

Modeling and control of a wheeled mobile vehicle using driving simulator application

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ABSTARCT

The PC steering wheel controller is a device that is designed to mimic the experience of driving a vehicle in a computer game or simulation. It typically consists of a wheel, pedals for accelerating and braking, and various buttons and switches for controlling other functions in the game. The wheel is designed to look and feel like an actual car's steering wheel, with many models featuring a textured surface and rubber grips for added comfort and control. The pedals are typically placed on the floor and are used to control the speed and braking of the virtual vehicle. They usually consist of a gas pedal and a brake pedal, with some models also featuring a clutch pedal for more realistic simulation of manual transmission vehicles. In addition to the wheel and pedals, PC steering wheel controllers may also feature additional buttons and switches for controlling other functions in the game, such as shifting gears or adjusting the view. Some PC steering wheel controllers also come with additional features such as programmable buttons, adjustable sensitivity, and force feedback. Force feedback is a feature that simulates the feel of the road or track surface, as well as vibrations and jolts from collisions or rough terrain, adding even more realism to the experience.

I. INTRODUCTION

PC steering wheel controllers have become increasingly popular in recent years as computer graphics have improved and gaming technology has advanced. They are now widely available from a variety of manufacturers, ranging from budget options to high-end models with advanced features. One of the main advantages of using a PC steering wheel controller is the level of immersion it provides. By using a realistic wheel

and pedals, the user can feel more connected to the virtual vehicle and experience a more realistic sense of speed and movement. Another advantage of using a PC steering wheel controller is the level of control it provides. With a wheel and pedals, the user can make more precise movements and adjust their speed more accurately than with a keyboard or controller. Some PC steering wheel controllers also come with additional features such as programmable buttons, adjustable sensitivity, and force feedback. These can add even more realism to the experience, making the player feel more like they are actually driving a vehicle. There are also a variety of games and simulations that are specifically designed to be used with PC steering wheel controllers. These can range from realistic racing simulations to more arcade-style games, and can provide a fun and challenging experience for players of all skill levels. Overall, a PC steering wheel controller can be a valuable addition to a gamer's setup, providing a more immersive and engaging experience than using a standard keyboard or controller. Whether you are a racing enthusiast or just looking for a more realistic way to play games, a PC steering wheel controller can be a great investment. Overall, the PC steering wheel controller is a valuable tool for games who enjoy driving simulations or racing games. It provides amore immersive and engaging experience than using a standard keyboard or controller, and can enhance the player's sense of control likely to continue to grow.

1.1 PROBLEM STATEMENT

A PC steering wheel controller is a peripheral device designed to simulate the experience of driving a car on a computer or diving console. The problem statement for this device could be how to design a PC steering wheel controller that accurately replicates the feel and responsiveness of driving a real car, with realistic force feedback, pedal resistance, and steering sensitivity. Other challenges may include ensuring compatibility with various games and platforms, providing intuitive controls and configuration options, and offering durability and reliability over extended periods of use.

1.2 PROBLEM MOTIVATION

The motivation for a PC steering wheel controller is to enhance the realism and immersion of driving simulation games on a computer or gaming console. While traditional keyboard and mouse or gamepad controls can be effective for some games, they cannot replicate the physical experience of driving a car. A steering wheel controller provides a more intuitive and immersive way to interact with driving games, allowing players to experience the thrill of high-speed maneuvers, precise steering, and realistic force feedback.

II. LITERATURE REVIEW:

In [1] of this journal, Kujala et al. (2015) investigated the effects of different input devices, including a PC steering wheel controller, on driving performance in a racing game. The study found that participants who used the PC steering wheel controller had better driving performance than those who used a gamepad or keyboard.

In [2] of this journal, Kim et al. (2018) found that participants who used a PC steering wheel controller had a more immersive and realistic gaming experience than those who used a standard gamepad. The study also found that participants who used the PC steering wheel controller had a higher level of enjoyment and satisfaction with the game.

In [3] of this journal, Matas et al. (2019) found that using a PC steering wheel controller improved the realism and accuracy of driving simulations in a virtual environment. The study also suggested that PC steering wheel controllers could be used for driver training and evaluation.

