



ASHESI UNIVERSITY COLLEGE

Psyche: A Mobile Application Connecting Students to School Counselors

APPLIED PROJECT

B.Sc. Computer Engineering

**Zaneta Asare
2019**

ASHESI UNIVERSITY COLLEGE

Psyche: A Mobile Application Connecting Students to School Counselors

APPLIED PROJECT

CAPSTONE PROJECT

Capstone Project submitted to the Department of Engineering, Ashesi University College in partial fulfilment of the requirements for the award of Bachelor of Science degree in Computer Engineering.

**Zaneta Asare
2019**

DECLARATION

I hereby declare that this capstone is the result of my original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature:

.....

Candidate's Name:

.....

Date:

.....

I hereby declare that the preparation and presentation of this capstone were supervised in accordance with the guidelines on supervision of capstone laid down by Ashesi University College.

Supervisor's Signature:

.....

Supervisor's Name:

.....

Date:

.....

Acknowledgements

To all the people whose encouragement and academic advice helped me undertake this project.

Abstract

This paper explores the problem of depression among university students and provides a means by which the students can be linked to a mental health professional, in order to receive guidance. This system is made up of a mobile application and an electrical system. The mobile application includes a chat system that allows the students to contact available counselors, and also, includes a virtual reality interface that allows the user to relax in a virtual environment of choice while listening to an audio of choice. This could be an instrumental, or natural sounds like the wind blowing, rain drops and othersa. The electrical system takes in the user's temperature and heart rate and sends these data to the cloud database, to be displayed to the counselor in the mobile application as per the counselor's request.

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Chapter 1: Introduction

1.1 Introduction/Background

Technology has gained many strides in the current world. Many technologies have been introduced and are tremendously impacting the life we live, making it more comfortable. Technology has also brought about many improvements in the medical sector, with the introduction of mobile applications to cause sensitization of medical issues, drone deliveries to help transfer drugs to locations that are hardly accessible by road, the creation of artificial body organs and many others [1]. Another gradually emerging technology gaining grounds in the medical sector is Virtual Reality. A Virtual Reality is a created world other than the one you live in. This world could be computer generated or filmed as 360-degree content [2]. As the user experiences it, the user becomes fully immersed in this new world as though they were in it. A virtual reality world is accessed through a virtual reality headset, which is worn over the head, covering the eyes as shown in Figure 1 below. This headset blacks out the user from the outside world, preventing all forms of distractions, making it more immersive, and its effect greater. Virtual Reality has been applied in the field of Psychology for a while. It has been used as a diagnostic and therapeutic tool in the field of mental health, and it has been said to have great potential [3]. Hence, the need for its application in the area of depression.



Figure 1 - How a virtual reality headset is worn over the head. Source: Google Search Images

A mobile application is a system designed to work on mobile devices to perform a specific function. An example of a typical mobile application is a messaging app, which allows the user to send and receive SMS messages. Various types of mobile applications have been developed. The first type is a native application, which is designed for one specific platform, i.e., either Android or IOS. The second is a hybrid application which is built on HTML/CSS and can be exported to run on various platforms. The third is a cross-platform application which is built on only one language but can be exported to work on other platforms. The fourth type comprises of three more parts which are the USSD, SMS and STK applications. The USSD application stands for Unstructured Supplementary Service Data, and this is the application that runs when a specific code is typed into the phone's keypad, e.g., *124#. SMS, which stands for Short Message Service is the standard messaging app used on a mobile device. STK stands for Sim Application Toolkit, and it is the application that is automatically installed by the network service one is subscribed to and which allows the user to access various network services. All these applications perform a specific task defined by the creator [4].

Sensors are used in our everyday lives to detect changes in the environment. Examples include temperature sensors, humidity sensors and heart rate sensors. A microcontroller, e.g., an Arduino, can track these changes, which can then be used to control other devices or systems through the microcontroller. For example, a temperature sensor can be connected to an Arduino to sound an alarm when the temperature goes beyond a certain threshold [5].

The technologies introduced in this section serve as the backbone upon which this project is built.

1.2 Problem Definition

Suicide is found to be the second leading cause of death for young people between the ages of 15-29 years [6]. According to the World Health Organization, in 2016 alone, approximately 200,000 people in the same age range committed suicide around the world [6]. In Ghana, the story is not so different. In 2015, the Daily Graphic newspaper, as reported by the radio station, Citi FM, published an article citing the number of deaths caused by suicide annually to be 1500, of which the primary cause was depression [7]. In addition to that, Dr. Akwasi Osei, the Chief Executive Officer of the Mental Health Authority at the time, said, “in every single reported case of suicide there were four unreported cases, and this brings the number of unreported cases to about 6,000 annually” [7].

One of the causes, if not the leading cause of suicidal behavior is said to be depression [8]. It has been discovered that college students, usually people between the ages of 18 to 25, are more prone to depression than any other age group [9]. From the information gathered, it shows how much of a nation’s population and human resource are lost to suicide. From the age range, it shows that it is mainly people in the working force that commit suicide. This results in lower productivity because the people that have the strength to work are committing suicide.

Lower productivity slows down or even halts economic growth, which will in turn raise the cost of living in the country. This shows how much of an effect suicide has on a country, and even on the lives of its citizens.

Suicide is a problem that must be attacked from the grassroots, hence the reason why I want to tackle one of the leading causes, which is depression.

1.3 Objectives of the Project Work

The objectives of the project are outlined as follows;

- To gain a deeper understanding of depression and how it affects human life, interactions, and productivity.
- To explore emerging technologies such as virtual reality and mobile application development and their implementation in the creation of a solution for college students that are depressed.

1.4 Expected Outcomes of the Project Work

At the end of the project work, there is a hope that the product will be a mobile application that would serve as a platform where students can reach counselors. It would have a virtual component where the user could choose a location to immerse himself/herself in, while listening to an audio of choice. This component could be viewed in a virtual reality headset. The goal is that, that component would immerse the user into an atmosphere that would bring relaxation which would end up infusing joy and peace to the user, thus improving the user's state of depression. It would also include a system where the depressed user is linked to a professional psychologist or counselor by chat, through which they would receive professional help without the need for their identity to be known. It would also have an electrical sensor system that would receive certain details about the user, for example, their temperature and

heart rate, which would then be sent to the counselor in order for the counselor to receive feedback about how well the user is responding to the treatment being administered.

1.5 Justification/Motivation for Project Topic

This project relates to me personally in the sense that, I have gone through a time where I was depressed, and it was difficult for me. It affected my academics and my interactions with others. If I had help then, I would have been able to come out of it faster, but I could not muster the courage to approach any person. It is a situation I would not want anyone to go through. As such, I want to create a tool that will help anyone who finds himself or herself in that situation to be able to get help and come out of it quickly. Also, another justification is that depression is one of the causes of suicide among youths [8] and if this problem is not dealt with, it can lead to more deaths which would affect the nation's human resource and in turn, affect economic growth.

1.6 Research Methodology to be Used

The primary research methodology to be used will be mainly online research through science and engineering journals. Also, there will be personal interactions with experts in the field of psychology to gain a deeper understanding of why people do what they do and how this can be infused into an application. An additional methodology will be to conduct interviews with students that have experienced depression in one form or another to gain insight into what makes them depressed and how they survived or came out of it. With these methodologies, it is sure that the desired outcome will be achieved.

