SmartDrive: A Leap Toward Intelligent Mobility

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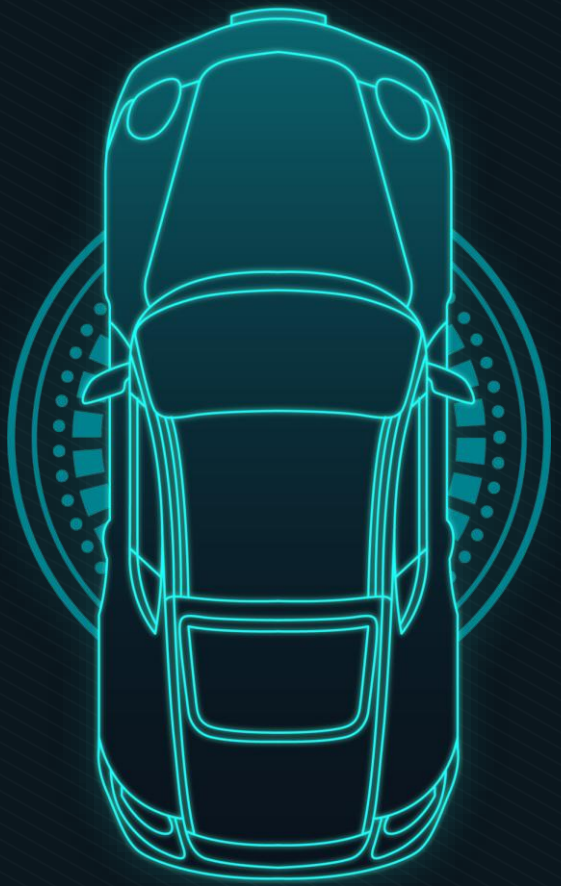
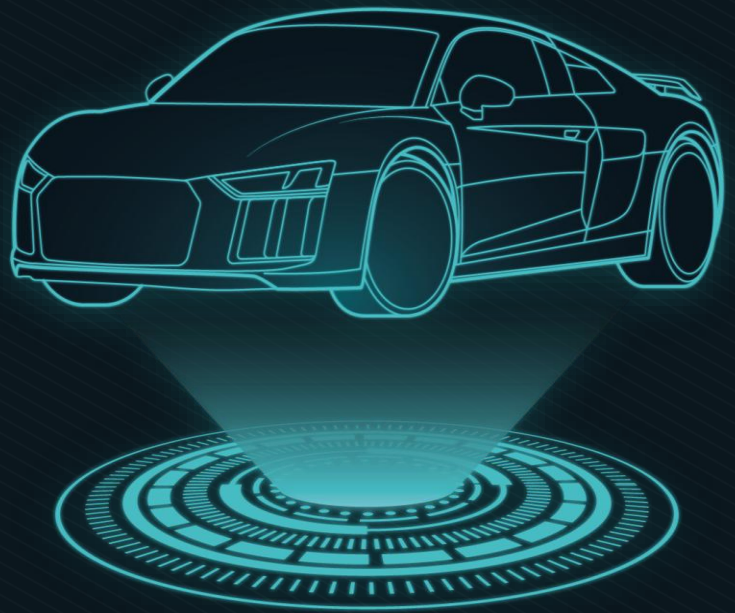


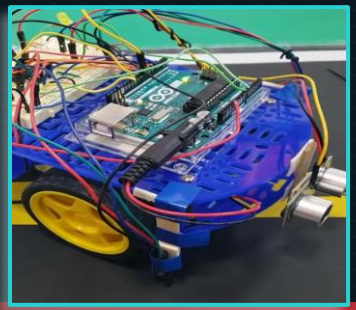
INTRODUCTION AND INSPIRATION

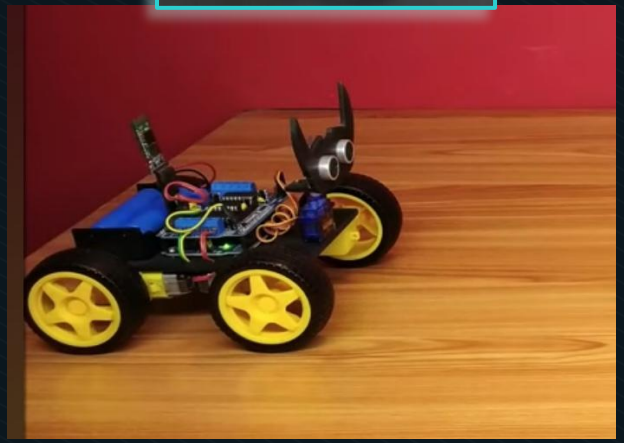
The rise of autonomous cars inspired my childhood dream of creating my self-driving vehicle. When Elon Musk launched the first Tesla Roadster in 2008, I was captivated and envious, sparking my fascination. Tesla's seamless hardware-software integration and features like ultrasonic sensors influenced me profoundly. Innovations by brands like Xpeng and NIO, including Facial Recognition and Autonomous Valet Parking, further motivated me to build an autonomous car with autosteer, smart turning, and automatic speed adjustment.



