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Auditory Avatar for Disables

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Abstract:- The planet Earth is completely risk-free for human habitation. Every human also possesses the five senses of sight, hearing, taste, touch, and smell. Humans should have unrestricted access to all their senses. Because of this many nations have taken different steps to prevent these sensory difficulties. In addition to developing similar technology for therapeutic purposes, they are researching and developing treatments for a wide range of conditions affecting the senses. Similarly, people experience a wide range of ailments for which they seek out and use a wide spectrum of medical treatments. As a result, when systems fail or become inefficient, maintenance must expend considerable resources to get them back up. In addition, not every system meets the criteria for major disorders. The price of everything is going up, therefore some countries can't afford to buy more than one computer. Therefore, many medical devices are extremely difficult to use, which has a negative effect on healthcare. The target audience for this research project is the deaf community, and the goal is to create a tool that can be used by those with a wide range of hearing loss. The study's overarching objective is to improve the quality of life for the deaf community by developing a system that accommodates all types of hard-of hearing individuals, not just one.

Keywords:- *Deaf Community, Medical Treatments, Machine Learning, Image Processing, Senses.*

I. INTRODUCTION

The fact that the ordinary person does not comprehend what a deaf person is trying to convey to them is the primary contributor to the humiliation experienced by a significant number of deaf persons in our nation. Because of this issue, many deaf people are isolated from the rest of society and are unable to do their jobs to the best of their abilities. It is really significant that our team has launched this new smartphone app since it will help avoid deaf individuals from having to deal with inconveniences like these. It also contains activities to help kids recognize their feelings and relate to others using the app. Additionally, the most significant obstacle they face is that the general public is not familiar with their sign language, which makes it challenging for them to adequately communicate with each and every individual. Because of the stress brought on by all these issues, our app offers users the opportunity to play a bubble game in an effort to alleviate some of that stress. They may play that game when they are feeling anxious, which will help them to relax and relieve some of the tension. In addition to that, this program has the capacity to recognize the vulnerabilities of newly born infants. This software has a number of unique features, one of which is the capability to test the hearing of infants. In this regard, the individual who uses the application in addition to the music can add a song of their own choosing. Additionally, it can capture the baby's reactions and emotions while the music is played in both baby's ears at once. The next step is to double-check the reported emotions and reactions, and then apply the insights gained from the process to the data. The data is processed and then stored in a database. Future test results will be generated using the same data.

When analyzing the newborn hearing detection component, the gadget needs to be positioned close to the baby's ear in order to be effective. Additionally, it plays music that is calming for the infant, or else it advises the mother of the baby to talk to the baby at that moment. By monitoring the expressions on the baby's face, we may determine with the help of the outcome of the infant whether the baby is experiencing any kind of problems with their ears. Additionally, it affects both the baby's left and right ears simultaneously. Also, the other component of Stress releasing component relieves a game to deaf people. Playing this game can help any deaf person who is feeling at least a little bit stressed. Bubbles and the need to pop them make for an interesting challenge that adds to the overall appeal of the game. In this case, we carefully looked at when and what color the people playing the game blew into the air. In line with what had been found before, we found that people who shot darker-colored bubbles were more likely to be worried. One theory says that how well a player does in the game affects how many bubbles they get. Music into vibration component also very useful for this system. When a customer uses the app to pick their favorite song, they will see information about the song's title. But to make sure that deaf people can still enjoy music, the first thing that needs to be done is to let them feel the vibrations that the music makes when they play it on their phone. This will let the vibrations from the music be turned into a wave, so that deaf people will be able to hear it. Sign detector also very useful because in this case, when a deaf person uses signs to talk to us in his language, the software looks at each sign, figures out what it means, and gives the output as a word. In other words, the software can turn sign language into spoken language. After that, it tells text-to-speech what to do so that the word can be spoken. After that, both hearing and deaf people will be able to use it. Image Possession, Hand Posture Recognition, and Connecting with Image Possession all help make the final product.

