

Product Requirements Document

Car Tire Rotator

Project by: The Automotive Team

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Introduction

Vehicle tires are susceptible to developing flat spots when stored for extended periods without movement, leading to costly replacements and compromised performance—especially for high-value, vintage, and luxury vehicles. Current solutions are either ineffective, inconvenient, or risk damaging suspension systems. Our product, the Automated Tire Rotator and Repositioning System, addresses this gap by combining automated tire rotation with omni-directional mobility, offering a hands-off, premium preservation solution for collectors, storage facilities, and dealerships alike.

Objectives

This project aims to design, develop, and launch a premium automated tire rotator system that prevents flat spots and enables effortless vehicle repositioning. Our primary objectives are:

1. Prevent Tire Flat Spots: Automatically rotate all four tires during storage to maintain tire integrity and extend lifespan.
2. Enable Omni-Directional Movement: Allow vehicles to be easily moved without starting the engine, improving space utilization and accessibility.
3. Provide two Stable Operating States: Support pre-engagement positioning, long-term storage with rotation.
4. Target High-Value Markets: Focus on luxury car collectors, professional storage facilities, and high-end dealerships with a premium pricing strategy.
5. Ensure Safety and Usability: Incorporate mechanical and electronic safety features, intuitive controls, and compatibility with a wide range of vehicle types, weights and different tire types.
6. Competitive Benchmarking – Match or exceed the convenience of existing solutions like Tuffiom dollies, while adding automated tire rotation functionality unavailable in competitor products.
7. Future-Proofing – Lay groundwork for future upgrades including smart monitoring, tire pressure integration, and “show mode” features for events and dealerships.

Stakeholders

- **Target Group (Users):** Classic car collectors, automotive museums, and professional storage facilities who need to prevent flat spots and reposition vehicles easily. They

would be valuing preservation, convenience, and aesthetics.

- **Target Purchasers (Buyers):**

- Individual collectors making personal investments.
- Large Institutions (museums, dealerships, storage companies) making buying for multiple vehicles.

- **Customer Service:** Must support installation questions, warranty claims, and safety concerns. Simplicity of repair and replacement is critical, given premium expectations.
- **Marketing & Sales:** Need clear, differentiated selling points these would include automation, tire preservation, and premium positioning as unique value ideas.
- **Senior Management:** Responsible for compliance with brand positioning (premium/luxury), setting R&D budgets, and ensuring the product aligns with our long-term strategic goals.
- **Retailers & Distribution Partners:** Prefer products with compact, durable packaging that withstands transport and storage. Need theft-resistant, tamper-evident packaging due to high per-unit value.
- **Regulatory Authorities:** Product must comply with relevant automotive safety, electrical, and consumer standards (CE, FCC, RoHS, UL, and equivalents in major markets).

Use Cases

User Story #1: John

John is a 60 year old who is the owner of a large storage facility in a large metropolitan city. As a result, a lot of clients store their cars with them and expect high quality services over other competitors. Additionally, John wants to keep their clients' cars in the best condition, so that they keep returning. Our product allows John to maintain customers' cars by preventing flatspots, ensuring his customers can safely drive their cars out of the building, regardless of how long they have kept their car in storage, since people don't use cars daily in this city.

Also, having the large number of customers that they do, John needs to ensure that the cars can be moved quickly and without much hassle so that customers can access their cars quickly with minimal fuss. Our product also allows for this, as it saves the headache of having to turn cars on to move them, having to manage which keys go to which car, and overall saving time when rearranging customers' vehicles.

User Story #2: Max

Max is a 28 year old who has a large collection of cars, both vintage and modern luxury vehicles, that he wants to keep in the best shape he can. Because he is trying to keep these cars in pristine condition, he does not want to drive them frequently so that their mileage on the engines can stay low, and they can maintain their resell value. Our product allows Max to prevent his cars from getting flatspots, aiding in keeping them in the best possible condition easily. This also prevents him from having to constantly buy new tires, which can get hard to find or very expensive for the vintage, rare, and luxury cars in his collection.

Max also has some cars that he uses for racing. These cars similarly need to be kept in top condition, and Max uses our product to maintain the vehicles tires so that there are no flat spots that will affect his ability to race or put him in a dangerous position as well.

User Story #3: Rosemary

Rosemary is a 50 year old dealership owner, owning multiple dealerships over the state. As a result, she has a lot of inventory and a lot of cars at these locations. Additionally, she doesn't want to have to worry about having to keep fixing these cars and tracking the work individually, especially for small maintenance and upkeep for cars. Our product allows Rosemary to keep the tires of her cars in good condition, so when people want to take them out for test drives or buy them, they are in perfect working condition. Additionally, Rosemary has to shuffle cars around constantly throughout the selling and maintenance and repair process, and using our product simplifies the hassle that moving cars can be. She additionally uses our products in show rooms to display her cars, both for ease of movement, and because customers love to see the wheels spinning in unison down the line.

