OTW (On The Way)
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Design Philosophy

1. Modularity First:
    - The component and chassis layout were planned with modularity in consideration.
    - A pre-planned grid of holes on the chassis was initially envisioned for installing fixed ultrasonic sensors at various angles.
    - This module's hole pattern is compatible with future upgrades, bracket relocation, or added hardware (e.g., IR sensors, additional cameras).
    - Independent power systems (motors on 12V, logic on 5V USB) increase modularity and system robustness.
2. Efficiency over Excess:
    - Motors and materials were chosen to maximise power consumption without sacrificing performance.
    - Lightweight PLA frame reduces motor load and enhances battery life.
    - Mid-RPM, high-torque gear motors provide a balance of speed and control.
3. Redundant Environmental Awareness:
    - Fixed positions for ultrasonic sensors in the original design using the chassis mounting holes.
    - In testing, blind spots in front detection became a critical problem.
    - As a reaction, a single ultrasonic sensor was moved onto a micro servo (FS90) to provide sweeping movement, significantly increasing front obstacle coverage.
    - This modification enabled the system to dynamically adjust to environmental complexity — a practical example of responsive design thinking.
4. Sensor Fusion and Intelligent Response:
    - Multiple sensor types (vision and ultrasonic) are blended to produce a wiser navigation system.
    - The sweeping ultrasonic sensor handles close-range obstacle detection, while the Huskylens AI camera processes visual data such as lanes or objects.
    - Movement choices are based on overlap and confidence, not binary triggers alone.
5. Built for Reliability and Competition:
    - Hardware is resilient and available for field repair or quick modification.
    - Wiring is neatly organised through chassis openings, diminishing interference or disconnections.

- Mounts are also supported by straightforward, heavy-duty materials such as popsicle sticks and brass screws.
- The design emphasises clarity, longevity, and simplicity of inspection for judges and technicians.

Overall, this self-driving car was engineered with a focus on modularity, efficiency, and intelligent navigation. Every design choice- from the use of lightweight 3D-printed materials to the integration of servo-mounted sensors- has been influenced by the necessity of performing reliably within the constraints of a robotics competition's voltage and size limitations. Strategically placed mounting holes allowed flexible sensor arrangements that proved pivotal when they needed to adapt for blind spots during testing. To address this, the team evolved by introducing a sweeping ultrasonic system, significantly improving the detection of obstacles. Combined with a solid sensor fusion and a distinct power system separation for safety and reliability, this design addresses the requirements of autonomous navigation and offers field-capable hardness and flexibility. It demonstrates careful equilibrium between engineering accuracy and world championship competition restrictions.