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Implementation of health cycle using VR and IoT

Saumya Bathla[1], Ravi Kumar Vishwakarma[2], Pulak Tandon[3]
[1, 2, 3]*Electronics and Communication Engineering Department, KIET Group of Institutions*

Abstract: ***This paper presents the implementation of Health Cycle using Virtual Reality (VR) and Internet of Things (IoT). A prototype system is developed for interactive indoor cycling. The methodology will inspire the people to experience and visit different places while exercising, improving their health and stamina. In our fast forward lives, we need to have some sort of physical activity. The manuscript is presenting a developed methodology and it is possible uses for everyone to take care of themselves in an interesting manner. The methodology used is the combination of software and hardware to work efficiently and to provide an immersive experience. The methodology is conducive to the health of the community without being monotonous.***
Keywords: WHO, COVID, NODE MCU, VR, IR, UI, IOT

I. INTRODUCTION

According to World Health Organization (WHO) health is a state of physical, mental, and social well-being. The greatest possession of a human being is health, and every person strives for it. Cycling is one of the ways to maintain physical health. Regular exercise improves cognitive functioning[1]. Regular cycling improves lungs, and circulation, while at the same time reducing the risk of heart disease. There can be significant reduction in body mass if a diet is also followed with cycling[2]. Cycling strengthens the heart muscles, relaxes the heart rate and lowers blood cholesterol. Cycling represents a potentially powerful way to meet the recommended levels of physical activity for many populations[3]. Regular cycling is considered by a lot of people as a part of their routine because of significant health benefits. Outdoor cycling may sometimes be a difficult task so as to balance it with work. There is an option for cycling in a gym i.e., indoor cycling which has shown improvements in anthropometric parameters[4]. The pandemic era has limited the number of outdoor activities including physical exercise. The COVID-19 situation has forced people to opt for indoor cycling which has resulted in health improvement. The design methodology includes a prototype exercise cycle system using an IR (Infra-red) sensor and Node MCU (Microcontroller Unit). Our project promotes indoor cycling as a game in VR that makes indoor cycling fun. As indoor cycling can seem boring sometimes, virtual cycling helps to break the monotony of the scenery. Indoor cycling pushes people to look at only one place with no enjoyment and makes the experience monotonous and boring hence, people tend to lose interest and give up exercise soon. VR makes the experience enjoyable as well as immersive and offers a variety of scenery to enjoy while cycling. Our prototype helps to cycle using VR which brings enjoyment while maintaining health. It will help users understand their limits with a sense of accomplishment[5].

II. VIRTUAL REALITY TO ENHANCE EXPERIENCE

VR is a computing environment in which scenes and objects appear real and make users feel immersed in their surroundings. VR has the potential to provide the users with captivating and fascinating experience which increases user's interest[6]. If a user is in a non-immersive environment, the user is more likely to stop or not accelerate but if the user is in an immersive environment, they are more likely to accelerate and improve their health by cycling[7]. VR helps break the monotony of indoor cycling and help users to experience variety of places while cycling. This technology is workable and enjoyable for kids as well as adults[8]. VR provides fascinating views and it feels like actual cycling in the nature[9]. In VR, the users do not have to face the traffic as well and while actual cycling the attention required is according to the traffic i.e., more the traffic, more is the visual concentration required[10].

III. INTERNET OF THINGS

The IoT is a network of electronic devices, software, sensors, actuators, and connections which allows remote detection of objects or automatically control objects using sensors in the Internet infrastructure. IoT provides the necessary services to make people's work easier. With the help of IoT data can be transferred over a network using device to device interaction[11]. In today's world IoT plays an important role in collecting data from the environment and then use it for better performance of tasks[12]. IoT is now widely being used in the healthcare industry and can be used to personalize patient care routine[11]. While cycling, IoT based systems can record the information and be fed to the software systems to maintain the accounts[13]. IoT based applications are more flexible to customizations and are hence convenient to use[5].

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IV. VIRTUAL REALITY AND INTERNET OF THINGS

Both IoT and VR have their own advantages individually as well as together because when different technologies are merged together, there is a better impact. Using VR and IoT together is the process of mixing the virtual/digital world and the physical world. IoT manipulates the physical data to digital data, i.e., transform the physical world into digital and VR helps to create and make the digital world realistic. Hardware is developed and is connected to the VR game which can be used on any mobile phone [14].

