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PSYCHOLOGICAL AILMENTS TREATED THROUGH IMMERSIVE VIRTUAL REALITY APPLICATION BY SCRUTINIZING BIOLOGICAL STIPULATIONS

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ABSTRACT

An Android application consists of an interface which provides access to experimental psychotherapy to the patient through Virtual Reality. An external monitoring device which has a heart rate sensor will continuously monitor patient biological information to cloud. The application retrieves real time biological information from the cloud. It intelligently scrutinizes the information and generates simulations.

The simulations provide immersive, rapid and spontaneous therapy. The artificial immersive environment in VR is simulated using Orion360 which enables the application to display the videos in VR format. The data security of the users is maintained using the RSA algorithm. Detect pulse rate using the pulse oximeter integrated into a microcontroller.

An approach treatment for multiple psychological disorders through objective biological information to deter cognitive dissonance. The biological information is processed by a Rapid and Spontaneous algorithm to produce VR simulations to neutralize the pulse rate. This application can be used as a medical assistant in treating psychological ailments for downtrodden people. This application is user friendly as personalized videos can be incorporated.

Keywords- Virtual Reality, Arduino Uno, Node MCU, Heart Rate Sensor, Orion360, Mobile application.

1. INTRODUCTION

Virtual Reality is a type of technology that provides carefully engineered simulations through an interactive computer system. The information contained in the simulation is multi-dimensional aural and visual information, fed to the user through a highly sophisticated screen. Owing to its technological advancement, Virtual Reality finds relevance in our project.

Virtual Reality forms a part of a crucial application in graded exposure therapy. A typical Virtual Reality setup would contain a head-gear as an input/output device for

processing simulated information. This head-gear will retrieve information from a computer system and will feed it to the user.

VIRTUAL REALITY PRINCIPLES

- **Immersion** is a perception of being physically present into a non-existing or non-psychical world. The perception is created by surrounding the user in images, sound or any other stimuli - stimulation.
- **Imagination** is also known as presence, is the feeling of being present of being a part of the computer-generated world - as a result of the stimulation of the human sense (visual, aural, smell etc.) by the system.
- **Interaction** is a means of communicating with the system, interaction in VR is usually through 3D means like a space ball and head-mounted device.

CHARACTERISTICS OF VIRTUAL REALITY

- Highly immersive
- Produces hyper realistic simulations
- The simulations can replicate any natural environment artificially
- Owing to the effectiveness, the applications of Virtual Reality range from gaming to psychotherapy
- Virtual Reality in its most primitive form as a media technology is non- interactive, however with the incorporation of intelligent computing the artificial simulations can act as interactive environments for the user.

2. RELATED WORK

The patient's ailment is identified with the help of psychological literacy. A psychologist generally conducts sessions in order to diagnose the specificity of the patient's psychological issue. After identifying the said condition, the virtual environment is meticulously constructed with the help of design/computer engineers and psychological guidance. The professional involvement of various professionals depends on the project, but the general norm is such as the aforementioned. Upon creating a virtual environment suited to the psychological condition, the integration of the required hardware and software (again specific to the project) is carried out. The therapeutic setup is finally in its usable form after this particular step. An apt patient for the process is selected after proper psychological screening and the patient is subjected to the therapy through the artificial environment constructed, with the help of the virtual reality hardware. The interactive hype realistic artificial environment is able to encourage the therapeutic process by relying on the exposure principle.

The exposure principle works in such a way that, gradual graded exposure leads to the desensitisation of the patient's In Existing systems, the patient's ailment is identified with the help of psychological literacy. A psychologist generally conducts sessions in order to diagnose the very specifics of the patient's psychological issue. After identifying the said condition, the virtual environment is meticulously constructed with the help of design/computer engineers and psychological guidance. The professional involvement of various professionals depends on the project, but the general norm is such as the aforementioned. Upon creating a virtual environment suited to the psychological condition, the integration of the required hardware and software (again specific to the project) is carried out. The therapeutic setup is finally in its usable form after this particular step. An apt patient for the process is selected after proper psychological screening and the patient is subjected to the therapy through the artificial environment constructed, with the help of the virtual reality hardware. The interactive hype realistic artificial environment is able to encourage the therapeutic process by relying on the exposure principle.