Aspects

1 Product Design

The new product design will be based on that of a wheel dolly jack with improvements based on the following requirements:

- 1.1 The product shall not protrude more than 20cm from the side of the wheel rim (P1)
- 1.2 The product shall be designed in an aesthetically pleasing manner to appeal to collectors or showrooms (P1)
- 1.3 The product shall have at least one electric motor per wheel jack to allow for tire rotation (P1)
- 1.4 The product shall have 4 wheels per dolly that can be disengaged when in long term tire rotation mode (P1)
- 1.5 The width of the product must be compatible with car lifts for long term storage (P1)

2 Functionality

- 2.1 The product shall be easy to reposition to the exterior side of each car tire (P1)

- 2.2 The product shall have 3 positions (P1)
 - 2.2.1 Disengaged – car is sitting on floor and device is simply positioned around each wheel
 - 2.2.2 Repositioning – car is lifted and wheel dolly wheels are in contact with the ground, no power connection and inactive electric motors
 - 2.2.3 Tire Rotation – car is lifted and wheel dolly is sitting on structure with grips to prevent it from moving, power is connected and electric motors are active
- 2.3 The product shall accommodate different tire widths (P1)
- 2.4 The product shall have multiple rotation speeds and intervals selectable by the user (P2)
- 2.5 The product shall be powered with a 12V battery car charger (P1)
- 2.6 The product shall have an inclination sensor to prevent activation of the repositioning mode if the car is situated on an incline of more than 3° (P2)

3 Interactivity & Intelligence

- 3.1 The product shall not require more than 300N of force to change the position (P1)
- 3.2 The product shall be easy to connect to power when in the tire rotation position (P1)
- 3.3 The product shall detect overloading conditions caused by the car being left in park and automatically shut off the motors to prevent damaging the motors. (P1)
- 3.4 The product shall provide real time updates on its status through the use of a mobile app.(P3)
- 3.5 The product shall provide real time updates on the condition of the tires including wear and pressure.(P3)
- 3.6 The product shall provide predictive maintenance suggestions based on its use. (P3)

4 Customization

- 4.1 The product shall be able to accommodate wheels 17"-22" in diameter and 7"-11" in width.(P1)
- 4.2 The product shall come in a variety of colors and finishes. (P2)
- 4.3 The product shall support a variety of add-on accessories such as sensors. (P2)
- 4.4 The product shall allow the user to adjust the speed of the rotation based on conditions. (P2)

5 Manufacturing

- 5.1 The total cost to manufacture the product shall be below \$750. (P1)
- 5.2 Parts must be mass producible in batches of 500 parts. (P1)
- 5.3 The product shall be designed to be assembled in under 1 hour. (P1)
- 5.4 The design shall minimize the number of unique parts. (P1)
- 5.5 Critical joints and fasteners shall be easily accessible for quality control and testing. (P1)
- 5.6 The product shall use standardized fasteners and connectors whenever possible. (P1)

5.7 The different parts of the product shall be modular to allow for easy repair.
(P2)

6 Regulations and Safety

- 6.1 The product shall comply with OSHA safety standards for rotating devices.
(P1)
- 6.2 The product shall pass vibration and load testing for industrial use. (P1)
- 6.3 The product shall operate between 0°F and 120°F. (P2)
- 6.4 The product shall meet CE and UL safety standards. (P1)
- 6.5 The product shall have appropriate safety features to prevent entanglement and pinch hazards. (P1).
- 6.6 The product shall comply with FCC/EMC standards for wireless communication. (P2)
- 6.7 The product shall be tested for resistance to common automotive fluids (oil, coolant, brake fluid) to prevent safety hazards. (P1)

Open Questions

- Can we improve on product weight to be able to handle larger vehicles like buses or RVs?
- Can we make a model that is self-sustaining for use outdoors and in inclement weather?
- Can we implement any form of antitheft?
- Is there an easier way for the jacks to be engaged with the car to ensure older customers are able to use our product with less difficulty?
- What kind of pivots can we make in case early user evaluations prove the product undesirable?

Milestones

Plan Finalized: 10/15/2025

Preliminary Design Completed: 10/29/2025

Design freeze: 11/26/2025

All Documents Completed: 12/10/2025

Appendix:

A. Explanation of Priority

- a. Under aspects, the priority scale used to rank the most and least important features for our product are structured such that a priority 1 (P1) rated aspect is an aspect of the highest priority, and a priority 10 (P10) aspect is of the least importance to us.