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II. BACKGROUND STUDY AND LITERATURE SURVEY

One of the most common problems in newborns and infants around the world is hearing loss. The goal of this project is to make a smart system that uses auditory evoked potential signals to measure how well someone can hear (AEP). An AEP signal is a non-invasive tool that can show how neurons in the auditory pathway interact when they are stimulated. By pulling out fractal features from the AEP signals, the AEP responses to normal sounds were found. More than 85% of the time, the suggested test was accurate [1]. The Brazilian Institute of Geography and Statistics says that a million Brazilians have trouble hearing in some way. There are clinical tests that can be done on babies right after they are born to look for possible developmental problems. A test that has gotten a lot of attention is the transient evoked otoacoustic emissions (TEOAE) test. At the moment, this test is done with otoacoustic emissions equipment, which has software that looks at the signals coming from the baby's ear. Unfortunately, in Brazil, this equipment is expensive and most of the necessary technology is owned by foreign companies. This means that most people can't take this test [2]. The author of this article suggests a program that uses Convolutions Neutral Networks (CNN) and a text to-speech translator to help people who speak English and people who don't speak English communicate better. This app uses the CNN algorithm to turn the gestures into text, which can then be turned into speech. This app works in real time and can make it easier for people who speak English and people who don't to talk to each other [3]. The hand gestures will be marked and cropped with a digital camera or cell phone camera. Then, the image processing system will match the hand gestures to gestures already in a database, which will be used for textual conversation on screen. It works in a way that normal staff will write the text and the nonspeaking staff will see the hand gesture that goes with it [4].A further technique for recognizing hands in webcam footage is Indian sign language recognition, which makes use of image processing, computer vision, and neural network approaches to accomplish so. The collected video of the phrase gesture is converted to text and then to voice by identifying the hand motions frame by frame using a sequence of image processing operations [5]. Also, there is a similar project for Gaining proficiency in a particular language. It may be necessary for children with hearing loss to learn to speak in order to interact with their peers. Some people may learn ASL (American Sign Language) as a means of communication (commonly known as ASL). In ASL, the shape, placement, and movement of hands, as well as facial expressions and body language, are all essential components of communication [6]. Physical activity, diet, recreational drug use, medication adherence, and preventative and rehabilitative measures all have direct effects on the prevalence of many lifestyle-related diseases and conditions[11]. Successful treatment of chronic illnesses due to poor health behaviors is essential for recouping the cost of care, which is estimated to be three-quarters of all health-care expenditures in the United States. Additionally, studies have demonstrated that even minor adjustments to one's routine can have a significant effect on one's quality of life. Therefore, behavior modification is one of the most important and frequently targeted levers for reducing the burden of preventable illness and mortality and promoting well-being [4]. However, according to self-determination theory (SDT), a well-known motivation theory, not all motivations are created equal. The question of whether behavior is innately or extrinsically driven is significant[12]. Intrinsic motivation refers to actions that are undertaken 'for the sake of it,' to meet core psychological requirements for autonomy, competence, and relatedness, resulting in feelings of volition, willingness, and pleasure [7]. Stress, though, is an inevitable aspect of being alive. In some cases, it may prove to be helpful. Whether it's to finish a marathon or get that promotion at work, stress may be a great motivator. Your employment, family life, and health could all suffer if you don't learn to control your stress.

Mental health problems at work or at home can be challenging to prevent and manage. Mobile applications are an excellent tool for making preventative measures part of one's routine [8]. Theorists who concentrated on task performance have largely explored how color impacts human behavior [7]. Although gamification is still in its infancy, we anticipate that it will acquire appeal in healthcare due to two factors. The first one takes use of people's desire for cutting-edge smartphones, providing them with more people to play their games and better resources to make health-oriented video games. The second factor is the creators' openness and willingness to incorporate cutting-edge behavioral insights into electronic treatments. [9] As a result of this study, a wearable vibration system has been developed that will help the deaf identify key sentences. The user wears a device consisting of a microphone and a vibration motor. Mel Frequency Cepstral Coefficients (MFCC), preprocessing, and Dynamic Time Warping were utilized in this research to identify human voice (DTW). There have been real-time tests in three environments with varying signal-to-noise ratios on a standard computer. Results are accurate 95% of the time, with a 97% level of specificity and a 76% level of sensitivity [10]. The model is verified by Smart Prayer Aid, an app designed to help the deaf and blind perform Islamic rituals. Subjects were used for the examination in a controlled laboratory setting, including both deaf blind and non-deaf blind individuals. Results showed that utilizing online speech recognition in Arabic, accuracy in recognizing human speech ranged from 77% to 96% in natural settings [10], depending on the conditions [8]. This research suggests that a smartphone-based acoustic event sensing and alerting system called UbiEar has emerged. UbiEar's fundamental techniques include a lightweight deep convolution neural network for location-independent auditory event recognition on commodity cellphones, and a collection of mechanisms for instant and energy-efficient acoustic sensing. UbiEar can help young DHH students become more aware of crucial sonic events in their daily lives, as demonstrated by controlled experiments and user studies including 86 DHH students [10].

