Traction Control Car

“The first project encountered during university studies & the second prize at the school level”

Design Requirements

★ **Project Objective：** Design and construct a line-following car capable of autonomously navigating a designated track, including straight sections, curves, and obstacle avoidance. The project evaluates students' skills in engineering design, mechanical fabrication, electronic control, programming, and teamwork.

★ **Vehicle Design Requirements：**

1.The car's mechanical structure must be independently designed and manufactured, including chassis, wheel system, and body frame.

2.The vehicle should be equipped with sensors (e.g., infrared or photoelectric sensors) for line detection and obstacle sensing.

3.The control system should be implemented on a microcontroller or embedded platform, capable of processing sensor signals and controlling the car for autonomous line-following.

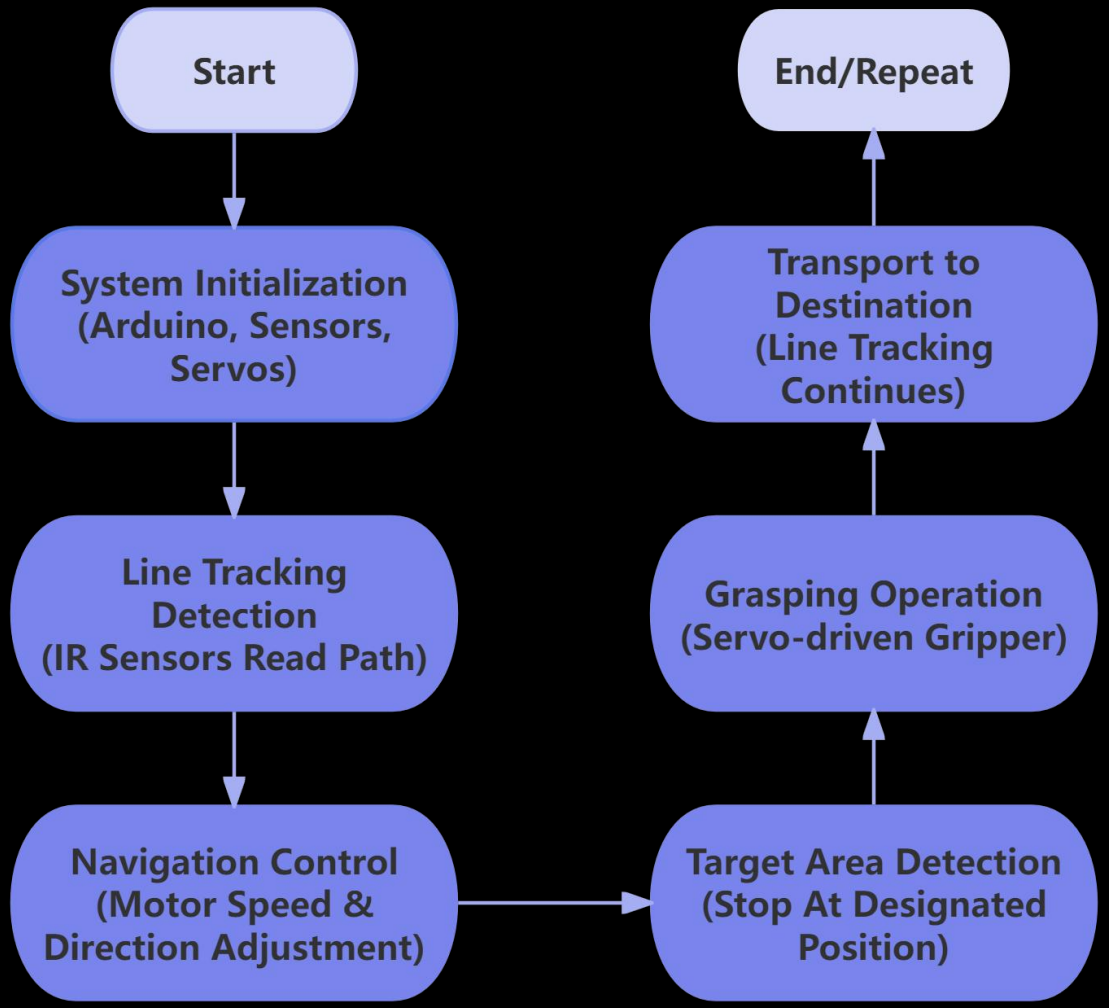
★ **Test Track and Tasks：**

1.The track consists of straight sections, curves, and obstacle zones, approximately 3–5 meters in total length.