In [4] of this journal, Rebenitsch and Owen (2016) found that using a PC steering wheel controller could increase the risk of simulator sickness, a condition that can cause nausea, headaches, and other symptoms.

In [5] of this journal, Kugler et al. (2020) report that participants who used the PC steering wheel controller had higher levels of immersion, realism, and enjoyment compared to those who used a gamepad. The study also found that the PC steering wheel controller increased participants' sense of control over the game.

Potentiometer:



Fig 1.1: Potentiometer

A potentiometer, also known as a pot, is a variable resistor that allows for adjustable resistance. It is a three-terminal device with a resistive element that is connected to a sliding contact or wiper, which can be moved to change the resistance. The resistance of a potentiometer can be varied by adjusting the position of the wiper along the resistive element. Potentiometers are used in a wide range of applications, including volume and tone controls in audio equipment, dimmer switches for lighting, and variable-speed control in motors. They are also commonly used in experimental circuits for measuring voltage, current, and resistance. Potentiometers can be classified based on their construction and include rotary, slide, and trimmer potentiometers. Rotary potentiometers have a circular resistive element with a rotating knob that allows for easy adjustment. Slide potentiometers have a linear resistive element with a sliding knob that can be moved along the element. Trimmer potentiometers are miniature variable resistors used for fine-tuning or calibration purposes. Potentiometers come in a variety of sizes and resistance values, and can be made from a range of materials including carbon, cermet, and conductive plastic. The choice of potentiometer will depend on the specific application and requirements of the circuit.

Controller Board:



Fig1.2: Controller Board

A controller board in a PC steering wheel controller is the component that processes the signals from the various buttons, pedals, and sensors on the steering wheel and translates them into commands that the computer can understand. The controller board is usually a small circuit board that is mounted inside the steering wheel and connected to the computer via a USB cable.

Mounting system:

The mounting system for a PC steering wheel controller can vary depending on the specific model you have. However, most PC steering wheel controllers come with a clamp or suction cup mounting system. A clamp system typically involves attaching the controller to the edge of a desk or table using a spring-loaded clamp. This allows you to adjust the height and angle of the controller to suit your needs. The clamp should be tightened securely to prevent the controller from slipping or wobbling during use.

USB Adapter:



Fig1.3: USB Adapter

A USB adapter is commonly used to connect a PC steering wheel controller to a computer. This adapter allows the controller to communicate with the computer through the USB port, enabling you to use the steering wheel to play racing games on your PC. The adapter usually comes with the steering wheel controller, and it's designed to convert the analog signals from the steering wheel into digital signals that the computer can understand. The adapter typically has a USB connector on one end that plugs into the computer, and a port or cable that connects to the steering wheel controller. It's important to make sure that the adapter you use is compatible with your steering wheel controller and your computer. Check the manufacturer's website or user manual to see if they recommend a specific adapter for your setup. Additionally, some newer steering wheel controllers may not require an adapter and can connect directly to the computer via USB. The USB adapter typically converts the analog signals from the steering wheel's sensors, such as the rotation of the wheel and the position of the pedals, into digital signals that can be read by the computer. The adapter may also have additional features, such as force feedback, vibration, and button mapping. When choosing a USB adapter for your PC steering wheel controller, it's important to ensure that it's compatible with both the controller and the computer. Some adapters are specifically designed for certain models of steering wheel controllers, while others are more universal.

MMJOY:

MMJoy is a software tool that can be used to configure and customize a variety of joystick and game controller devices, including steering wheel controllers, for use with a PC. With MMJoy, you can create custom control profiles for your steering wheel controller, map buttons and axes to keyboard keys or mouse movements, and more. To use MMJoy with your PC steering wheel controller, you will first need to download and install the MMJoy software onto your computer. Once installed, you can then connect your steering wheel controller to your computer and use the MMJoy software to configure it. To configure your steering wheel controller with MMJoy, you will need to first create a new control profile for your device. You can then map the buttons and axes on your controller to various inputs on your PC, such as keyboard keys or mouse movements. You can also customize the sensitivity and dead zone of your steering wheel, adjust the force feedback settings, and more. Overall, MMJoy can be a powerful tool for customizing your PC steering

wheel controller and tailoring it to your specific preferences and needs. However, it does require some technical knowledge and expertise to use effectively.