1.7 Facilities/Materials to Be Used for The Research

Resources to be used include digital libraries like the Association for Computing and Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), Wiley Digital

Library and other online databases. They will be used to research on information regarding depression and how virtual reality can be used in its combat.

1.8 Scope of Work

This project work covers research, analysis of information gathered, implementation of the research gatherings in the planning and the design of the system; both mobile and electric parts, and building the various systems based on that design. The last phase will be testing and evaluation where the system would be tested to ensure that it is fully functional and that it is able to serve its purpose fully. Observations and limitations would also be recorded.

1.9 Proposed Chapter Outline

The project will cover the following parts;

- Chapter 1 – Introduction and Scope
- Chapter 2 – Literature Review
- Chapter 3 –Design
- Chapter 4 – Methodology
- Chapter 5 – Results
- Conclusion – Discussion, Limitations, and Future work
- Appendix and References

Chapter 2: Literature Review

2.1 Introduction

This section presents an overview of various researches done in the field of virtual reality and how they are being used to improve mental health, more specifically, in the area of depression.

2.2 Review of Related Works

According to Choo and May [10] , mindfulness meditation has been shown to reduce stress and encourage relaxation, and they believe that it is naturally beneficial for different kinds of demographics like those with the consistently low level of satisfaction [10]. In their study, they aimed to translate these learning outcomes gained from the mindfulness practices in the form of gamification into educational software. The model of this software was designed to assist casual gamers in learning mindfulness practices in an emerging and rewarding fashion. A drawback for their research was that the software was not tested with actual users to get feedback on functionality and effectiveness.

Another paper reviewed was “Usability and acceptability assessment of an empathic virtual agent to prevent major depression,” conducted by Bresó et al [11] . In this paper, they introduce a virtual agent that interacts with a user to help the user overcome any form of depression. This virtual agent has been trained with data provided from clinical institutions and seasoned psychologists. This information is used to embody the virtual agent that interacts with depressed patients. Based on the answers given by the patient, specific activities and media are also suggested by the virtual agent for the user to engage in or with. This virtual agent has been designed in the form of a human being on a computer screen, since research has shown that people are more receptive when talking to human beings they can relate with, rather than some

abstract idea or technology [11]. It was tested on some people, and the results were very positive [11]. A drawback of this research is that complex technology goes into making it and thus, it will be difficult for someone to follow through and replicate the idea. The researchers who contributed to this paper used a technology known as Electroencephalography (EEG). The term describes the concept behind recording brain activity. The results from the recording could be used to determine a person's feelings at a particular point in time. A pervasive three-electrode EEG collector is used in this research to collect signal data from the user. The signal data received, goes through signal processing where noise is removed from the signal. Also, any form of interference is removed. Other complex data processing methods are also performed on the signal data. The final signal data is fed into the game engine for the game to be generated. The game engine takes the signal data and the patient's profile and uses them to create a virtual reality game. As the patient plays the game, the EEG collector re-records signals, and then the data is processed and fed into the game engine, and the cycle continues. The games are played in sessions, with ten minutes per session, after which the patient or therapist can adjust the level of difficulty. After every session, the system generates a report for evaluation. A group of twelve participants; six males and six females tested out the system. They were made to have only a session of the VR game, after which they were interviewed. Eleven out of twelve participants felt that the system was effective and expressed a willingness to use it again. Some participants also stated that the immersive nature virtual reality provides made the calming effect more apparent for them [12]. However, a drawback could be the sample size used for testing, as the size was not big enough to make a good judgement.

Solutions to depression took another turn in this paper [13]. Falconer et al. introduce the reader to self-compassion and how it harnesses the power of virtual reality to treat depression.

In this experiment, a patient is made to comfort and show love to a child in need. In another setting, the patient becomes the child and receives the love that was being given by the patient in the first setting. This way, the patients can experience self-compassion and help themselves out of a state of depression. This experiment was tested, and it was a success. However, a drawback could be that there might be some distortion when it comes to switching roles between patient and child, which may result in a headache, nausea, and other uncomfortable situations.

2.3 Conclusion

From a few of the papers reviewed, it is clear that new technologies like virtual reality and artificial intelligence play a considerable role in the medical industry, most especially the mental health field. I learned about the approach other people used in addressing the problem of depression and how I could leverage on their drawbacks in order to make my solution better.

Chapter 3: Design

3.1 Review of Existing Designs

In the field of psychology, more specifically, in the field of depression, there are a lot of technological advancements. A couple of them were described in the preceding chapter. Most of those designs incorporated modern technologies like virtual reality and artificial intelligence, see [10] [11]. However, these designs had some drawbacks, which by my design, I will attempt to address. Some of those drawbacks included the level of complexity of some of those solutions, and the sicknesses users got after having the virtual reality experiences. In my design, I hope to use a more simple and straightforward approach to solving the problem. The context for the problem is in the university, and the primary target is the college student since most of the people who commit suicide are mostly youthful [6]. The problem statement is thus, “College students need a way to deal with depression because they end up being unproductive and may even commit suicide as a result, which ends up reducing the country’s human resource.”

3.2 Chosen Design

Most students find it difficult to express themselves to a therapist or counselor because they want to maintain their ego, are shy, or do not want other people to see them depressed [14]. Therefore, the design solution is to create a mobile application that connects the depressed user to a counselor. It will consist of a chat system where the user would be able to chat with a counselor. It would also include a VR component which introduces the depressed user to a relaxing virtual environment with soothing background music, where they can relax and be uplifted on their own. This experience can be accessed through a virtual reality headset like the google cardboard, or more sophisticated ones like the HTC Vive or Oculus Rift. For phones that are not VR compatible, the chat system can still serve as a way by which the users can get

help by having a conversation with the counselor. All interactions within the application will be anonymous. The user will only be identified by the username he/she provides the system. The project also consists of an electrical system to be used in conjunction with the mobile application. The electrical system consists of sensors to measure the user's temperature and heart rate. This is needed in order to give the counselor feedback about how the user is accepting treatment. It also gives an idea of how the user is feeling. For example, a high temperature level can signify that the user is nervous, or a high heart rate might indicate fear. The interpretation of the data will be done by the counselor.

The primary technology to be used in this mobile application is PhoneGap, a framework for building hybrid applications. It incorporates HTML, CSS, and JavaScript programming languages for the basic appearance and functionality of the app. A framework called A-Frame, which is built on three.js, a JavaScript library, will be used to create the virtual reality experience.