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III. METHODOLOGY

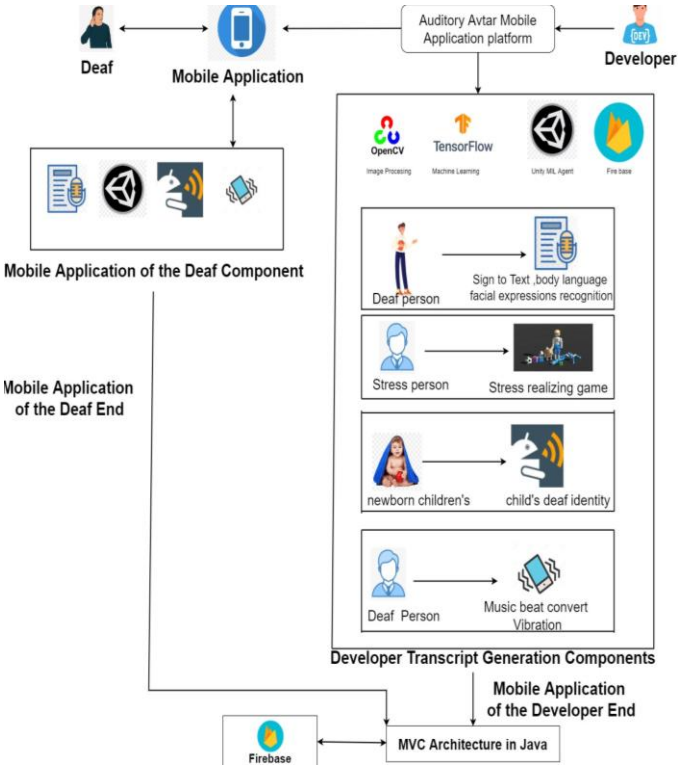

Fig.1.System Diagram

The proposed solution intends to provide a resourceful approach for the hard-of-hearing who need to interact with the deaf community and the public. If the user is a registered deaf user of the system, then they can take advantage of this website, as shown in Fig. 1. All interested Deaf persons must first create an account on our site so that they can join in on the helpful hand activities. The auditory avatar platform allows users to pinpoint exactly where they need help solving a problem. In this system, the primary tools for developing answers to research questions are machine learning, image processing, and video avatar. Use of the Model-View-Controller design pattern and Firebase to ensure a smooth website launch.

In the first phase of development, supervised learning training of new data sets is required. Google Colab and the Jupyter Notebook are two options for this. It can be used to classify data into predefined categories and train fresh data sets. The next step is to put the trained data sets through their paces and determine the likelihood of correctly identified images. Deaf individuals use these tried-and-true data sets to solve the most fundamental issues they face. After the system detects the problem, it constructs a video character to depict the solutions. In addition, the system will immediately alert users to any newly available tools and inquire as to how they may be of assistance in times of need. Please provide four examples of how you might use these to a research problem. The primary aims of the study are to gain insight into the processes by which the deaf may interpret sign language via the use of spoken language and the hearing can do the same through the use of lip reading. Additional objectives include measuring stress levels and determining a player's potential in games, as well as employing music to determine a newborn baby's hearing range.

The qualitative method was used to complete this investigation. We used example photos to decide on appropriate actions or masks to adopt. Qualitative research is conducted to gain a deeper understanding of human experiences through the collection of information other than numbers. Tools used in qualitative research include questionnaires, interviews, and observations. OpenCV is a computer vision and machine learning software library that can be utilized without cost. OpenCV was developed in order to expedite the process of incorporating artificial intelligence into various products by establishing a standard infrastructure for computer vision application development. Because OpenCV is a product that is licensed under the BSD, it is extremely straightforward for enterprises to consume and modify the source. The collection contains more than 2500 algorithms that have been tuned for use. These algorithms cover a wide variety of computer vision and machine learning strategies, some of which are more conventional while others are more cutting edge. These algorithms can be used to recognize faces, identify objects, classify human behaviors in films, follow the movements of the camera and follow moving objects, extract 3D models from objects, create 3D point clouds from stereo cameras, and more. Other applications of these algorithms include stitching images together to create a high-resolution image of the entire scene, searching an image database for related images, erasing red eyes from flash-captured photos, tracking eye movements, identifying scenery, and recognizing people.