BLOCK DIAGRAM:

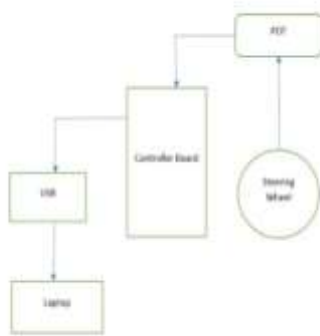


Fig1.4: Block Diagram

The steering wheel is the main input device of the controller. It usually has a circular shape and is mounted on a base that allows it to rotate freely. The wheel is connected to sensors that detect its position and movement, allowing the controller to emulate the steering of a real vehicle. The block diagram of a PC steering wheel controller consists of three main components: the PC game software, the USB interface, and the steering wheel controller. The PC game software is responsible for generating the virtual world of the racing game and interpreting the signals received from the input devices. This software generates signals corresponding to the user inputs from the steering wheel, pedals, and buttons. These signals are then passed through the USB interface. The USB interface is a piece of hardware that connects the PC game software to the steering wheel controller. The USB interface acts as a bridge between the two devices, translating the signals generated by the PC game software into a language that the steering wheel controller can understand. Finally, the steering wheel controller itself is the physical device that the player interacts with. It includes a steering wheel that can be turned left and right, pedals for acceleration and braking, and buttons for various in-game functions like changing gears or activating nitrous oxide. The steering wheel controller receives the signals from the USB interface and uses them to move the steering wheel, pedals, and buttons accordingly. The controller can also provide feedback signals to the PC game software, allowing the game to respond to the

player's actions.

Application, Advantages, Disadvantage:

Application:

1. The primary application of a PC steering wheel controller is for playing racing games on a computer.
2. It provides a more immersive and realistic experience compared to using a keyboard or gamepad.
3. A PC steering wheel controller can also be used for driving simulations used for training purposes, such as in driver education programs or professional driver training courses.
4. Some flight simulator games also support the use of steering wheel controllers to simulate the controls of an airplane or helicopter.
5. Overall, a PC steering wheel controller is a versatile input device that can enhance the experience of playing various simulation games on a computer.

Advantage:

1. **Immersive Experience:** A PC steering wheel controller provides a more immersive experience compared to using a keyboard or gamepad. The physical feedback from the steering wheel and pedals can make the player feel like they are actually driving a car.
2. **Realistic Controls:** A steering wheel controller provides a more realistic control scheme compared to other input devices. The steering wheel can be turned left and right, and the pedals can be pressed for acceleration and braking, which closely mimics the actions of driving a real car.
3. **Improved Precision:** With a steering wheel controller, the player has more precise control over their vehicle, which can lead to better lap times and more victories in the game.
4. **Customizability:** Many PC steering wheel controllers allow for customization of the button and pedal layout, allowing players to tailor the controls to their preferences and playstyle.
5. **Compatibility:** Most modern PC games support the use of a steering wheel controller, so players can use it with their favorite racing games.

Disadvantage:

1. **Space Requirements:** they require more space than other input devices, which may be problematic for gamers with limited desk or living space.
2. **Learning Curve:** using a steering wheel

controller can take some time to get used to, especially for players who are used to using a keyboard or gamepad.

3. Maintenance: steering wheel controllers may require more maintenance than other input devices, such as regular cleaning and calibration.
4. Compatibility: some older or less popular PC games may not be compatible with steering wheel controllers, limiting the player's options.

III. CONCLUSION:

A PC steering wheel controller is an input device that allows players to simulate the experience of driving a car or other vehicle in racing and simulation games on a computer. It typically consists of a steering wheel, pedals, and buttons that players use to control their vehicle in the game. One of the primary advantages of using a PC steering wheel controller is that it provides a more immersive and realistic experience compared to using a keyboard or gamepad. The physical feedback from the steering wheel and pedals can make the player feel like they are actually driving a car, and the realistic controls allow for better precision and control over the vehicle.

Compliance with Ethical Standards:

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Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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