Design Insights

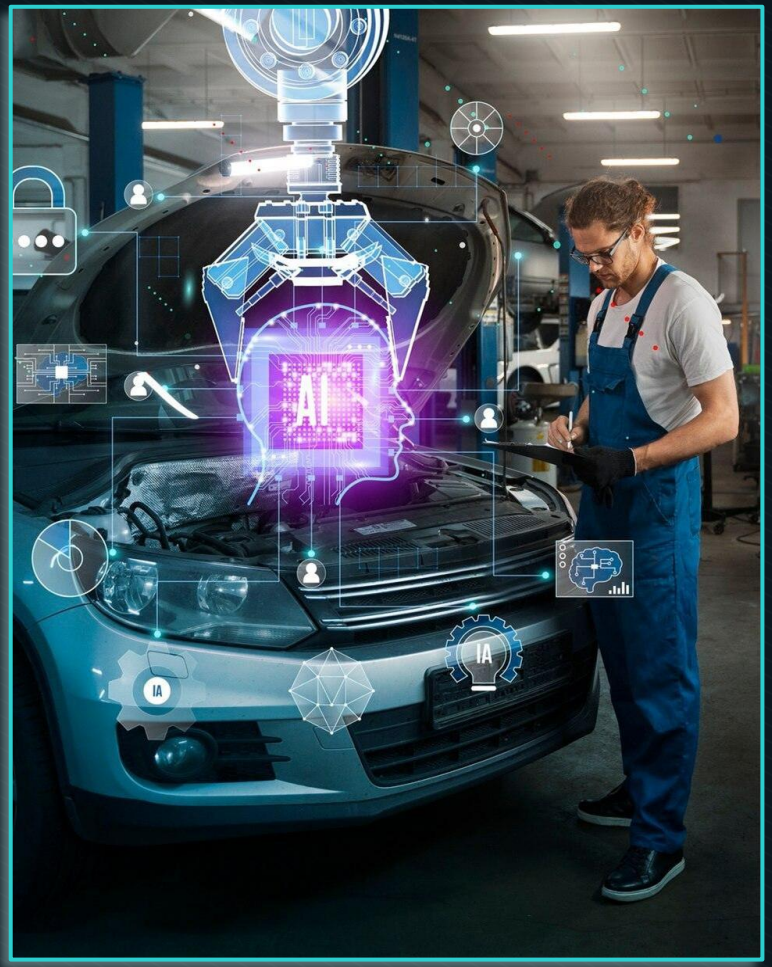
Designing an autonomous car seemed simple at first, but the challenges quickly became clear. I aimed for a realistic prototype with three ultrasonic sensors angled at 45 degrees to reduce blind spots. To optimize space, I divided the car into two parts: the front for steering with a servo motor and the back for transmission and the microcontroller, connected via a compact chassis. Smaller front wheels improved the turning radius and avoided sensor interference during turns.