The high-level architecture of the system looks like this;

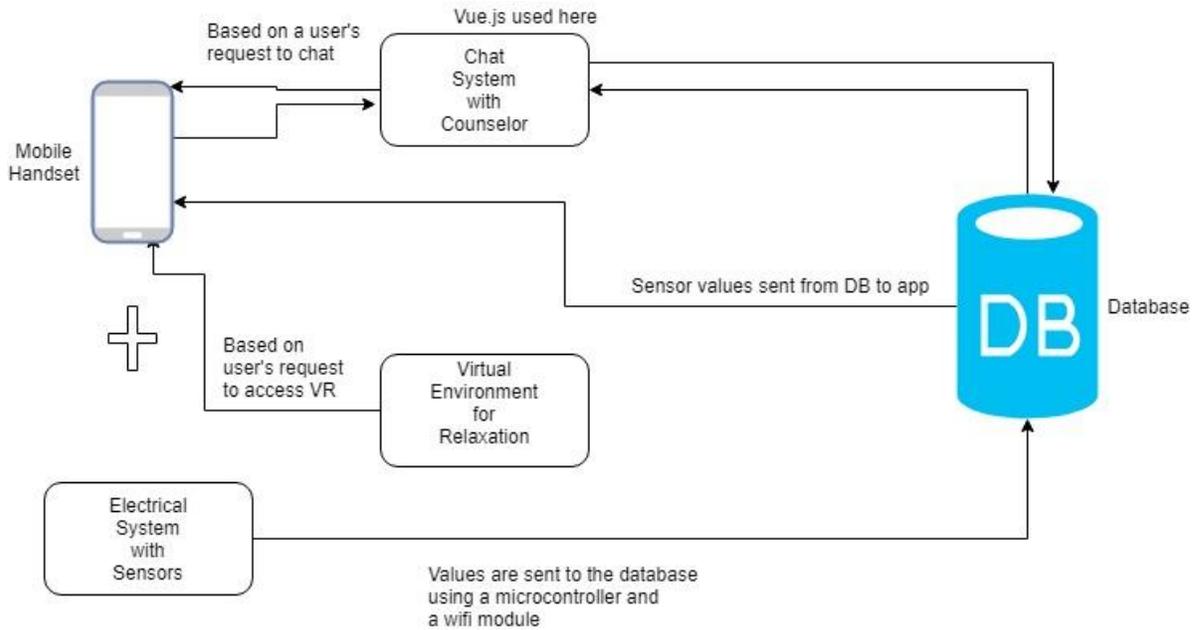


Figure 2 - High-level system architecture

In this architecture, the mobile application comes with an external electrical system with which it will work. The electrical system is to be used in conjunction with the mobile application. As the user is using the application, the electrical system, which is made up of sensors, will be taking note of the user's temperature and heart rate. This information will be sent to the cloud and then to the mobile phone with the help of a microcontroller and a Wi-Fi module. The values will be displayed in the application in real-time, as requested by the counselor. In the mobile application, the user can choose to chat with the counselor in the chat system or choose to enter the virtual environment to relax. When the choice is made, and the request is sent, the appropriate response is received from the server for the session to be initiated.

The walkthrough of the application will be as follows;

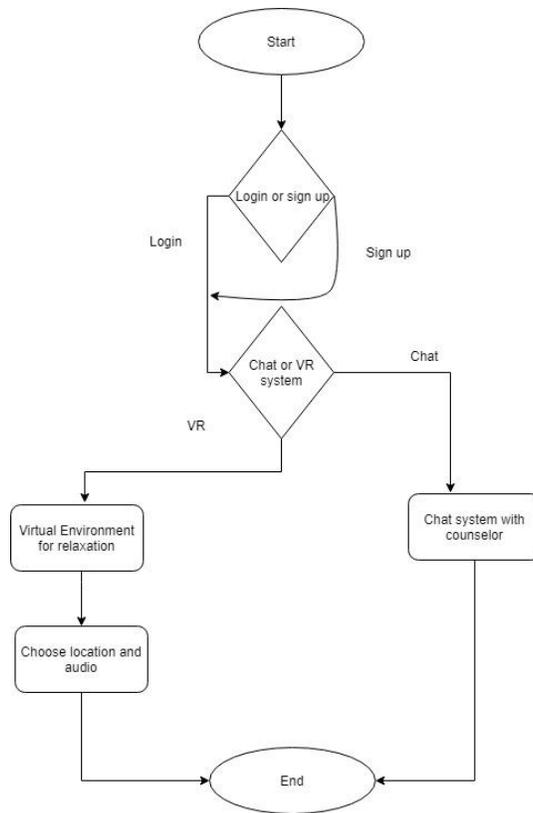


Figure 3 - Flowchart of the mobile application system

When the user starts the application, the user is required to sign up or login into the system. The user would then have to choose whether they would want to have a counseling session where they chat with their school’s counselor anonymously or relax in an environment of their choice. During the relaxation session, they would be introduced to a peaceful environment, with or without music where they could relax. This helps the user get out of or minimize their state of depression.

3.3 Justification for Chosen Design

The approach is making use of a virtual environment or what is popularly known as a virtual reality where most of the application activities will take place. Virtual reality is being used because of its immersive nature. Once the user is in this new environment, all focus is on the activity being carried out, and there is less distraction there so treatment can be more

effective than a regular application on a phone or computer. There are different types of applications, one that could be downloaded on a mobile phone as a mobile application or on a computer. For this project, a mobile application will be used because of its mobility and accessibility. To be more specific, a hybrid application is used because of its ease of development and its ability to be exported to work on all other platforms.

3.4 Design Iterations

This project has undergone many changes since the first time the idea was conceived. The initial plan was to have an artificially intelligent virtual counselor, that would interact with the depressed user in a virtual environment and suggest various activities for the user to undertake in the virtual environment in order to relieve the user from his/her state of depression. This idea was changed because after research and conversations with students, and based on feedback from faculty, the feasibility of such a project in the time frame given was not realistic. Also, another feedback received was about the level of trust given to an artificially intelligent bot. A concern raised was about depression being a sensitive issue and leaving it in the hands of a machine might not be the best solution because there has to be a certain level of empathy and emotion expressed between the counselor and the patient, a trait A.I powered machines are yet to learn thoroughly.

The design then moved from the creation of an A.I powered virtual counselor to a web application which would connect students to the school counselors available, for the students to have expert guidance from a real person through a chat system and a virtual environment. In the virtual environment, the students can have the opportunity to relax in a peaceful environment of choice while listening to relaxing audio of choice as well. The immersive power of virtual reality makes the effect of the relaxation in the virtual environment more exceptional

as there are minimum distractions from the environment of the user. For the virtual environment, there was a need for it to be displayed on a mobile phone so the mobile phone can be inserted into the virtual reality headset. If the program were to be a web application, it would need to have both a mobile version and a version for larger screens, and because for this project, the VR component was for only mobile phones, it would be advisable to build an application for only mobile devices. Through that reasoning, the final idea was birthed.

Chapter 4: Methodology

4.1 Mobile Application Setup

The project comprises of two sections; the mobile application system and the electrical system. The mobile application system is also in two parts; the side which enables students and counselors to chat and the side which enables the students to have a relaxing virtual experience. The complete mobile application will be created using PhoneGap, a framework used for building hybrid applications. For the virtual environment, a JavaScript framework known as A-Frame is used. The application has a registration and login system that is used for authentication. The database used for the storage of registered users is Firebase.

4.1.1 Virtual Environment Setup – A-Frame

A-Frame is a JavaScript framework built on three.js, and it allows the user to create a virtual environment with various elements in it. These elements are added using custom HTML tags defined by the framework.

The framework works like HTML, and it allows for different virtual worlds, or pages to be linked together using `<a-link>` tag which functions as an anchor tag in HTML. The welcome page is created where the sky color is defined, and a plane preset is also defined. Various links to the other sections of the program are shown on this page. It also contains headings and titles.

