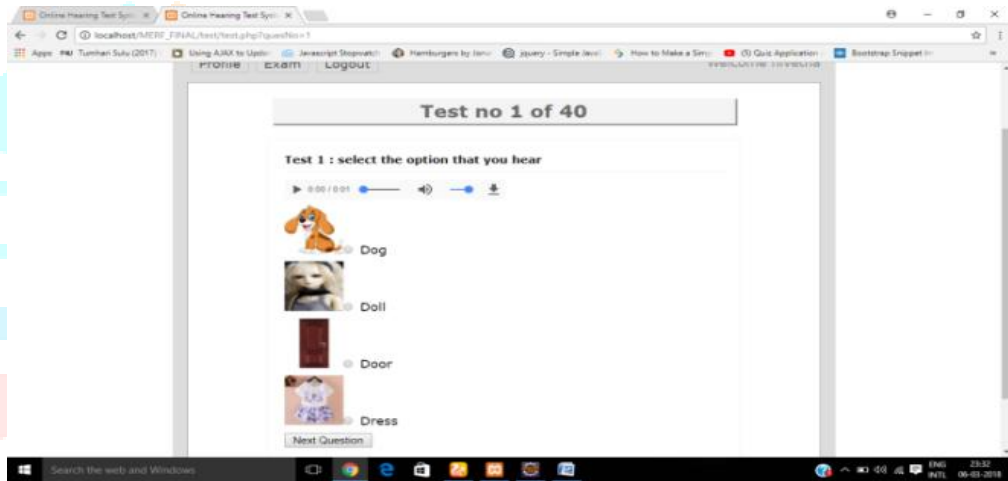

Figure 7: Audio only stimulus test page

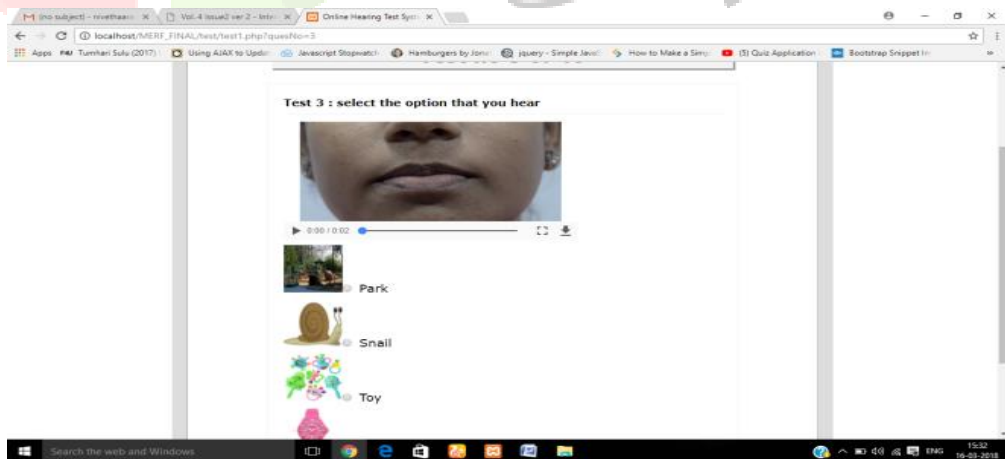Similarly the visual test is depicted in the below figure.

Figure 8: Visual stimulus test page

Once the test gets completed, the score of the test is displayed in the result page. It displays both the number of right answers and wrong answers along with two other options like view answer and start the test again.
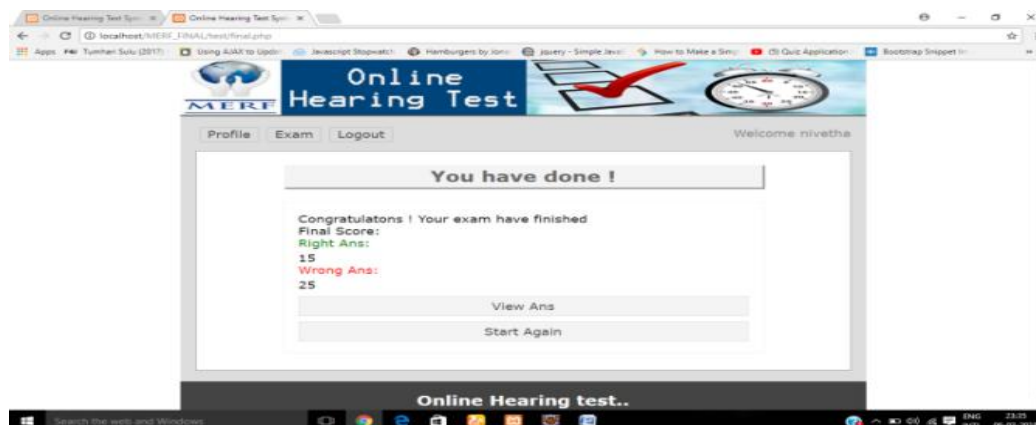

Figure 9: The result page with the scores generated

VI.   CONCLUSION

This project helps in testing the perception level of every human who have some kind of problem in hearing. They can use the application by themselves without the assistance of anyone. We have developed our project with service point of view by making it cost efficient as it replaces audiologist. This is also a time efficient process. All the words used in this project for testing are validated with several processes and so no issue arises in testing the patient with the words. This multimedia application was developed based on the audio and video stimuli and this application involves an advance concept which deals with the mcgurk effect. After the completion of the test, the scores are calculated and also represented in the form of the graph. This satisfies the end user, when they visually observe the improvement of their hearing level. From that graph, the suggestions can be provided about whether the treatment has to be taken or not. So, this is a best application, to self check the hearing level of any human with problem in hearing.

VII.   ACKNOWLEDGEMENT

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