2.The car must complete the entire track autonomously, optimizing for speed and stability.

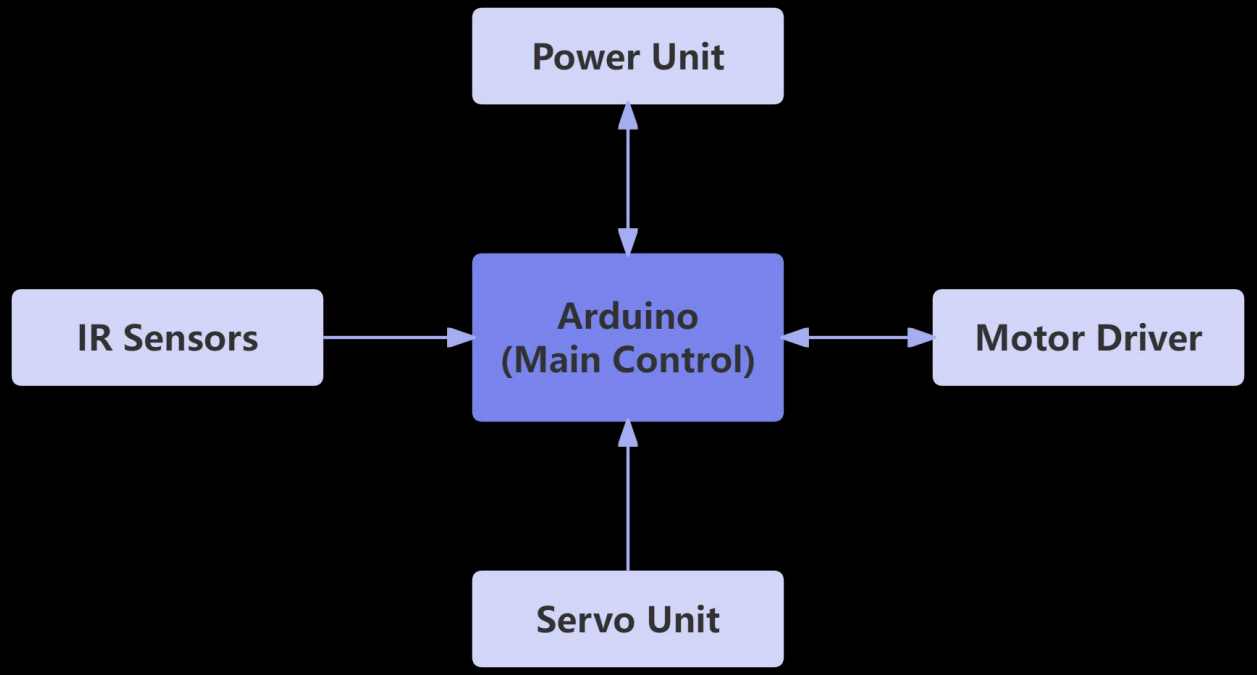
3.Manual placement of the car at the starting point is allowed, but the car must run automatically throughout without manual intervention.

System Flowchart



The system initializes all hardware modules and performs line tracking using infrared sensors. Navigation is achieved through motor control based on path detection. Upon reaching the target location, the servo-driven gripper executes object grasping, transportation, and release to complete the logistics task.

