

## Heart Health Diagnostic Monitoring in Virtual Reality

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**Abstract** – Virtual reality technology has become an increasingly popular tool in the field of medicine in recent years. One of the most important applications of this technology is the development of devices for monitoring heart health. Heart health monitoring devices developed in conjunction with virtual reality technology provide users with real-time measurements of heart rate, blood pressure, oxygen levels, and other parameters. These devices are seen as an important tool for early detection of heart disease, and through this technology, patients' heart health can be improved. Early detection of heart disease can prevent or slow down their progression and thus protect the patients' heart health. Therefore, virtual reality technology is considered a highly beneficial tool for heart health monitoring and treatment.

**Keywords** –Virtual Reality, Heart Health, Diagnosis, Treatment

### I. INTRODUCTION

Virtual Reality (VR) refers to the creation of a virtual environment rather than the real world. Virtual reality typically allows a user to enter and interact with a virtual environment using a VR headset, controller, or transmitter.

VR technology has rapidly developed in recent years and has been used in various fields such as education, tourism, gaming, defense, as well as healthcare, with many applications being developed. Among these applications, tracking heart health is one of the areas that VR technology can be utilized for. Heart diseases are one of the most common causes of death worldwide. VR technology can be used as a tool for tracking, treating, and educating people on symptoms caused by heart diseases. This technology can assist individuals with heart diseases, doctors, and nurses. Therefore, it is important to measure heart health and develop methods to be used during the treatment process.

VR heart health monitoring applications enable individuals with heart disease to track their heart rate, blood pressure, and other vital functions. These applications can help individuals monitor their health status and check if they have taken their medications on time.

VR technology can be used in the treatment process of heart patients. In a study, developments in the treatment process of heart patients were followed by using VR technology. Thanks to this follow-up, problems in the treatment process can be determined and resolved in advance [1].

VR technology has great potential in the field of heart health. Studies have shown that VR technology is an effective method for diagnosing heart diseases, measuring factors such as heart rate and rhythm, and for use in the treatment process of heart patients [2].

VR technology can be used to determine heart attack risk. In a study, the risk of heart attack was determined using VR technology. These

measurements provide information about a person's heart health and can help predict potential risks [3].

Bradycardia, or in other words, low heart rate, is an important issue related to heart health. A study on this topic has shown that virtual reality technology can be used in the treatment of bradycardia patients. Exercises performed with virtual reality technology help increase the heart rate of bradycardia patients [4].

Tachycardia refers to a high heart rate, which is also an important issue for heart health. Virtual reality technology can also be used in the treatment of tachycardia patients. In a study, it was observed that yoga exercises performed with virtual reality technology helped to reduce the heart rates of tachycardia patients [5].

VR technology can be used not only for diagnosis and treatment in the field of heart health, but also for prevention of heart diseases. In a study, it was found that exercises performed using VR technology have a protective effect against risk factors for heart health such as obesity, high blood pressure, and high cholesterol [6].

VR technology can be used to measure heart rhythm variability (HRV). In a study, HRV was measured using VR technology. These measurements can be helpful in determining a person's stress level [7].

VR technology can also be used as an effective method in heart health education. Especially in raising awareness of risk factors for heart disease and preventing these factors, VR technology can be very useful. In a study, a realistic heart attack scenario was created using VR technology, and it was observed that participants learned about the symptoms of a heart attack and how to intervene through this scenario [8].

VR technology can also be used in the preparation process before heart surgery. In a study, VR technology was used to help surgeons better understand the surgical site before heart surgery and make more accurate decisions during the procedure [9].

VR heart health monitoring applications can help individuals with heart disease better manage their health. These applications can raise awareness about heart health, help individuals monitor their health status, check whether they are taking their medications on time, and increase their adherence to treatment. Additionally, these applications can help patients better track their heart health, maintain their

health, detect heart disease risk factors early, learn about heart disease treatment options, psychologically relax, and create personalized treatment plans. Moreover, VR applications may be a less costly option for patients to monitor their heart health and receive treatment compared to traditional methods. This can make it possible to deliver healthcare services to a wider population.

VR technology demonstrates the potential for further development of applications used for monitoring heart health in the future. This technology can help us better understand the effects of methods and medications used in heart disease treatment, and provide opportunities for treating heart patients in their own homes. Additionally, VR technology can help individuals with heart disease and those at risk gain knowledge about heart health, leading to earlier prevention of heart disease. VR technology can serve as an important tool in monitoring and treating heart health, and its continued development will assist in better treatment and management of heart disease for a healthier life.

In conclusion, VR technology emerges as a highly effective method for monitoring and treating heart health. The development and use of this technology will help to better treat individuals with heart disease and enable them to live a healthy life. Therefore, the potential of VR technology in the field of heart health should be further researched and developed. This article addressed the development of a model for monitoring heart health using VR systems to evaluate user experiences.

## II. MATERIALS AND METHOD

### A. *Material*

Raspberry Pi Pico W : Based on the Raspberry Pi RP2040 microcontroller chip, it is a Wi-Fi version of the Pico model. It is a microprocessor with a microcontroller. It is a small, fast and versatile card. Internally it has a 2.4GHz wireless interface and internal antenna. It can be programmed with C and MicroPython. As shown in Figure 1, there are 40 pins on it.



