Bicycle Simulation Using Virtual Reality

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Abstract- The main aim of this project is to develop a bicycle simulator, which will give a real-life bicycle riding experience in the virtual world using virtual reality headset. In this project, a bicycle is mounted on a double stand to give proper balance to the rider as the bicycle will stay stationary in the real world and only the rear tire of the bicycle will rotate by pedaling. The rider of the bicycle will give input in real-time and will be able to see the output in the virtual world, for this mechanism a ball mouse is used. The y-axis wheel of the ball mouse is mounted on the rear tire of the bicycle while the x-axis wheel of the ball mouse is attached to the handle of the bicycle. The y-axis wheel will give the forward movement if the rear tire starts rotating on pedaling and the x-axis wheel will help the rider to steer the bicycle left or right in the virtual world. Both the y-axis wheel and x-axis wheel of the ball mouse is extended from the mouse to two separate general purpose PCB with the help of connecting wires and soldering. The virtual world Android application package and the coding for the simulation purpose are developed using Unity 2017.3.0 software. The ball mouse is connected to an android phone and the android phone is adjusted in virtual reality headset which the rider will wear on his face while pedaling and steering the bicycle. Hence, using a ball mouse as encoder this project becomes very cost effective without any use of costly sensors.

Keywords- Bicycle, Virtual Reality, Simulation, Mouse, Android

I. INTRODUCTION

For almost all means of the transport driving simulators are developed that offer a real-time experience of riding under enclosed or indoor environment. These simulators are successfully implemented for riders training and education and as a result, they have significantly contributed towards the safety of the road. Sadly, there is no such approach for the bicycle simulation. Hence in this paper, we have proposed a system for bicycle simulator that virtually creates situations within a 3D virtual environment. For this purpose, the bike is mounted on a double stand that enables a semi-realistic simulation of riding. The virtual environment can be developed as per as our choice using unity 3D and blender software. The virtual environment will be integrated into a VR android application and will be experienced through VR headset. To gain all this, a dynamic hardware and software synchronization is made which is able to simulate the bicycle riding experience.

II. OVERVIEW

Since technology is growing so fast the human race is oblivious to the fact that how virtual reality can be used in almost everything. It can be useful in medical industry, gaming, education, etc. But this technology is not used to its full capability. In the real world, humans can interact with the objects around them but a virtual reality is an artificial environment that is created using programming and presented to the user in such a way that the user suspends his belief and accepts it as a real world. Generally, when a person does exercise he faces lots of difficulties at first. So in this application, the user will be given a virtual environment for physical fitness where the user can experience himself exercising in a virtual world with the exact reflection of his actions performed in the real world. The user can experience accurate real world physical parameters produced as output in the virtual world by accessing them as input in the real world using different sensors.

III. IMPLEMENTATION

In this section, the project implementation is discussed in two sections: - A) Hardware B) Software.

A. Hardware

For the hardware part of this bicycle simulator, the following components are used: - Bicycle, Ball mouse, VR headset, Android device, Castor wheel, Bike stand.

In order to read the real-time tire rotations of the bicycle, we are using the ball mouse as an encoder.
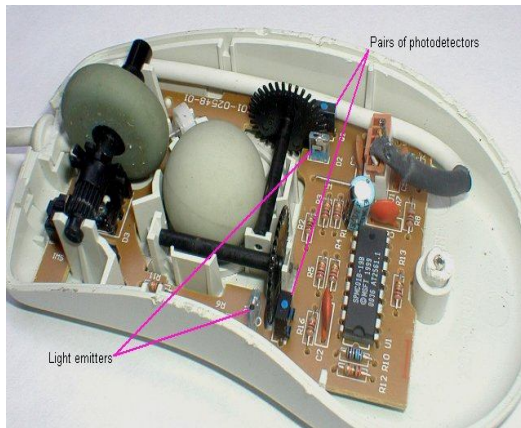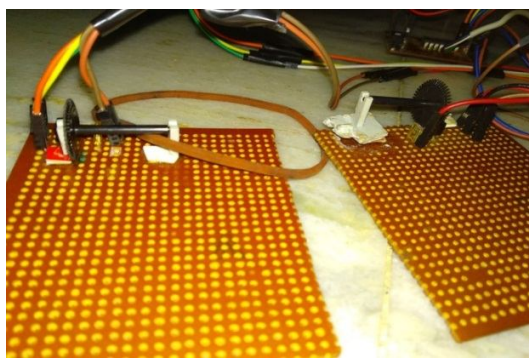
Fig - 1 Ball mouse