V. SOFTWARE SPECIFICATIONS

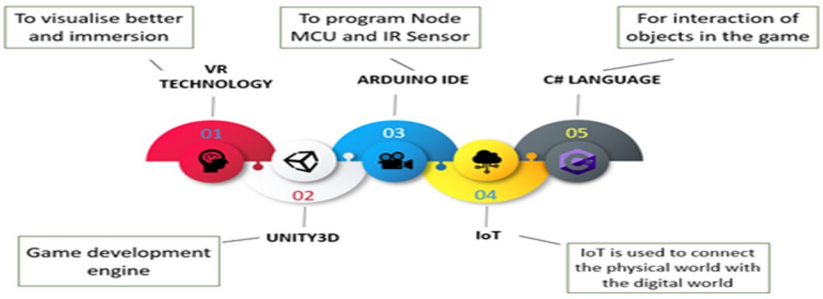


Fig. 1: Schematic diagram of the software used.

A. Unity 3D

For the development of this prototype, Unity version 2020.3.24f1 is used. Unity3D is one of the most common and widely used engine for virtual reality. It supports three scripting languages, C#, JavaScript and a dialect of python named Boo. These can also be mixed and used in a project. It is a very powerful visual editor. The virtual reality systems developed with Unity3D are vivid and interactive and hence, provide a great experience[15].

B. Google Firebase

Google firebase is backed up by google and is used to save data. It provides tools to track the analytics as well as reporting and fixing bugs. Firebase acquires NoSQL cloud data storage and synchronous data storing so as to maintain high speed and stability of the data. It can be used for secure authentication methods by the users. Firebase provides real time database and the data is secure. Fig. (1) shows the software requirements in a diagram.

VI. HARDWARE SPECIFICATIONS

A. IR Sensor

An infrared sensor detects the body placed in the neighbourhood by radiating light. Temperature of objects can be computed and movement can be determined with the use of an IR sensor. An IR sensor has two sections: an IR LED and a photodiode. The IR LED emits the light which is sensed by the photodiode after reflection. The IR sensor is placed near the wheel of the cycle. Most of the wheels of exercise cycles are either white or black, so we will put a black or white coloured strip so that it is detected by the IR sensor.

B. Node MCU

Node MCU is an open-source firmware which helps in connection of devices using Wi-Fi protocols. Open-source board designs are also available for this. It also provides some important features of a microcontroller. It requires Lua scripting. Fig. (2) shows the connections of the IR Sensor and Node MCU.

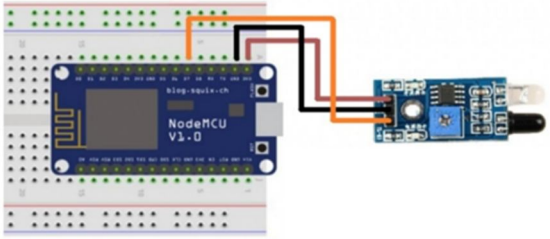


Fig. 2: Connections of the IR Sensor with Node MCU as used.

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VII. WORKING

The android application is made on Unity3D using C# scripting and other features of Unity3D. the virtual scenery is added to the application so as the user can select which scenery to enjoy while cycling. The UI (User Interface) is designed in such a way that there will be no difficulty for the user. The is in control of the scenery he/she want to enjoy. The roadmaps/routes are created for an exciting experience. The application shows the speed of the user and also the distance covered which is calculated using the Node MCU. Wi-Fi is used as the communication medium. Google firebase is the database used for smooth running of the application and enhanced user experience. Flow chart of the process taking place is as shown in **Fig. (3)**.

The data collected by the IR sensor will be sent to the firebase via Node MCU and using the node MCU speed can be determined. Arduino IDE is required to program the Node MCU. The application is connected to the database and the data from the IR sensor is fetched. The data collected is used to find the speed and distance covered by a person while cycling. The same data is fetched by the application which will be displayed for the user. Fig. (4) displays the diagrammatic representation of the working of our project.