The frames are extracted from the stream and then transformed into gray scale images with a pixel size of 50x50 using OpenCV. From the beginning to the end, each of the images' dimensions should be consistent with one another.

A. Newborns Hearing Detection

When the baby is born, a device is placed near his ear. This device either plays soothing music or advises the mother to talk to the baby. If we use this technology to investigate a newborn baby's hearing problems, we will quickly be able to determine the nature of the difficulties that the infant is experiencing. It is necessary to apply this device to both baby's ears while positioning the device so that it is in close proximity to the baby's ears. It affects the ears on both sides. In the case that you are unable to elicit a response from either of baby's ears on the very first effort, you can try this method once more, twice, or even three times, depending on how many times you feel it is required. After we have finished saving all the data that was generated by this process, we will be able to decide whether or not it has been found at that point.

B. Stress Releasing game

Any deaf person experiencing at least moderate levels of stress can benefit from playing this game. The inclusion of bubbles and the requirement to pop them gives for an intriguing challenge that adds to the game's overall appeal. In

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this case, we carefully examined the timing and hue of the bubbles launched into the air by the game's participants.

Consistent with prior research, we discovered that people who shot darker-colored bubbles were more likely to be anxious. According to one theory, the number of bubbles a player gets depends on how well they've done in the game. The player computes a score in response to the bubble explosion, using that number to assess whether he is under substantial stress and what mental state he is in at the moment. This will improve their mood even if they learn nothing else from it.

C. Music into Vibrations

When customers use the app to choose their preferred song, they will be presented with information on the title of the song. However, to prevent the inability of deaf people to enjoy music, the first thing that needs to be done is to make it possible for them to feel the vibrations produced by the music when they play it on their phone. This will allow the vibrations produced by the music to be transformed into a wave, which will allow deaf people to hear the music.

D. Studied and Create data sets for components

1) *Data collection, processing, and Testing :* Images of newly gathered hand motions, facial expressions, and changes in stress level were used to build Machine Learning (ML) models. Prior to training the photographs, groupings of pictures were identified and sorted under names using information gained from supervised learning. After then, the train repeated the identical actions and responses more than ten times, and it was carried out in a variety of ways. The methods of Google Colab and TensorFlow were utilized in the completion of this task. TensorFlow is a library that simplifies the process of developing a wide range of neural network models by providing pre-built features as well as advanced algorithms. It provides the necessary hardware and infrastructure, which places it among the top libraries in the field of deep learning and makes it one of the top libraries utilized regularly by academics and researchers. In order to accomplish this, we made use of OpenCV to generate the most relevant and high-quality images pertaining to the research.

In addition to this, players are required to blow bubbles for the game in order to reduce their levels of tension. Build a bubble wrap popper using the Unity game engine. Touch controllers are utilized for the manipulation of sprites and objects that are 2D. The camera region should be populated with columns and rows by utilizing a 2D array, and the sprite, audio, and particle should all be added to the same script. Create a list of the items in the game, then search through it to find what the user are looking for. If all of the bubbles in the scene have been burst, then all of the game items should be reset. Turn on some modern music while the user creates the burst particle out of thin air. Putting on a show of particles Destroy the particle as soon as it has fulfilled its role in the performance. It Characters can move around the scene toward a shared purpose, avoid each other, or in any other situation requiring spatial reasoning or path finding with the assistance of the NavMesh Agent component. This scenario should require the developer to install NavMesh agent before testing. After a NavMesh has been constructed for the level, it is time to create a character who is able to move around in the environment.