It will look like this;

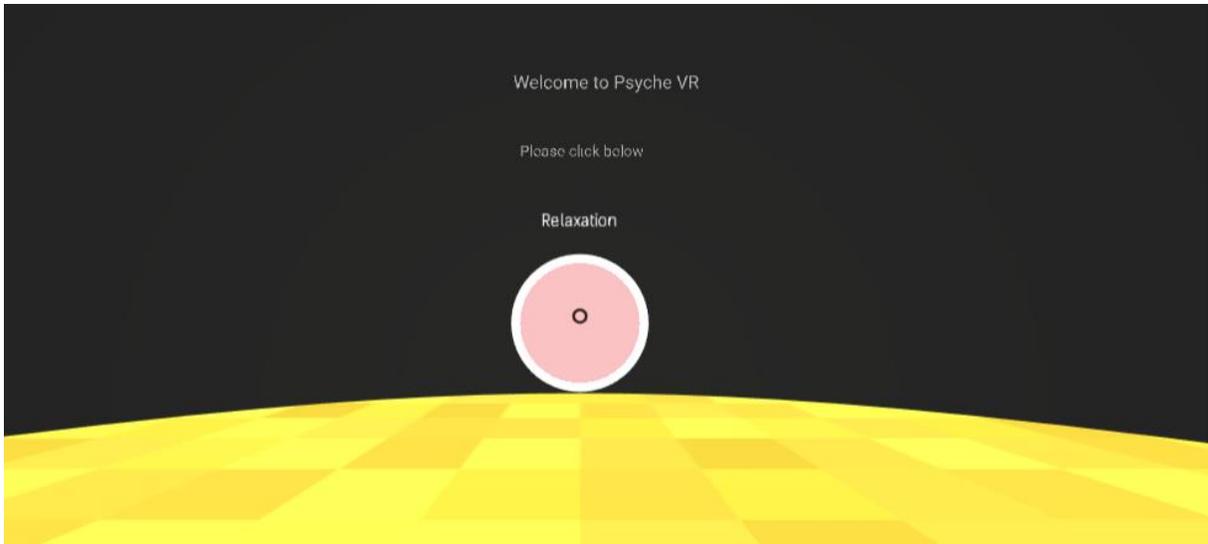


Figure 4 - Welcome page in the virtual environment

The code used to create this section can be found in Appendix 1. A similar approach is used to build all the other virtual environments. For the relaxation page where the user is immersed in a location of choice, the `<a-sky>` tag is modified to set the 360-degree image of the chosen location as the background. This is shown as;

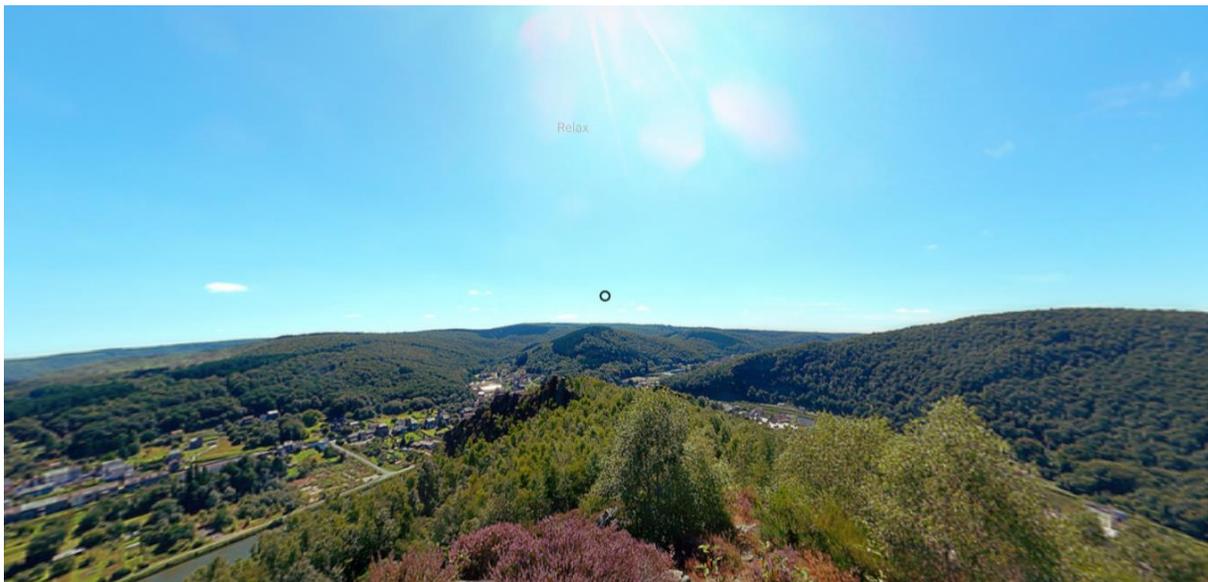


Figure 5 – Relaxation page with a 360-degree image of a mountain top as the background

In this location, the user is also able to choose particular audio files to listen to. This is done using a <audio> tag where the audio is represented as a graphical character that is played when clicked on. The code for this section can be found in Appendix one.

4.1.2 The Chat System Setup

For the chat system, a front-end JavaScript framework known as Vue.js is used in conjunction with Firebase. Firebase is an online database which provides real-time data exchange services. This allows the chat side to work in real-time. When a message is sent from one user, it is uploaded unto the database and then automatically downloaded unto the other user's page. For this to be fully functional, the database must keep record of active users with which it will be able to track the kind of messages to be exchanged between which particular user.

4.2 Electrical System Setup

The electrical system consists of three parts; the sensing part, the processing part, and the transfer part. The sensing part is the part that deals with sensing the information of the user, i.e., the user's heart rate and temperature. This part would therefore, make use of two types of sensors – the temperature sensor, LM35, which can be used to take body temperature as well, and the heart rate sensor, which consists of an infrared LED and a photodiode placed side by side or the pulse sensor itself. These sensors have separate circuits but all feed into the second part which is the processing part. The circuit of each of the sensor equipment is shown below.