Fig - 2 Y-xis wheel and x-axis wheel mounted on PCB

For the forward movement of the bicycle in the virtual world, the IR transmitter and receiver of the mouse are mounted on a general purpose PCB face to face, the y- axis wheel of the ball mouse is placed between the IR transmitter and receiver. The caster wheel is mounted above the rear wheel of the bicycle in such a way that when the rear tire will rotate the caster wheel will also rotate. The encoder is fixed such that when the caster wheel rotates the y-axis wheel mounted on the PCB will also rotate.

Fig - 3 Y-axis wheel connected to the caster wheel

For moving the bicycle in left or right directions the x-axis wheel is fixed on the handle of the bicycle. So when the

rider turns the handle of the bicycle the x-axis wheel will also rotate.

The output of this mechanism will result in the movement of the rider in the virtual environment. The encoder is connected to the Android device via USB cable and then using the VR headset the rider can visually experience the virtual 3D environment.

B. Software

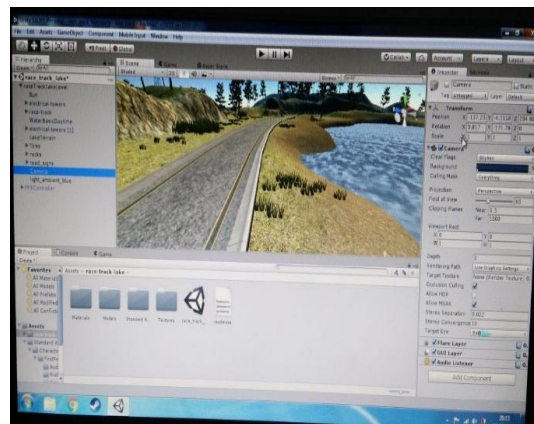For this project we are using the following software: - Blender, Unity 2017.3.0 and Google Android Studio.

Fig - 4 3D environment 1

Fig - 5 3D environment 2

The 3D Virtual environment is developed using both Blender and Unity 3D software. The real-time movements of the rider are synced with the virtual environment in Unity 3D using C# scripts. After this, an Android application is developed using Google Android Studio. This application is then installed on an Android device. After starting the application on the Android device and placing the Android device in the VR headset the rider will experience the developed 3D virtual environment.
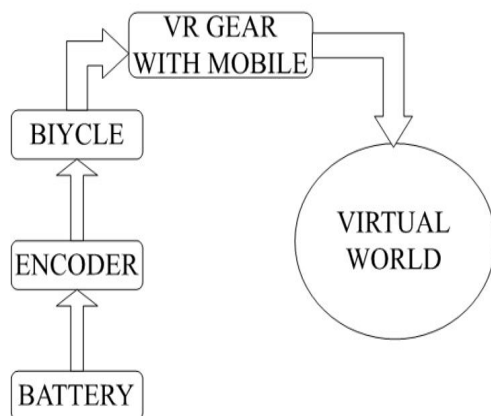
Fig - 6 Block Diagram

IV. CONCLUSION

By using this project we can experience the 360-degree view of various locations we want using Unity and 3d modeling software. Real-time experience of any future construction or location like a new college campus, building locality or a city can be achieved using this project. This model can also be used for indoor cycling purpose as fitness equipment providing much more entertainment compared to the normal gym cycle. Our future plans for this project is to include real-time road traffic conditions that will help the rider to learn driving in traffic safely without any chance of a road accident.

V. ACKNOWLEDGMENT

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