3. PROBLEM DEFINITION

The system treats psychological ailments through immersive Virtual Reality technology. It is an approach treatment for multiple psychological disorders through objective biological information to deter cognitive dissonance. It can also be made available to the economically downtrodden people who do not have the privilege to gain access to therapy. This provides a rich catalogue of ailments and treatment for the same. The simulations provide immersive, rapid and spontaneous therapy.

3.1 SYSTEM MODEL

The system consists of an android application for a specific user, heart rate sensor will sense the user's biological information via ESP8266 and send that information to firebase cloud server. A User has to register in the virtual reality application providing their basic information such as name, phone and password. User credentials will be stored in firebase cloud storage after the initial registration user has to login and he can customize a list of videos based on heart rate category such as low, mild, medium, high and very high. When a user starts to play video based on biological information in the cloud, the virtual reality video will be played randomly from user video preference.

The application provides the following set of modules:

- User Login and Registration
- Upload Virtual Reality Videos
- Play Virtual Reality Videos
- Therapy based on biological value

3.1.1 User Login and Registration: User has to do a registration process by providing their basic information such as email, password and doctor number will be stored in firebase cloud platform, where user can access their account in any mobile. After their initial registration process, they have to login using their registered email and password and if the credential matches with firebase cloud server they are allowed to access the application. In case if the credentials don't match, an error notification will be displayed.

3.1.2 Upload Virtual Reality Videos: After successful login with virtual reality application, basic information about virtual reality therapy will be displayed in home page of the application. In navigation drawer user can be able to see list of categories low, mild, medium, high and very high. User can customize their category videos based on their preference; user has to select video from their local internal storage path to the video file which will be stored in firebase database.

3.1.3 Play Virtual Reality Videos: The application begins to stream the video file from network, and when the media player has buffered enough content, video starts to play on screen based on their respective heart beat rate. Since this is a 360 video, the user is exposed to an immersive artificial environment. To provide a platform to view the Virtual Reality videos, a technology called Orion 360 is used. If the heart rate is detected to be extremely low or extremely high, then a text message is sent to the doctor whose number was specified by the user during the registration process to notify that they need psychological support from the experts.

3.1.4 Therapy based on biological value: A hardware kit consisting of heart rate sensor will sense users' biological information through Arduino Uno where the heart beat rate is categorized in to five categories. The ESP8266 microcontroller sends patient biological information to firebase cloud server. Once the users' heart rate is detected, the corresponding VR video is displayed on the screen which can viewed using Head Mounted Display to experience the immersive 360degree view. If there is any deviation in the user heart rate, the video changes according to it.

Mobile application: The mobile application is the user interface used for the purpose of personalized psychological therapy. The user registers initially by providing his credentials which is stored in the Firebase cloud and the user is assigned with a specific unique ID. Then when the user is validated to be an authorized user, then he can experience the Immersive VR therapy.

Heart rate sensor: The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of this application, the sensory output from the heart rate sensor is fed to Arduino Uno for categorizing the heart rates into 5 levels: Low, Mild, Medium, High and Very High.

Arduino Uno: Arduino Uno is a microcontroller board based on the ATmega328P. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Arduino IDE is coded in C language and is dumped in Arduino Uno for the purpose of categorization of the heart rate input into levels. Arduino Uno is serially connected to Node MCU for Wi-Fi connection. Node MCU: Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi, and hardware which is based on the ESP-12 module. The Node MCU is used to transfer the obtained categorized value of the heart rate level obtained from Arduino Uno to the Firebase cloud storage.