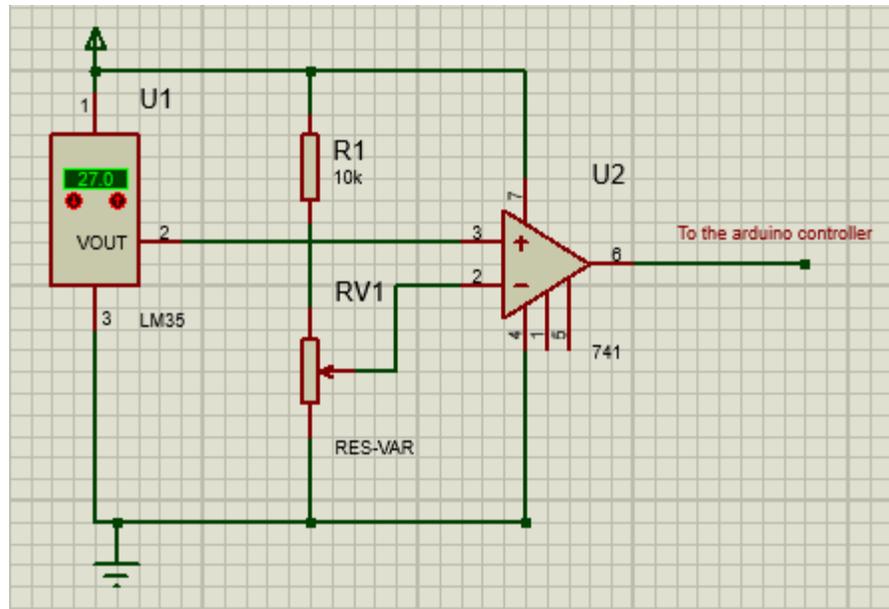


Figure 6 - Circuit diagram for LM35

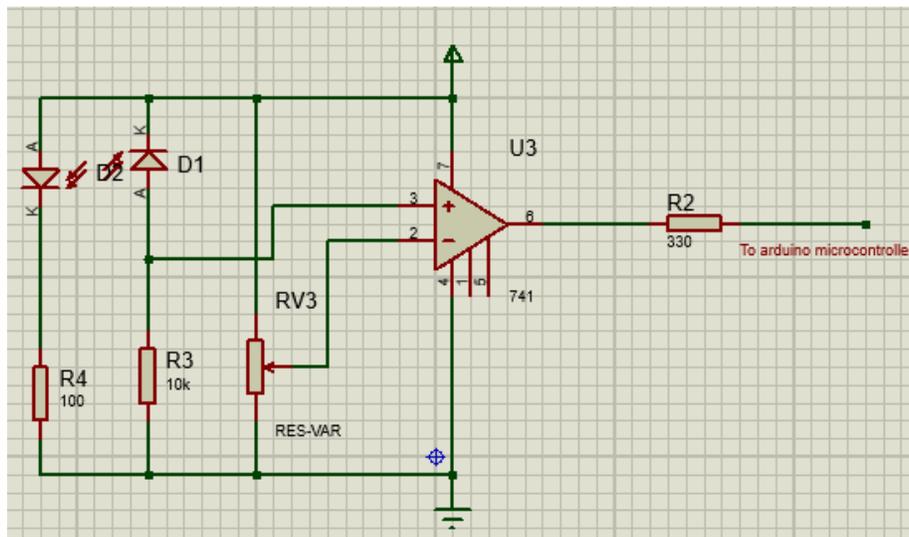


Figure 7 - Circuit diagram for heart rate sensor

The combined circuit with the microcontroller and Wi-Fi module look like this in the physical;

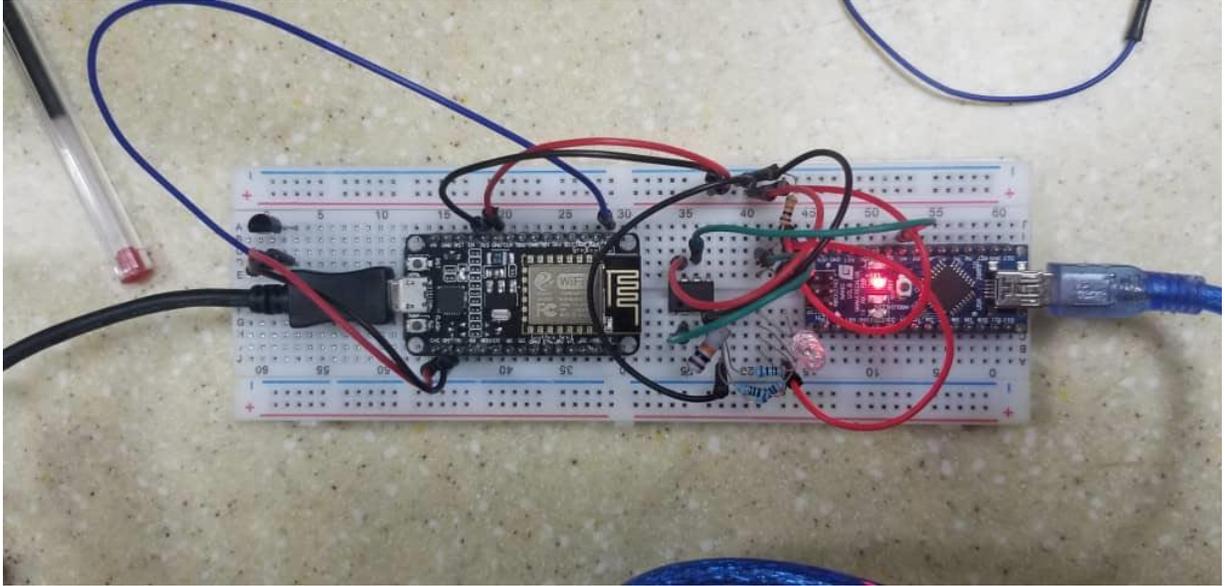


Figure 8 - Actual temperature and heart rate sensor circuit

4.3 The Electrical System and Mobile Application Merger Setup

The processing of the various circuits is done using the microcontroller, and then the values are transferred to the mobile application through the cloud. That is, the information is first uploaded onto a cloud database and then displayed in the application. This is done by sending a POST request from the Arduino via a Wi-Fi module to a MySQL database server. From the client side, the information is retrieved from the database by issuing a query that fetches the information from the table per specifications given like the time start and time end and other features and then displays it in the mobile application using an ajax call. The code used in the micro-controller for retrieving sensor values and sending the values to the database is shown in Appendix one.

Chapter 5: Results

The type of test performed in this system is mainly a system test to ensure that all aspects of the system is fully functional. The mobile application system, which consists of the chat and the Virtual Reality Experience is tested to ensure correct functionality. The electrical system is also tested to ensure that it is able to record user values and also send those values to the database.

5.1 Mobile Application System

5.1.1 Chat System

For the mobile application system. All the systems are fully functioning. The chat system is able to accurately send information from one user to another. An image is shown in the figure below.

