Low-Cost L5 Autonomous Driving System

This white paper outlines a fully functional, true Level 5 autonomous driving system capable of full-domain adaptation at a cost lower than half of current industry solutions. The system requires only the following hardware:

1. Two standard cameras (left and right) to calculate depth and simulate binocular vision.
2. One infrared camera to detect biological heat signatures and determine object viability (i.e., living or not) for collision avoidance.
3. LLM module to learn and interpret traffic regulations dynamically.
4. AI model to predict collision impact and calculate safe trajectories.

Optional modules for full demonstration:

- Transparency and reflectivity sensors for visibility adaptation.
- Infrared motion detection for object movement analysis.
- Audio sensors to determine sound direction and distance.
- Redundancy mechanisms and startup error tolerance.

This system is designed to be mounted on existing gasoline vehicles without requiring specialized electric platforms. The compact structure, affordability, and modularity make it ideal for rapid deployment.

Complementary code for basic visual preprocessing and hazard reasoning is available and ready to integrate.

This project demonstrates the feasibility of democratizing autonomous driving while maximizing safety and minimizing operational costs.

AI-Centric Modules in the L5 Autonomous Driving System

1. Visual Depth Estimation via AI Preprocessing Module

- Function: Calculates real-time depth using stereo vision (two standard cameras).
- Core AI Role:
  - Deconstructs image into 50×50 weighted sub-grids
  - Separates RGB and luminance channels
  - Outputs normalized JSON data for depth computation
- Significance: Enables accurate spatial awareness with extremely low hardware cost.

2. Infrared Motion & Lifeform Detection

- Function: Uses a single infrared camera to detect heat sources.
- Core AI Role:
  - Differentiates between stationary vs. moving heat signatures
  - Applies lifeform probability thresholds
  - Classifies objects as 'collision-permitted' or 'collision-forbidden'
- Significance: Adds bio-safety layer, mimicking instinctual predator-prey logic via AI.

3. Collision Impact Prediction and Safe Path Selection

- Function: Estimates potential collision impact for each object.
- Core AI Role:
  - Integrates transparency, object volume, infrared motion speed
  - Calculates collision force and risk per target
  - Dynamically selects the path with least threat to in-vehicle lives
- Significance: First AI system to approximate ethical judgment through physical estimation.