Development Stages

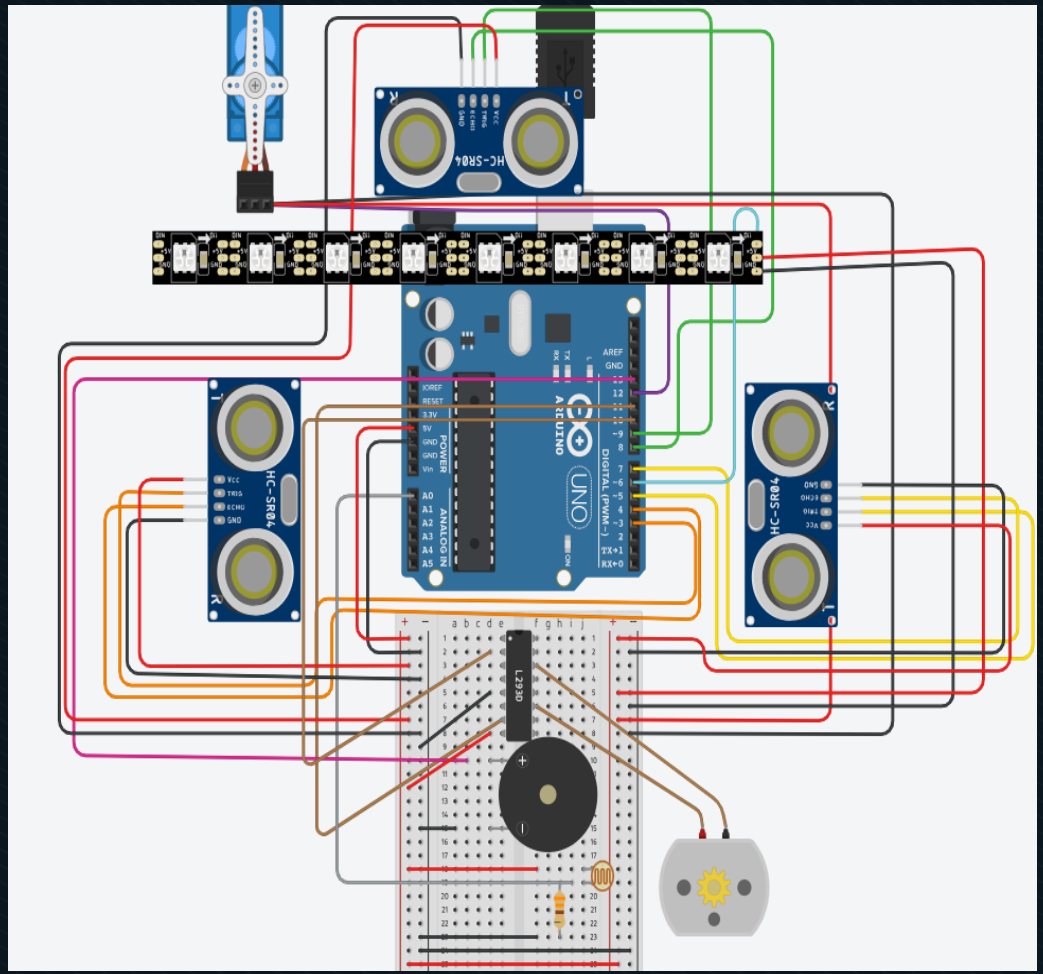
1. Circuit design & simulation in TinkerCad.
2. Prototype creation to hold components and wiring.
3. Training the car for real-life scenarios based on sensor inputs.
4. Testing, debugging, and enhancing accuracy by adjusting to environmental conditions.



Technical detail

Components

- 3 Ultrasonic Module
- Power Module for breadboard
- TA6586 motor driver
- Arduino UNO R4 Wifi
- Speaker and RGB Strip
- Photoresistor
- Jumper wires
- DC motor and Servo motor



Functionality & Features

Auto-brightness

“This adjusts the car's LED lights based on surrounding light levels, ensuring optimal brightness. This feature enhances energy efficiency and reduces power consumption. ”

Auto-steer

“It features auto-steering based on object distance, ensuring collision avoidance and autonomy. ”

Smart-turning

“When blocked, it measures left and right sensor distances, navigating the clearer path. If equal, it randomly chooses a direction, showcasing smart turning.”

Speed - Adjustments

“Speed adjusts based on turning, decision-making, and object proximity. A starter function activates at zero speed to ensure optimal torque for movement. ”

Interactive - lighting

“The LED lights sync with steering direction, enhancing visibility and ensuring safer roads”

Safety & Warning

“A key safety feature is that if the car is blocked on all sides, it halts movement. The LEDs turn red, and a constant beeping sound warns the user of the obstruction. ”

Challenges and Solutions

Compact Design:

“Adjusted components and wiring inside a minimal prototype.”

Steering Mechanism:

“Failed with my custom design due to insufficient turning radius. Required patience and effort to fit all electronics efficiently.”

Motor Issues:

“DC motor (3.3V–12V, 4500 rpm) caused excessive speed for the lightweight car. Implemented software coding techniques for speed control across landscapes. Numerous trials helped discover optimal speed settings”

Future improvements:

Increased Precision:

Use additional ultrasonic sensors to detect road dips and ditches, avoiding free fall.

Adaptive Speed Control:

Add a friction measurement sensor to adjust speed based on road conditions.

Enhanced Turning Radius:

Improve the turning radius mechanism for better stability during sharp turns.

Advanced Parking Features:

Develop algorithms for reverse and parallel parking after hardware updates like omnidirectional wheels.

THANKS

SUGNAY PATEL

All questions are encouraged and warmly welcomed!

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