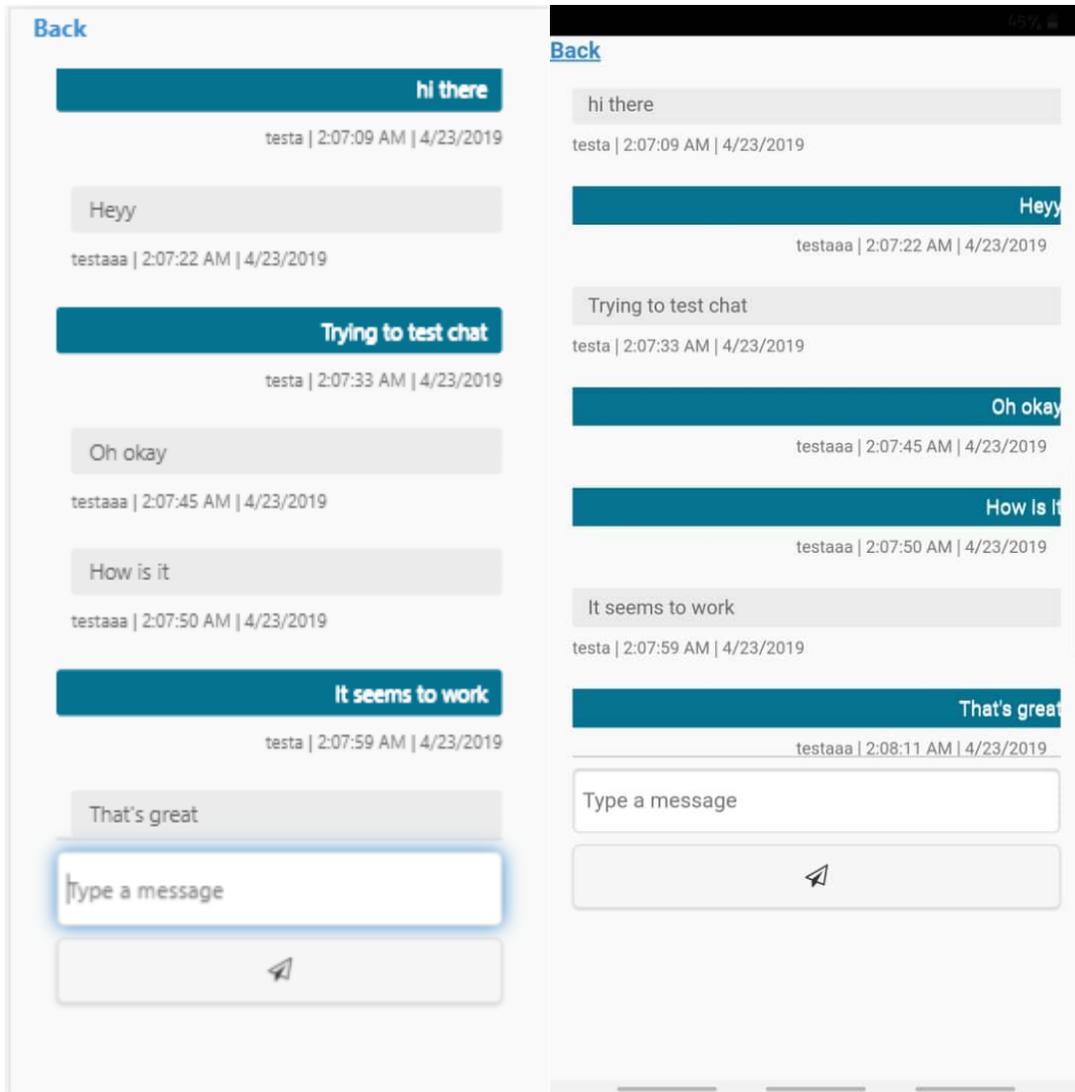


Figure 7 - Screenshots of chat from two different devices

From the images above, it can clearly be seen the interaction that has gone on between two different users. Anonymity is also ensured by the usage of the usernames provided by the user. This is shown beneath each of the messages sent.

5.1.2 VR System

The virtual reality system, upon system testing works. It is able to perform the function to which it has been defined to perform. The user is able to choose a location to be immersed in. When the user chooses the location, he/she is also able to choose an audio to listen to. The location and audio selections are shown in the figures below;

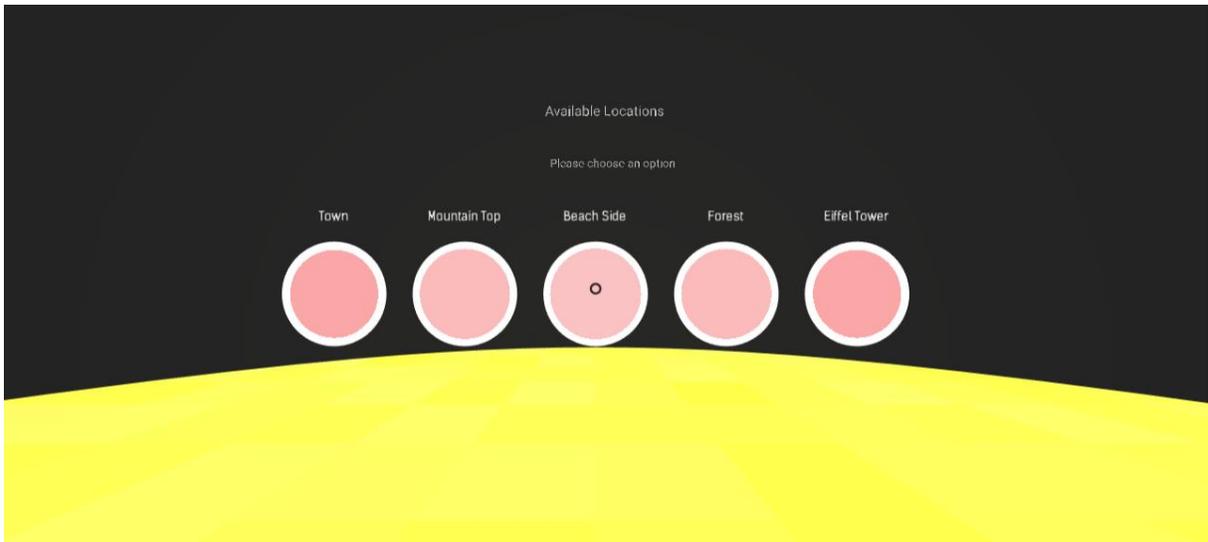


Figure 8 - The sceneries available for relaxation

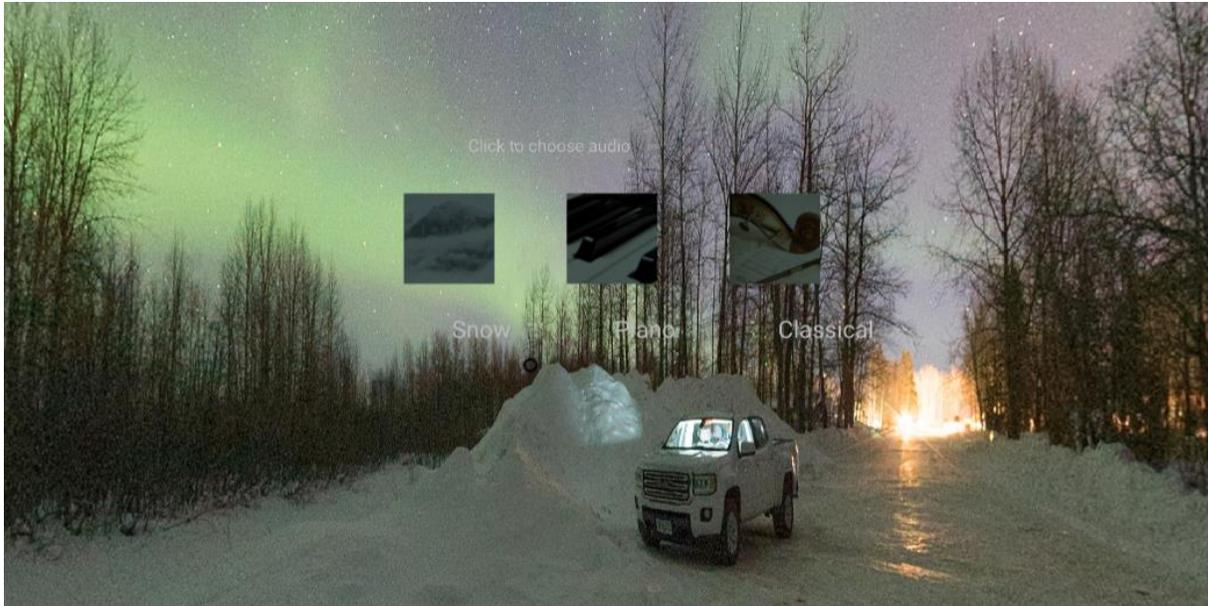


Figure 9 - Audio selection in the virtual environment

5.2 Electrical System

For the electrical system, the circuit is able to record sensor values and send the information to the database through the Arduino microcontroller. The record of sensor values is shown in the figure below.