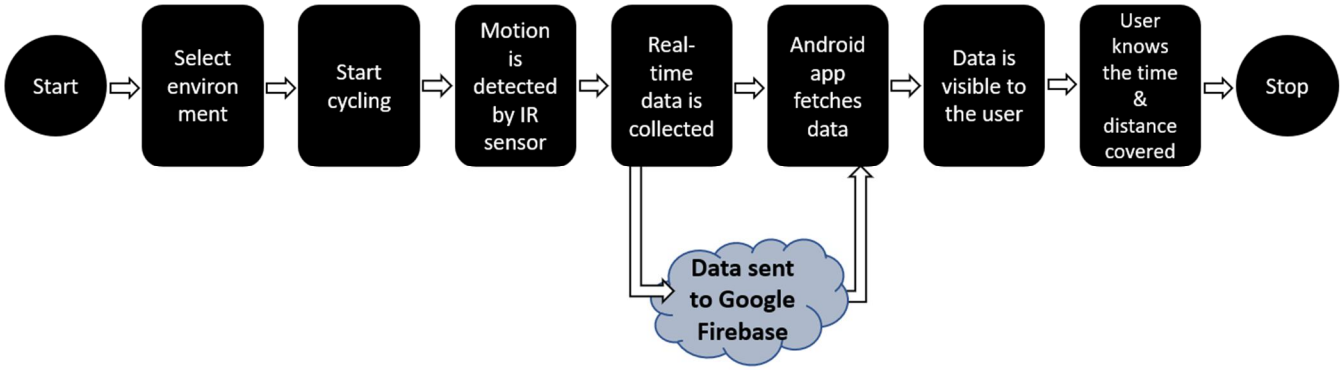


Fig. 3: Flowchart representation of the process being involved.

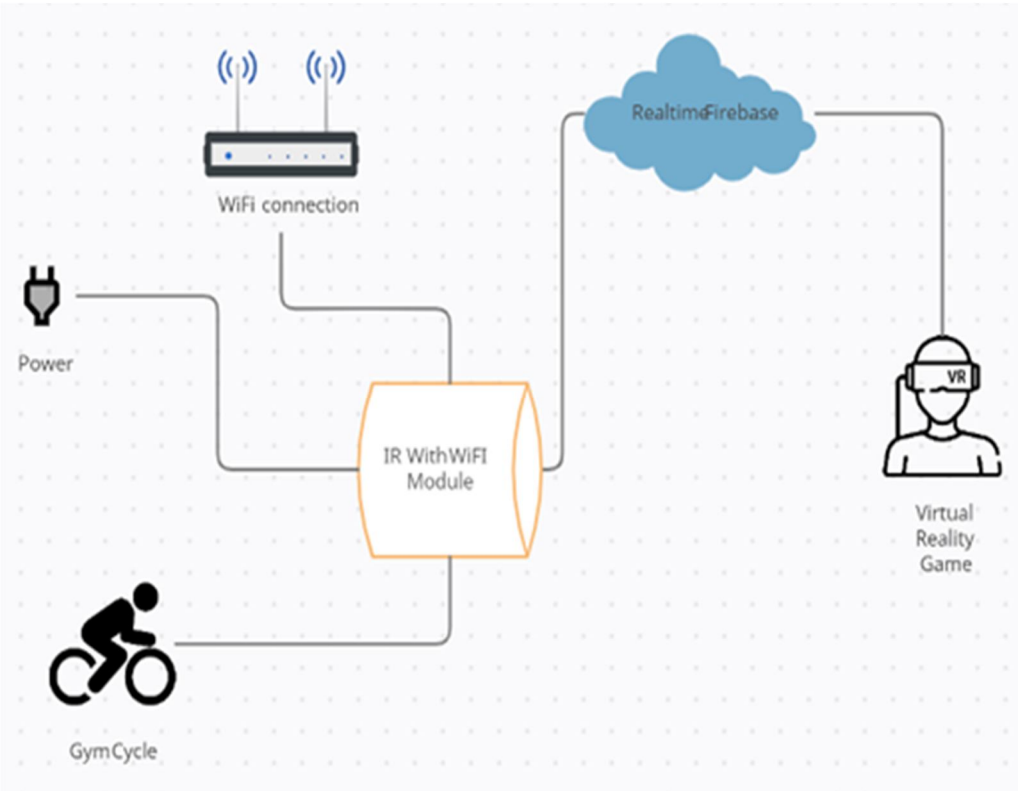


Fig. 4: Block diagrammatic representation of the project.