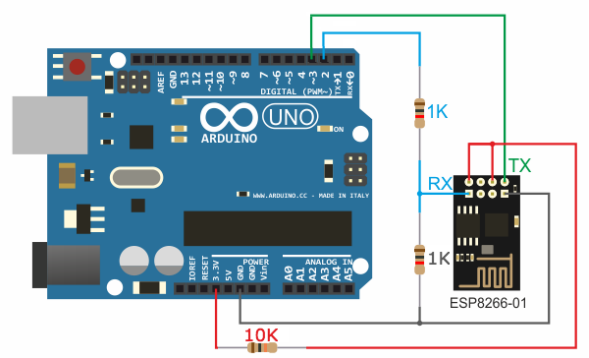

Figure 1: Arduino Uno connected to Node MCU

Firebase cloud storage: Cloud Storage for Firebase is built for app developers to store and serve user-generated content, such as photos or videos. Cloud Storage for Firebase is a powerful, simple, and cost-effective object storage service built for Google scale. The Firebase cloud stored the information such as user credentials, heart rate details and video details by assigning a specific ID for each authorized user.

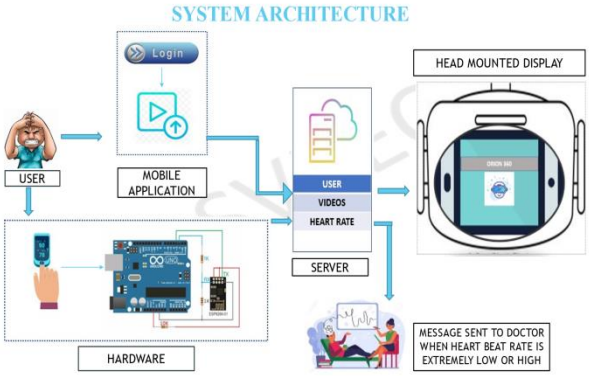

Figure 2: System architecture diagram

Head mounted display: The VR headset is used to provide artificial environment to the user which is believable, interactive, computer

generated, explorable and immersive. The mobile is placed in the HMD to experience the VR environment and to seek the psychotherapy.

4. RESULT AND DISCUSSION

The user logs in and uploads the VR videos based on his preference at each category. After detecting the heart rate of the user using Heart rate sensor, the value is sent to the Arduino uno where it is categorized into levels. The Node MCU transfers the heart rate to Firebase cloud and thus the VR videos from the respective category will be played randomly in the mobile application. If the heart rate is found to be extremely low or extremely high, then a text message will be sent automatically to the respective doctor that the user specified during the registration process by providing doctor's number to notify that the user needs an immediate guidance from a professional therapist.

Figure3:Heart rate modes

Figure 4:Display VR Videos

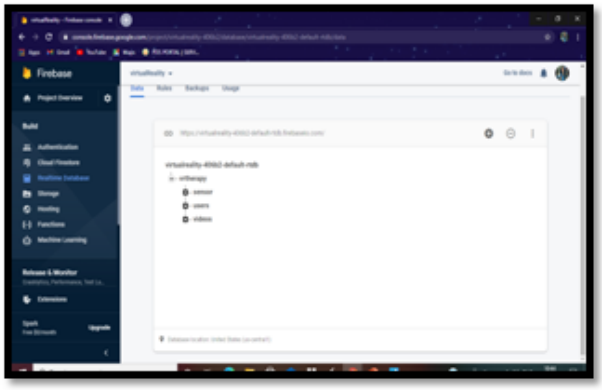

Figure 5:Firebase cloud storage

5. CONCLUSION

This application intelligently scrutinizes the information and generates simulations which provides immersive, rapid and spontaneous psychological therapy. It provides personalised therapy in a more responsive way. It can be easily available for economically downtrodden people to seek psychotherapy from their mobile application. In future this application can be improved by including feedback visualization techniques so as to provide more specific psychotherapy for a wide range of people with a rich catalogue of ailments. Figure 3: Heart rate modes.

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