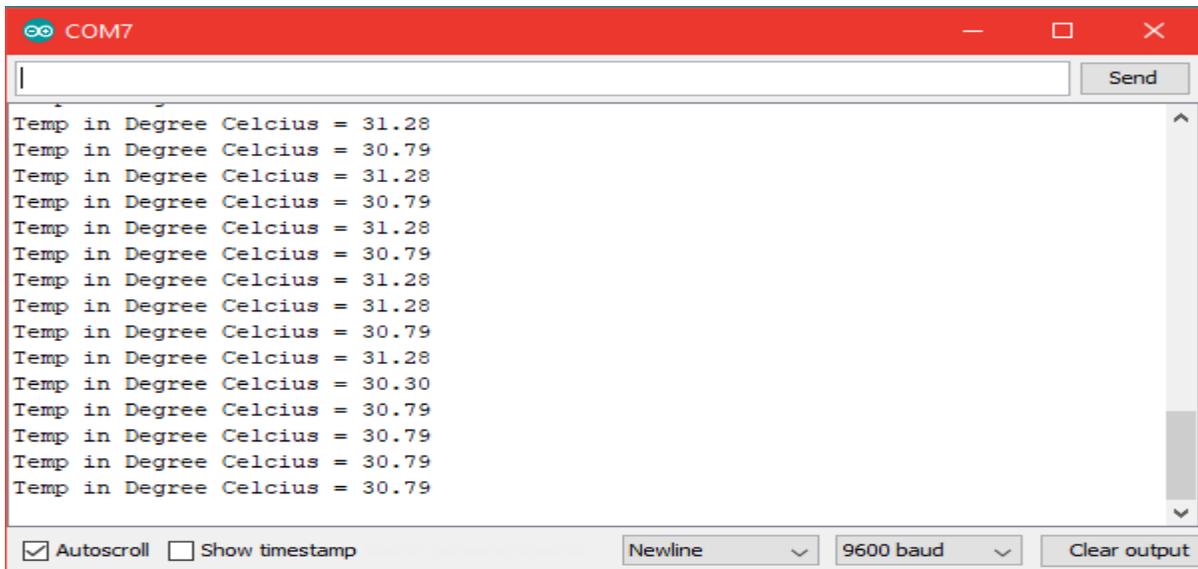


Figure 10 - Record of values from temperature sensor

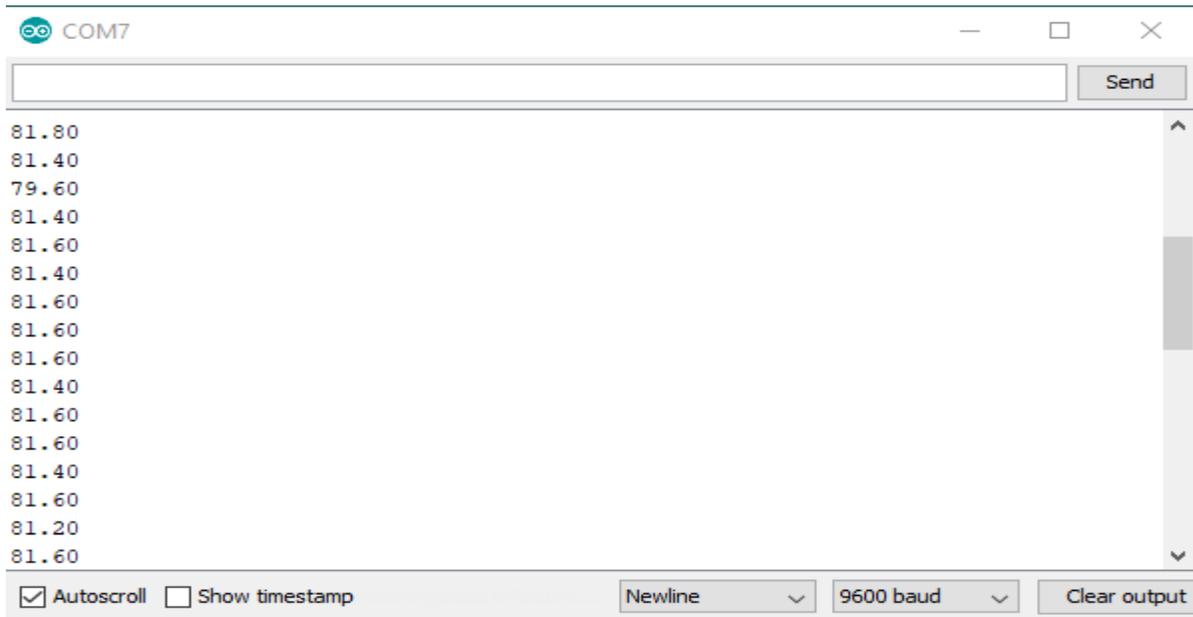


Figure 11 - Record of values from heartrate sensor circuit

These values are uploaded onto the database and is shown in the diagram below;

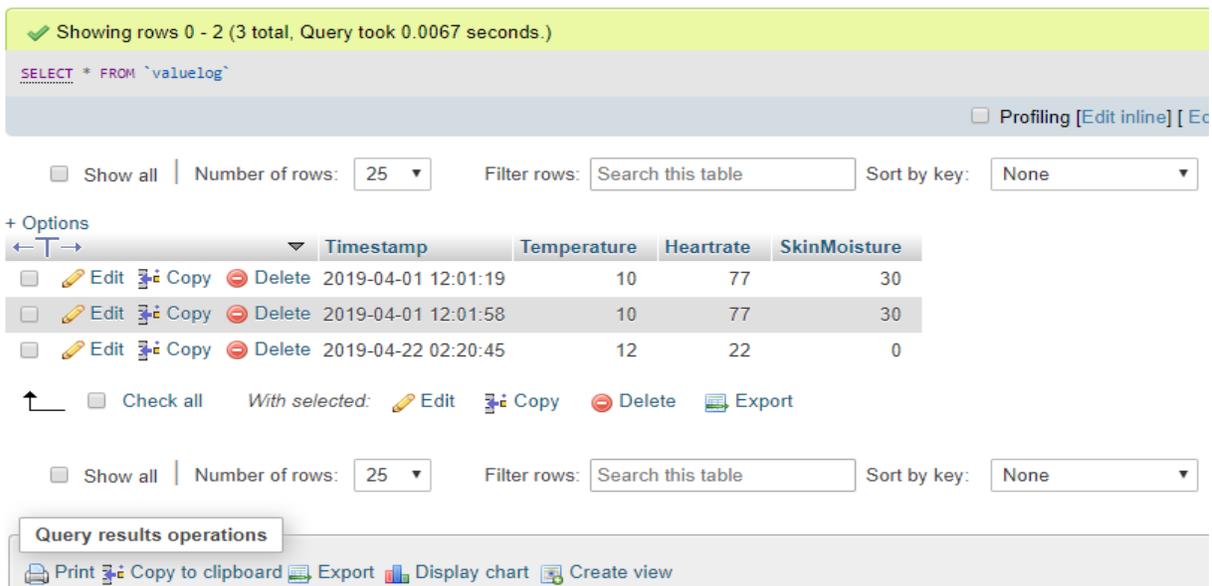


Figure 12 - Database showing values transferred by the microcontroller

For the display of values in the application, a demo application was created and it was able to display in the application. This is shown in the image below;

Temperature / heartrate readings

Timestamp	Temperature	Heartrate
2019-04-23 20:40:04	30	205
2019-04-23 20:39:56	30	205
2019-04-23 20:39:53	30	205
2019-04-23 20:39:49	30	205
2019-04-23 20:39:45	30	205
2019-04-23 20:39:38	30	205
2019-04-23 20:39:35	30	205
2019-04-23 20:39:30	30	205
2019-04-23 20:39:26	30	205
2019-04-23 20:39:22	30	205
2019-04-23 20:39:18	30	205

Figure 13 - Readings from sensors displayed in an application

Chapter 6: Conclusion

6.1 Discussion of Results

From the results, it can be seen that the system is fully functional in their individual capacities. However, it is observed that the sensor readings are sometimes inaccurate. This could be attributed to the faultiness of some of the components used and human error.