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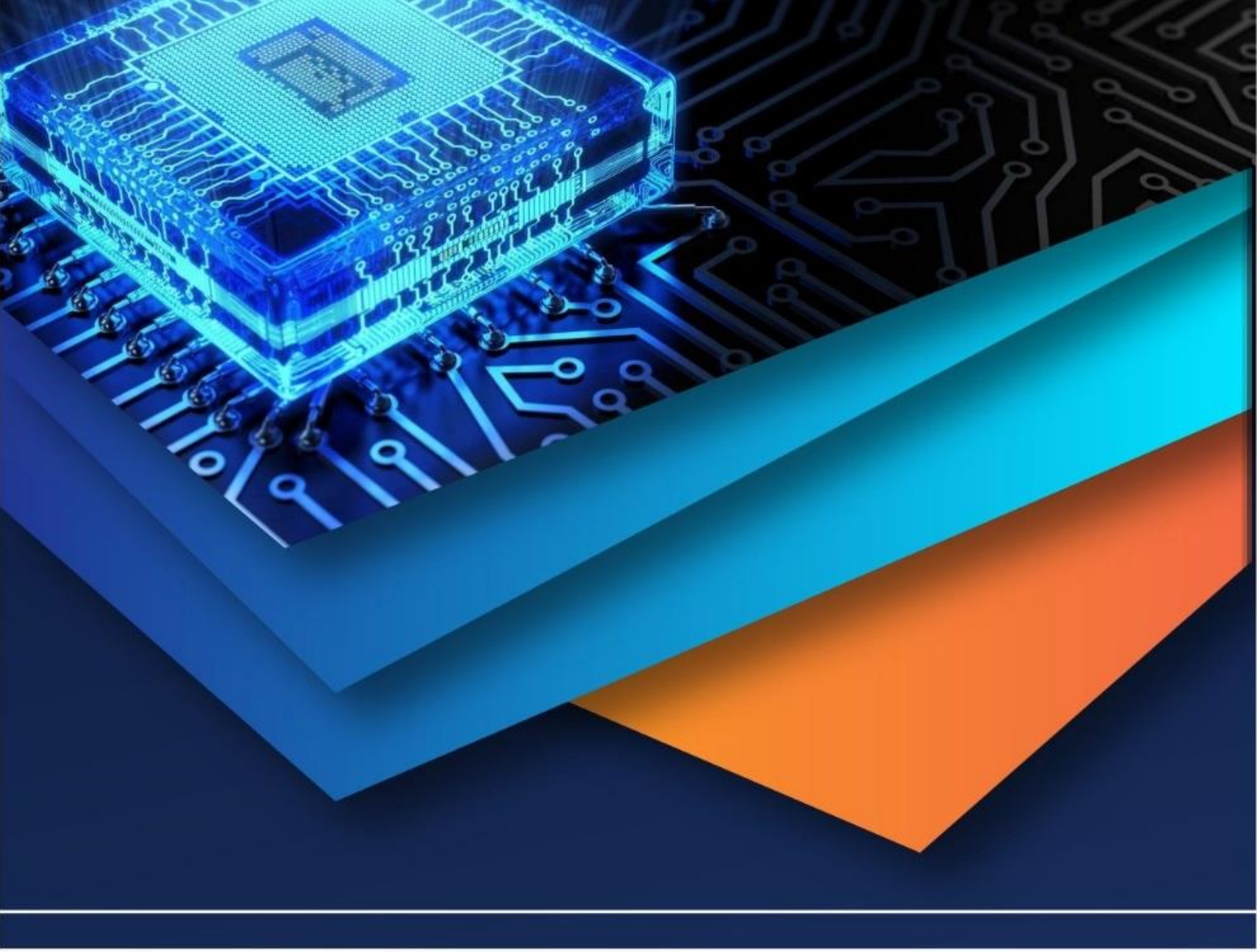
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