80% - 90% the pictures were utilized for training, while the rest of the pictures were used for validation (10 percent - 20 percent). After receiving instruction, new sets of photographs were taken in order to evaluate the performance of the model. The process of data collection is broken down in detail in Table 1, which may be found here. The use of preprocessing techniques allowed for an increase in accuracy as well as a simplification of the data set. Due to the fact that the generated photographs were of varying sizes and color formats, they needed to be resized to fit into the same dimensions and have their color space changed from BGR to RGB. Data augmentation strategies such as rotation, filling, shearing (both horizontally and vertically), flipping (both horizontally and vertically), and zooming were utilized so that the amount of data sets may be increased without the models being overly accurate.

2) *Research Design and sampling :* The goal of this study, which used a qualitative research method, was to create a case study about five people from different backgrounds by combining the data collected with what was already known. The main goal of the study was to find out what might affect how deaf people build their identities in a hearing-dominated society. Since identity can't be defined or measured, the researcher used the phenomenological method, which is based on each person's experience and also takes into account their thoughts and feelings. Everyone who took part in the study volunteered to be deaf, even though their hearing loss was different. The researcher talked to each person in a semi-structured interview. The information was typed up, and common themes or other things that might have influenced identity formation were looked for. This was a qualitative study that followed the broad rules of phenomenological research, as was explained in the section before this one. The stated goal of this study, which was to find out what factors affect cultural identity in deaf people, was a good fit for a qualitative approach. The group for this study was made up of people with significant hearing loss who were either born deaf or lost their hearing as children (pre-lingual). To account for any possible gender restrictions, all the people who were chosen were both men and women and were between the ages of 18 and 40. Since the researcher was looking for people with different backgrounds and experiences, the level of hearing loss did not affect who could or could not take part. The main goal of this study project's data analysis was to find recurring themes that might have come up and could be used to help explain how deaf people form their identities. The main goal was to get to the heart of each participant's experiences and, as a result, to write down as much information as possible about the data. This was done

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based on the core ideas of qualitative research and phenomenology.

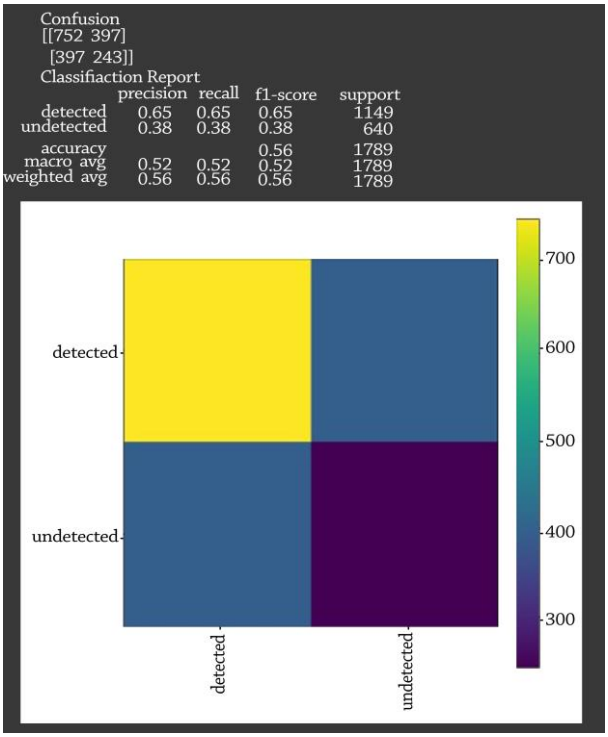

Fig.2.Confusion Metrics

IV. RESULTS AND DISCUSSION

A. Newborns Hearing Detection

When a baby is born, there is a device that is placed near his ear that either plays music intended to calm the infant or gives the mother instructions to talk to the baby. When a baby is born, a device like this one is placed in their ear to help them adjust to their new environment and improve their hearing. If we consider the hearing problems of a newborn infant first. Because of this, it has an effect on both ears. In the case that the user does not achieve an expression in either of user's ears during the first try, it is feasible to repeat this method two or even three times in order to meet the requirements of the situation. After we have finished saving all of the data that was generated by this process, we will be able to decide whether or not it has been found at that point.