6.2 Limitations

The system, although functional, has some limitations. For example, the system is a bit slow due to the virtual reality component which requires a high processing power. Also, all the systems work fully in their individual capacities. When they are brought together, a few conflicts arise, which reduces the performance of the system. Also, some of the sensor readings were inaccurate due to environmental conditions and system errors.

6.3 Future Work

For future work, the application can be developed to incorporate more sceneries in the virtual environment. Also, the system should be able to filter counselors according to age, sex, geographical location and other factors. There is also the hope to optimize the application such that it is fast and does not have a large size. In the grand scheme of things, there is the hope for the application to extend to a broader community outside the school campus. Also, there could be an inclusion of a system to measure brain activity and also, the incorporation of an artificial intelligence algorithm which would suggest various types of treatment to the psychologist for use.

Appendix One

Code for the welcome page in the virtual environment

```
<!-- This is my VR welcome page -->

  <div data-role="page" id="vr-welcome-page">
    <a-scene>
      <!-- 360-degree image. -->
      <a-sky id="image-360" radius="10" color="#222"></a-
sky>

      <!-- Plane setting -->
      <a-entity environment="preset: forest;
dressingAmount: 500"></a-entity>

      <!-- Headings -->
      <a-text value="Welcome to Psyche VR" color="#BBB"
position="-1.0 5 -7" scale="1.2 1.2 1.2"></a-text>
      <a-text value="Please click below" color="#BBB"
position="-0.9 4 -7" scale="1 1 1"></a-text>

      <!-- Link to other page -->
      <a-link href="#vr-area-selection-page" position="0
1.5 -7" image="#sechelt-thumb" title="Relaxation"></a-link>

      <!-- Camera + Cursor -->
      <a-camera>
        <a-cursor id="cursor">
          <a-animation begin="click" easing="ease-in"
attribute="scale" fill="backwards" from="0.1 0.1 0.1" to="1 1 1"
dur="150"></a-animation>
          <a-animation begin="cursor-fusing"
easing="ease-in" attribute="scale" from="1 1 1" to="0.1 0.1 0.1"
dur="1500"></a-animation>
        </a-cursor>
      </a-camera>
    </a-scene>
  </div>
```

```

        </a-cursor>

        </a-camera>

    </a-scene>

    <!-- /content -->

</div>

<!-- page -->

```

This is the code for the town page

```

<!-- This is my town page -->
    <div data-role="page" id="vr-town-page">

        <a-scene>
            <a-assets>
                
                
                
                
                <audio id="snow_s"
src="./sound/snow.mp3"></audio>
                <audio id="piano_s"
src="./sound/piano.mp3"></audio>
                <audio id="classical_s"
src="./sound/classical.mp3"></audio>
            </a-assets>

            <!-- 360-degree image. -->
            <a-sky id="town" radius="10" src="#town-360"></a-
sky>

            <a-text value="Click to choose audio" color="#BBB"
position="-1.0 5 -7" scale="1.2 1.2 1.2"></a-text>

            <a-entity id="sound_pictures">

```

```

        <a-entity cursor position="0 0 -5"></a-entity>
        <a-entity position="-0.9 3 -5" id="taudio1"
geometry="primitive: plane; height: 1; width: 1" material="src:
#snow_p" sound="src: #snow_s; on: click" loop="true"></a-entity>
        <a-entity position="0.9 3 -5" id="taudio2"
geometry="primitive: plane; height: 1; width: 1" material="src:
#piano_p" sound="src: #piano_s; on: click" loop="true"></a-entity>
        <a-entity position="2.7 3 -5" id="taudio3"
geometry="primitive: plane; height: 1; width: 1" material="src:
#classical_p" sound="src: #classical_s; on: click" loop="true"></a-
entity>
    </a-entity>

    <a-text value="Snow" color="#BBB" position="-0.9 2 -
5" scale="1.2 1.2 1.2"></a-text>
    <a-text value="Piano" color="#BBB" position="0.9 2 -
5" scale="1.2 1.2 1.2"></a-text>
    <a-text value="Classical" color="#BBB" position="2.7
2 -5" scale="1.2 1.2 1.2"></a-text>

    <a-light type="ambient" color="#445451"></a-light>

    <!-- Camera + Cursor. -->
    <a-camera>
        <a-cursor id="cursor">
            <a-animation begin="click" easing="ease-in"
attribute="scale" fill="backwards" from="0.1 0.1 0.1" to="1 1 1"
dur="150"></a-animation>
            <a-animation begin="cursor-fusing"
easing="ease-in" attribute="scale" from="1 1 1" to="0.1 0.1 0.1"
dur="1500"></a-animation>
        </a-cursor>
    </a-camera>
</a-scene>

    <!-- /content -->
</div>
<!-- page -->

```

Code for retrieving the sensor values and sending them to the database

```
#include <Arduino.h>
#include <ESP8266WiFi.h>
#include <ESP8266WiFiMulti.h>
#include <ESP8266HTTPClient.h>
#include <WiFiClient.h>

ESP8266WiFiMulti WiFiMulti;

float val;
const int values = A0; //holding heartrate value

const int sensor=D0; // Assigning analog pin A0 to variable 'sensor'

float tempc; //variable to store temperature in degree Celsius

float vout; //temporary variable to hold sensor reading

String data;

void setup() {

  pinMode(sensor,INPUT); // Configuring sensor pin as input
  pinMode(values,INPUT);

  Serial.begin(115200);
  // Serial.setDebugOutput(true);

  Serial.println();
  Serial.println();
  Serial.println();
```

```

for (uint8_t t = 4; t > 0; t--) {
    Serial.printf("[SETUP] WAIT %d...\n", t);
    Serial.flush();
    delay(1000);
}

WiFi.mode(WIFI_STA);
WiFiMulti.addAP("Student", "778006011F");
}

void loop() {

val = analogRead(values);

val = (val/5);

Serial.print(val);

vout=analogRead(sensor); //Reading the value from sensor

vout=(vout*500)/1023;

tempc=vout; // Storing value in Degree Celsius

Serial.print("Temp in Degree Celcius = ");

Serial.print(tempc);

Serial.print(" ");

Serial.println();

```

```

data = "templ=" + String(30) + "&heart1=" + String(val);

if ((WiFiMulti.run() == WL_CONNECTED)) {

    WiFiClient client;

    HTTPClient http;

if (client.connect("10.10.54.148",80)) { // REPLACE WITH YOUR SERVER
ADDRESS
    client.println("POST /arduino/add.php HTTP/1.1");
    client.println("Host: 10.10.54.148"); // SERVER ADDRESS HERE TOO
    client.println("Content-Type: application/x-www-form-
urlencoded");
    client.print("Content-Length: ");
    client.println(data.length());
    client.println();
    client.print(data);
}

if (client.connected()) {
    client.stop(); // DISCONNECT FROM THE SERVER
}
}

delay(3000);
}

```

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