Virtual Cycle Simulator using Arduino and Unity 3D

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ABSTRACT

Cycling, though considered to be one of the best exercises, is impractical in Oman due to high temperatures and lack of cycling lanes, leading to accidents. Though exercising indoors is a feasible alternative, it is monotonous. Virtual Cycle provides a virtual interactive environment for cycling with real world physics to simulate an original experience.

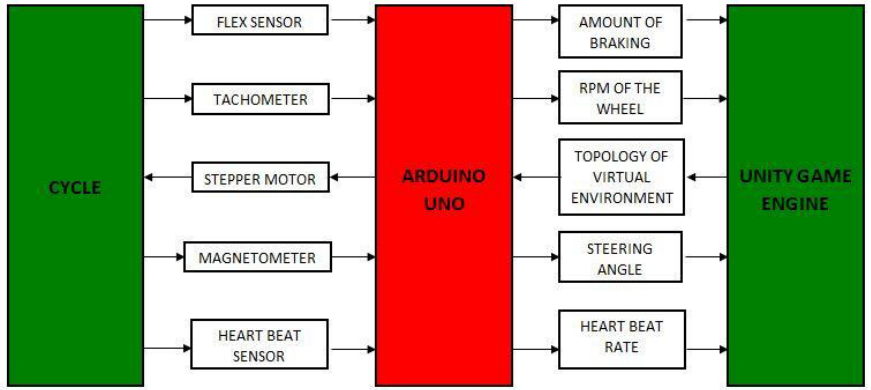
INTRODUCTION

Virtual Cycle is an interactive bicycle simulator. The rider on the bicycle feels the motion and has the visual experience of riding in a virtual environment displayed on a screen in front of him.[1]

The cycling speed, braking action and steering controls[2][4] of the cyclist are read from the cycle and replicated in the gaming environment, along with information about the calories burned and distance cycled. On the other hand, terrain changes in the virtual environment will be used to change the pedal resistance of the exercise machine, so as to replicate the experience of cycling uphill or downhill.[1] The heart rate of the individual, along with calories burned and the total distance pedaled is displayed in the HUD.

The integration of the effects of real world physics and the visual graphics provided by the game give the user the realistic feel of cycling outdoors.

METHODOLOGY



Hardware:

- An IR based tachometer is placed on the cycle rim and used to calculate speed.
- Heartbeat sensor is used to display heartrate and calories burned in the HUD.
- Magnetometer is used to read angular movements of the handlebar for steering the virtual cycle.
- Flex sensor is used to measure the amount of braking applied by the cyclist.
- A stepper motor is used to vary the pedal resistance according to the slopes in the game environment giving the user a more realistic feel. Virtual Cycle has three levels of braking : uphill, plane and downhill.
- An Arduino microcontroller is used to interface the real cycle values with the game environment.

Software:

- The virtual environment is made in Unity 3D software with scripting done in C# language.
- Blender 3D is a software is used to model the cycle and buildings in the game environment.

RESULTS

A normal cycle is converted to an exercise machine and integrated with a virtual environment as shown below:

CONCLUSIONS

This project provides the immersive experience of riding outdoors from the comfort of your home. The following disadvantages are overcome:

- Cycling outdoors for exercise is impractical in Oman due to very high temperatures.
- Lack of cycling lanes make it a dangerous venture.
- Women may not be able to cycle outside.
- Exercise machines are bought to combat these issues, but users fail to keep up with their daily fitness routine as the initial enthusiasm wears off.

The advantages include:

- Exercise routine is combined with the fun experience of exploring a virtual world, encouraging individuals to return to it.
- Encouragement for patients undergoing physiotherapy.
- Children and the elderly can use it within the safety of their homes.
- Using two or more of the same equipment, it is possible to play multiplayer games online.

REFERENCES

[1] KAIST Interactive Bicycle Simulator by Dong-Soo Kwon et al.
[2] Challenges in Virtual Reality Exergame Design by Lindsay Alexander Shaw et al.
[3] Improving the Experience of Sports by adding a Virtual Environment by Peter de Koning
[4] VRACK - Virtual Reality Augmented Cycling Kit: Design and Validation by Richard Ranky et al.