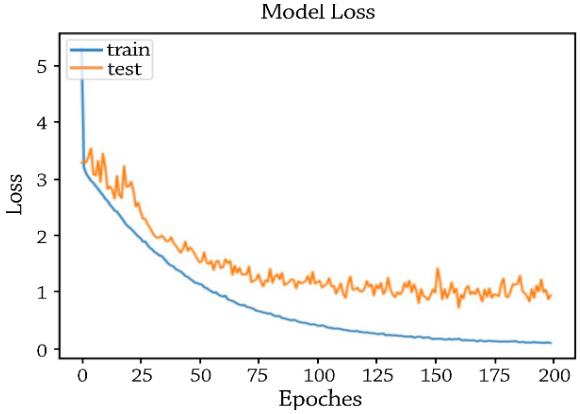

Fig.3.Model Loss

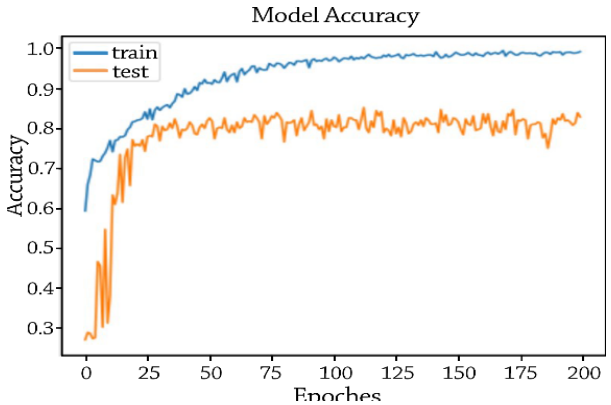

Fig.4.Model Accuracy

Following the result has been gathered, a report about it will be compiled and written. The output will be appropriately recognized by the application of machine learning and image processing.

TABLE I. LOSS AND ACCURACY OF THE TRAINED MODEL

	Loss	**Accuracy**
Train	0.0700	0.9972
Test	0.9838	0.8260
Final Train Accuracy		99.72
Validation Accuracy		82.60

B. Sign Detector

It is difficult for any of us to properly communicate with a deaf person, the primary objective of this component is to be developed to lessen the annoyance that is caused by the fact that deaf people are hard of hearing. This component's primary goal is to be created in order to lessen the annoyance that is caused by the fact that deaf people are hard of hearing. In this scenario, when a deaf person communicates with us in his language using signs, the software analyzes each sign, recognizes what it means, and gives the output as a word. In other words, the software can translate sign language into spoken language. After that, it gives instructions to text-to speech so that the word can be read out. After then, it will be possible for persons who are hearing as well as those who are deaf to make use of it. Connecting with Image Possession, Image Possession, and Hand Posture Recognition all contribute to the final product's creation.

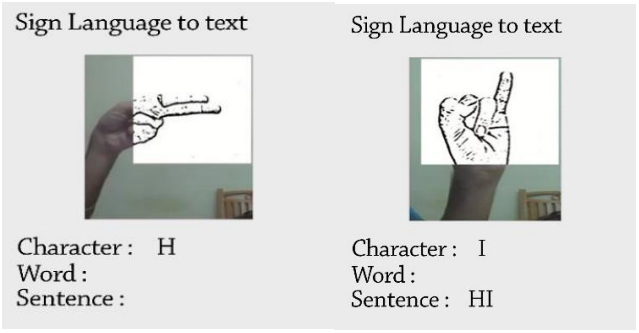

Fig.5.Training and Testing the Data set

C. Stress Releasing game

Because they are unable to communicate easily with other people, those who are deaf frequently experience feelings of stress. One of the things that emerged as a consequence of this is the game of popping bubbles, which can be considered an element. The gamification of this was accomplished by the application of features of machine learning. If a deaf person is feeling anxious to some degree, playing this game with them can make them feel better about themselves and their circumstances overall. The fact that bubbles appear in this game and the user required to pop them provides for an extremely exciting task, which contributes to the overall attraction of the game. In this instance, we focused our attention on the timing as well as the color of the bubbles that the people participating in the game launched into the air. When we compared our findings to those of other studies, we discovered that those who shot bubbles of a dark color were more likely to be stressed out. This was the conclusion that held true across all of the investigations. At the very least according to one theory, the number of points a player has earned is the factor that decides whether they are given bubbles in this particular iteration of the game. The individual who is playing the game generates a score based on the bubble blast, and then utilizes that number to assess whether he is under a considerable amount of stress, as well as what kind of level he is currently functioning at. Even if the only thing they take away from it is a score, doing this will help them feel better about themselves.

