

CLAIMS:

1. A dynamic control system for controlling an amusement park ride, comprising:
 - a game server configured to generate game data that describes movement of a virtual vehicle through a virtual environment;
 - a programmable logic controller (PLC) of a ride vehicle configured to receive and conditionally execute instructions of a dynamic ride profile relative to one or more stored limits to operate physical actions of the ride vehicle;
 - a dynamic ride profile server communicatively coupled to the game server and the PLC, wherein the dynamic ride profile server is configured to:
 - receive input data from one or more input devices, sensor data from one or more sensors, and the game data from the game server;
 - provide the input data, the sensor data, and the game data as inputs to one or more physical models to generate a portion of a dynamic ride profile based on the movement of the virtual vehicle through the virtual environment; and
 - provide the portion of the dynamic ride profile to the PLC for conditional execution.
2. The system of claim 1, comprising the one or more sensors communicatively coupled to the dynamic ride profile server and configured to collect sensor data during operation of the amusement park ride.
3. The system of claim 2, wherein a first portion of the one or more sensors are communicatively coupled to the dynamic ride profile server via the PLC and a network, and wherein a second portion of the one or more sensors are communicatively coupled to the dynamic ride profile server via the network.
4. The system of claim 1, comprising the one or more input devices communicatively coupled to the dynamic ride profile server and the game server, wherein the one or more input devices are configured to collect input data from a passenger of the

amusement park ride and provide the input data to the dynamic ride profile server and the game server.

5. The system of claim 1, comprising a second PLC of a second ride vehicle configured to receive and conditionally execute instructions of a second dynamic ride profile relative to one or more stored limits to operate the second ride vehicle, wherein the game data also defines movement of a second virtual vehicle through the virtual environment, and wherein the dynamic ride profile server is configured to:

provide the input data, the sensor data, and the game data as inputs to one or more physical models to generate a portion of a second dynamic ride profile based on the movement of a second virtual vehicle through the virtual environment; and

provide the portion of the second dynamic ride profile to the second PLC for conditional execution.

6. The system of claim 5, wherein the one or more stored limits of the PLC or the second PLC comprise a maximum/minimum speed limit, an acceleration limit, a yaw limit, a tilt limit, a current/voltage limit, a torque limit, a minimum intravehicular distance, or a combination thereof.

7. The system of claim 5, wherein the game data describes interactions between the virtual vehicle and the second virtual vehicle in the virtual environment, wherein the interactions comprise drafting effects, collisions, or projectile attacks.

8. The system of claim 7, wherein the one or more physical models define how the ride vehicle and the second ride vehicle should move in response to the interactions.

9. An amusement park ride, comprising:

a game server configured to generate game data that includes a virtual environment;

a ride vehicle communicatively coupled to the game server and configured to move passengers along a ride path, wherein the ride vehicle comprises:

one or more output devices configured to present the virtual environment to the passengers of the ride vehicle based on the game data generated by the game server;

one or more input devices configured to collect input data from the passengers of the ride vehicle;

one or more sensors configured to collect sensor data during operation of the ride vehicle; and

a programmable logic controller (PLC) communicatively coupled to the one or more input devices and the one or more sensors, wherein the PLC is configured to receive and conditionally execute instructions of a dynamic ride profile relative to one or more stored limits to operate physical actions of the ride vehicle; and

a dynamic ride profile server communicatively coupled to the game server and the PLC, wherein the dynamic ride profile server is configured to:

receive the input data and the sensor data via the PLC and receive the game data from the game server;

provide the input data, the sensor data, and the game data as inputs to one or more physical models to generate a portion of the dynamic ride profile; and

provide the portion of the dynamic ride profile to the PLC for conditional execution.

10. The amusement park ride of claim 9, wherein the one or more output devices comprise displays, speakers, haptic feedback devices, physical effects devices, or a combination thereof.

11. The amusement park ride of claim 9, wherein the one or more sensors comprise a positional sensor, a radio-frequency identification (RFID) sensor, a camera, a light detection and ranging (LIDAR) sensor, a velocimeter, an accelerometer, a gyroscope, a revolutions per minute (RPM) sensor, a voltage/current sensor, or a combination thereof.

12. The amusement park ride of claim 9, wherein the one or more input devices comprise a button, a steering device, a control pedal, a gear shift, a brake lever, or a combination thereof.
13. The amusement park ride of claim 9, wherein the one or more input devices comprise a head or eye tracking system that monitors passengers' head or eye position to collect steering input from the passengers.
14. The amusement park ride of claim 9, wherein the PLC of the ride vehicle is communicatively coupled to and controls a speed controller, a rotation controller, a drive, or a combination thereof, of the ride vehicle based on the portion of the dynamic ride profile and the one or more stored limits.
15. The amusement park ride of claim 9, wherein the one or more stored limits comprise maximum/minimum speed limit, an acceleration limit, a yaw limit, a tilt limit, a current/voltage limit, a torque limit, a minimum intravehicular distance, or a combination thereof.
16. A method of controlling an amusement park ride, comprising:
receiving input data from input devices of a ride vehicle of the amusement park ride;
receiving sensor data from one or more sensors of the amusement park ride;
receiving game data from a game server of the amusement park ride, wherein the game data describes movement of a virtual vehicle through a virtual environment;
providing the input data, the sensor data, and the game data as inputs to one or more physical models to generate a portion of a dynamic ride profile based on the movement of the virtual vehicle through the virtual environment; and
providing the portion of the dynamic ride profile to a communicatively coupled PLC of the ride vehicle, wherein the PLC of the ride vehicle is configured to conditionally

execute the portion of the dynamic ride profile during operation of the amusement park ride to physically move the ride vehicle based on one or more stored limits of the PLC.

17. The method of claim 16, comprising:

receiving second input data from input devices of a second ride vehicle of the amusement park ride;

receiving the game data from a game server of the amusement park ride, wherein the game data also describes movement of a second virtual vehicle through the virtual environment;

providing the second input data, the sensor data, and the game data as inputs to the one or more physical models to generate a portion of a second dynamic ride profile based on the movement of the second virtual vehicle through the virtual environment; and

providing the portion of the second dynamic ride profile to a communicatively coupled second PLC of the second ride vehicle, wherein the second PLC of the second ride vehicle is configured to conditionally execute the portion of the second dynamic ride profile during operation of the amusement park ride based on one or more stored limits of the second PLC.

18. The method of claim 17, comprising generating game data that describes interactions between the virtual vehicle and the second virtual vehicle in the virtual environment, wherein the interactions comprise drafting effects, collisions, or projectile attacks.

19. The method of claim 18, wherein the one or more physical models comprise physical models defining how the ride vehicle and the second ride vehicle should move in response to the interactions.

20. The method of claim 16, wherein the game data describes the virtual vehicle transitioning between a first medium and a second medium in the virtual environment, and comprising:

using a first of the one or more physical models to generate the portion of the dynamic ride profile before the transition and to use a second of the one or more physical models to generate the portion of the dynamic ride profile after the transition.