System Flowchart



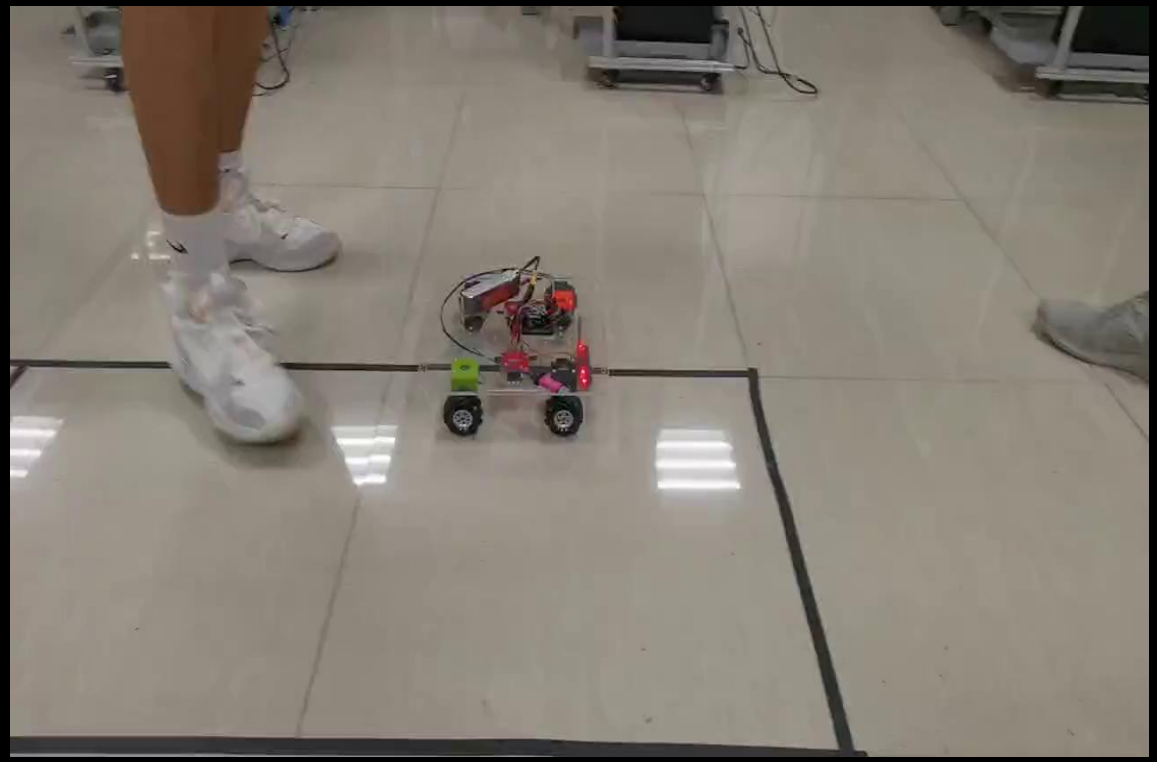
The system is centered on an Arduino microcontroller, which integrates infrared line-tracking sensors for navigation, motor drivers for chassis control, and servo units for object grasping. A dedicated power module supplies stable energy to all components.

Some Records

The vehicle is built on a 20 cm × 20 cm transparent acrylic base with a thickness of 3 mm, providing sufficient structural rigidity while allowing clear observation of internal components. Four caster wheels are mounted at the corners of the base to support the vehicle and enhance stability and maneuverability during motion.

A robotic arm module is installed above the base, with a bearing-supported joint serving as the rotational foundation. The arm is actuated by four servo motors, enabling multi-degree-of-freedom motion. The end-effector consists of two vertically staggered arc-shaped gripper claws, allowing stable grasping of objects with varying shapes. The overall mechanical design is compact and well-organized, facilitating system integration and debugging.

Some Records



During the line-following test, the vehicle is able to move forward smoothly along the black guide line on the ground, demonstrating stable motion and reliable performance on straight paths. However, when encountering curved sections, the increased path curvature reduces the accuracy of line detection, causing the vehicle to deviate from the intended trajectory. The turning performance therefore requires further improvement.