Fig. 1 Raspberry Pi RP2040

Used in coding the RP2040 microcontroller on Raspberry Pi Pico, MicroPython, CircuitPython, C / C++ and Arduino allow many kinds of programming languages, including its own language, and even supports Piper Play, a block-based version of Python.

Although the structure of this board is quite small, it has quite a lot of pins in its small structure. Raspberry Pi Pico, which has 40 pins, also includes components such as temperature sensor, led bootset button, USB. The diagram of the card is shown in Figure 2.

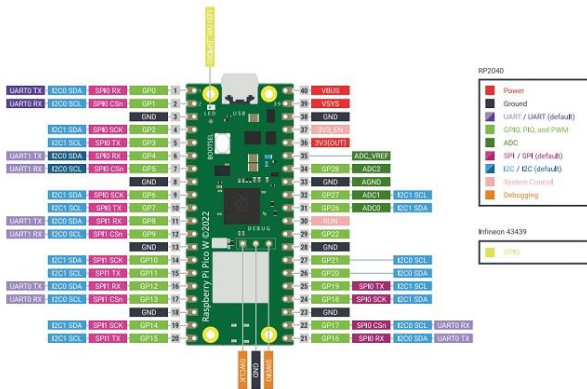


Fig. 2 Diagram of Raspberry Pi RP2040 board

React: React is a JavaScript framework. Websites can be prepared in a short time. In this study, a web interface was made with React to enable instant communication with our micro service.

Virtual Reality Glasses: Virtual reality glasses are a device that is worn on the head, as in Figure 3, to make users feel themselves in a specially prepared virtual environment. As soon as users put on the virtual reality glasses, they are completely isolated from the current environment.



Fig. 3 Virtual Reality Glasses

### B. Method

A microservice was written for instant communication with the Raspberry Pi Pico shown in Figure 4. This service classifies the data coming from the device and tells whether there is tachycardia or barycardia.

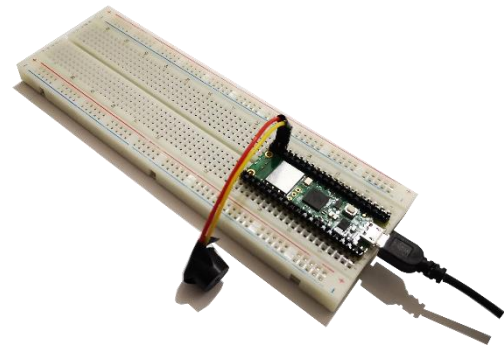


Fig. 4 Virtual Reality Glasses

There are ECG signals in the data sets used. First of all, these signals are output with the neurokit library as ECG Raw, ECG Clean, ECG Rate and ECG Quality. These outputs create a frame with pandas. This frame is thrown into the detection algorithm.

Signals transmitted with the help of a graphic library in the WEB interface made with React were measured with virtual reality as in Figure 5.



Fig. 6 Measurement with virtual reality glasses

As a result of the measurements made, numerical values were obtained as in Figure 6.

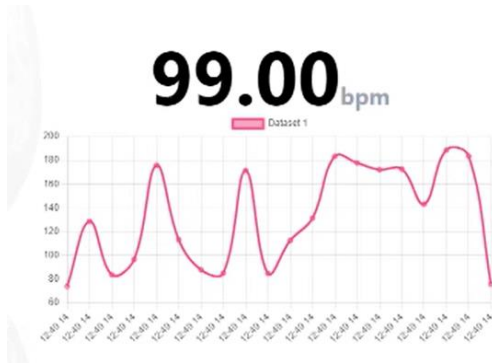


Fig. 5 Achieved BPM rate

### III. RESULTS

In our experimental work, the machine, time and dht11 MicroPython libraries were used. Thony IDE software is used as programming environment. By providing necessary network connections and settings for Internet of Things (IOT), signals were sent to port 5000 received over the network. The function was used to reduce these signals to certain intervals. The resulting signals were coded with MicroPython to send them to the microservice every 0.1s. Digitization of real-time ECG signal was obtained.

### IV. DISCUSSION

The virtual reality application used in this article measures the user's heart rate level and creates a report. Through this report, users can track their heart health and detect the onset of heart disease early. This application can help with the early diagnosis of serious health problems such as heart

disease. However, further research is needed on the accuracy and reliability of the application.

### V. CONCLUSION

The use of virtual reality technology in the healthcare industry is increasing rapidly. Virtual reality applications for monitoring heart health have also been developed and are being used. With these applications, users can monitor their heart health and become more aware of how to protect their health by taking preventive measures.

However, virtual reality technology is considered an area that requires more research on its use in monitoring heart health and other healthcare fields. Virtual reality applications have many different uses that can help with the diagnosis and treatment of health problems. Therefore, it is important to conduct the necessary research for the use of this technology in the healthcare industry and gain more knowledge about the safety and effectiveness of these applications.

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