D. Music into vibration

The next discussion will center on the primary way in which music is created, which is as a vibration. When it comes to this project, the primary purpose is to realize the goal of making it possible for deaf people to experience the same sensation that hearing people do when they listen to music. This was created for the simple reason that the primary goal of any living human being is to fill their lives with things that bring them joy. If the vibrations are created by the beat of the song, then even a person who is deaf might potentially attend a party and have a good time as long as the music has a beat. Then, when he looks at it with other people, he equally has the ability to appreciate it without there being any distinction between himself and the other people who are looking at it.

V. CONCLUSION

The purpose of this research was to identify effective strategies for dealing with the repetitive motions that are common in people who have hearing loss disorder. According to the data that was provided, it is possible to deduce that the modification of this behavior will require the utilization of a variety of different computer-based methodologies. The development of new assisting modules might benefit from additional research in the future on computer-based modifications regarding methods for deaf people. It would be worthwhile to conduct research into the extent to which this could improve the lives of people who engage in behaviors involving repeated motion.

REFERENCES

[1]. Paulraj, M.P., Subramaniam, K., Yaccob, S.B., Adom, A.H.B. and Hema, C.R., 2014, December. A Machine learning approach for distinguishing hearing perception level using auditory evoked potentials. In 2014 IEEE Conference on Biomedical Engineering and Sciences (IECBES) (pp. 991-996). IEEE.

[2]. Barros, N., Medeiros, R., Leite, C., Lopes, M., Ribeiro, A., Araujo, F. and Guerreiro, A., 2013, October. OtoLeitor: A protocol implementation of Universal Newborn Hearing Screening by a mobile platform in Brazil. In 2013 IEEE 15th International Conference on e-Health Networking, Applications and Services (Healthcom 2013) (pp. 1-3). IEEE.

[3]. Karabasi, M., Bhatti, Z. and Shah, A., 2013, December. A model for real-time recognition and textual representation of malaysian sign language through image processing. In 2013 International Conference on Advanced Computer Science Applications and Technologies (pp. 195-200). IEEE.

[4]. Dabre, K. and Dholay, S., 2014, April. Machine learning model for sign language interpretation using webcam images. In 2014 International Conference on Circuits, Systems, Communication and Information Technology Applications (CSCITA) (pp. 317-321). IEEE.

[5]. Hearing loss in infants and babies [WWW Document], 2020. . Healthy Hearing. URL https://www.healthyhearing.com/report/52411-Newborn-hearing-loss-from-prevention-to-intervention (accessed 1.24.22).

[6]. Newborn Hearing Screening FAQs - HealthyChildren.org [WWW Document], 2018. . HealthyChildren.org. URL https://www.healthychildren.org/English/ages-stages/baby/Pages/Purpose-of-Newborn-Hearing-Screening.aspx (accessed 1.24.22).

[7]. Ahtinen, A., Mattila, E., Välkkynen, P., Kaipainen, K., Vanhala, T., Ermes, M., Sairanen, E., Myllymäki, T. and Lappalainen, R., 2013. Mobile mental wellness training for stress management: feasibility and design implications based on a one-month field study. JMIR mHealth and uHealth, 1(2), p.e2596.

[8]. Kutchma, T.M., 2003. The effects of room color on stress perception: red versus green environments. Journal of Undergraduate Research at Minnesota State University, Mankato, 3(1), p.3.

[9]. King, D., Greaves, F., Exeter, C. and Darzi, A., 2013. 'Gamification': Influencing health behaviours with games. Journal of the Royal Society of Medicine, 106(3), pp.76-78.

[10]. Yağanoğlu, M., 2021. Real time wearable speech recognition system for deaf persons. Computers & Electrical Engineering. https://doi.org/10.1016/j.compeleceng.2021.107026

[11]. A. S. Buddhika, P. K. Wijesekera, D. G. H. Kavindu, D. S. Dinusha, U. S. S. S. Arachchillage and T. A. Kuruppu, "Smart Photo Editor for Differently-abled People using Assistive Technology," 2021 6th International Conference on Information Technology Research (ICITR), 2021, pp. 1-6, doi: 10.1109/ICITR54349.2021.9657285.
[12]. U. S. S. S. Arachchillage, "Smart Virtual Expert System to Assist Psychiatrists (SVESTAP)," International Journal of Information Technology and Computer Science (IJITCS), vol. 10, no. 1, pp. 59–67, 2018.