

Automatic Trailer Parking: AEROPVS017

The "Automatic Trailer Parking" is a specialized simulation demo and algorithmic study developed by **VirtualSim** using their **vsTASKER** platform. It demonstrates how an automated system (automaton) can safely reverse and park small or long trailers hooked to a car or truck without jackknifing.

Core Objective & Challenge

- Driving a multi-body vehicle forward is relatively simple, but **reversing or parking a 5-axle semi-truck into a bay** is highly complex.
- The system must constantly manage the **hitch angle** and steering characteristics to prevent the trailer from crossing the jackknife threshold.

The Three-Rule Algorithm

The simulation logic uses an advanced path planning system based on three main spatial positioning rules:

1. **Gate Point Alignment:** The software automatically generates a "gate point" aligned with the parking lot, usually placed at a distance equal to **two times the length of the trailer**.
2. **The "MoveAway" Function:** If the tractor-trailer is too close to the gate point or the turning radius is incompatible, a moveAway logic task forces the vehicle to drive forward to clear about 15 meters and reposition itself.
3. **The Reverse Park Phase:** Once optimal distance and zero speed are achieved, the reversePark command triggers two vital control loops:
 - **Cornering:** Backs the trailer toward the target point while maintaining the maximum allowed angle between the shafts without jackknifing.
 - **CtrlDirection:** Takes over once the trailer's heading is within a **15-degree range** of the final target to guide it straight into the bay.

Technical Stack Used

- **vsTASKER Software:** Handles the scenario logic, task assignment, and behavioral rules.
- **OpenSceneGraph (OSG):** Utilized as the 3D graphics rendering engine.
- **Bespoke Axle Component:** A specialized runtime component built to realistically calculate chassis and wheel physics during articulated motion.

Are you planning to build or program a multi-carriage simulation, or are you interested in the **mathematical control loops** vsTASKER uses to track the hitch angles? Let me know how you would like to expand on this topic!

The vsTASKER Automatic Trailer Parking algorithm is a rule-based autonomous system designed by VirtualSim to simulate the complex kinematics of reversing multi-body vehicles. It replicates expert driving skills to park multi-axle semi-trucks, cars with caravans, or trailers into tight bays without jackknifing.

Core Architecture & Rules

The automaton bypasses heavy pre-defined physics modules by using a custom **Axle Component** combined with three primary procedural rules:

- **Rule 1: Gate Point Creation** – The software generates a "gate point" at a set distance from the parking lot, perfectly aligned with the bay. Testing shows the best distance is roughly **two times the trailer length**.
- **Rule 2: Retry Logic (moveAway)** – If the configuration angle is incompatible or the vehicle is too close to turn, the moveAway function triggers. This pulls the truck forward ~15 meters to realign.
- **Rule 3: Reverse Parking Execution** – Once aligned and at a complete stop, the system activates the reverse Park function to steer the trailer backwards into the target lot.

Key Maneuver Tasks

During the reverse phase, the simulator switches dynamically between two engine loops to control vehicle direction:

- **Cornering:** Backs the trailer toward the target while maintaining the maximum allowable articulation angle without exceeding the hazardous **jackknife threshold**.
- **CtrlDirection:** Engages when the trailer heading drops within **15° of the target heading**. It transitions the truck from a turning arc into a stabilized, straight-line reverse path.

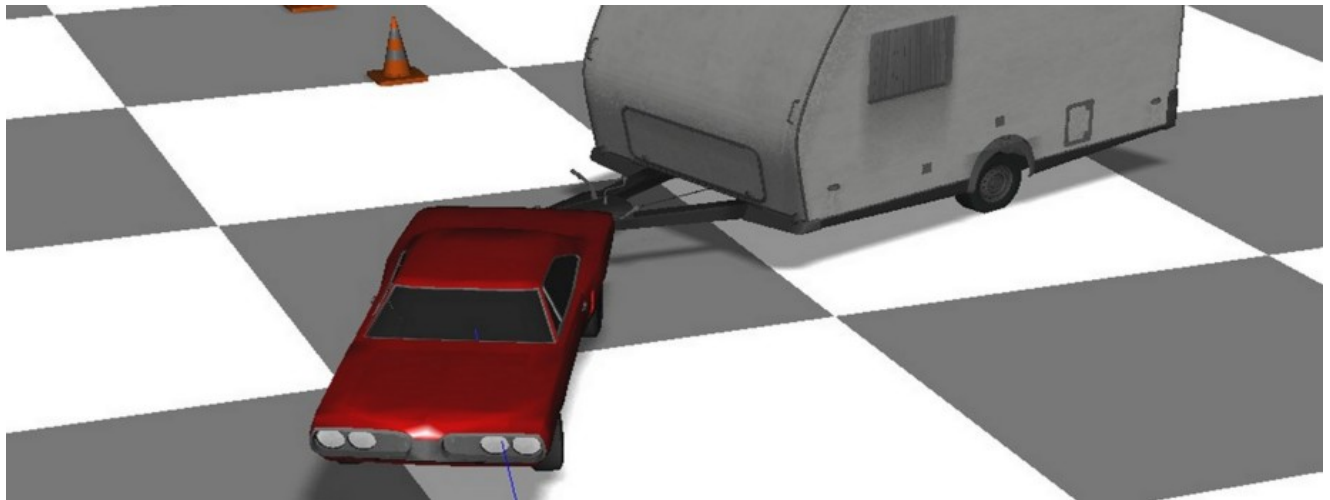
If you are currently setting up a multi-carriage simulation, would you like to know how to configure the **database variables** for the Axle component, or do you need help optimizing the **jackknife threshold settings** for a specific truck model?

Automatic Trailer Parking

by VirtualSim

The purpose of this study is to create a set of rules for that an automaton can park a small or long trailer, hooked to a car or truck.

The proposed algorithm is based on three points that need to be well positioned and a set of control loops to replicate the driving skills.



What was needed:

- OpenSceneGraph (engine and some programming knowledge)
- 3D models for the car, the caravan, the trailer and the truck
- vsTASKER with some knowledge of how to use it

- A bespoke Axle component for moving the chassis

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