Executive Summary- Flat Exploration Robot

1. Requirement specifications

Requirement	Specification	Instructions
Maximum payload	2.5 kg	Designed for 2.5kg. However, in the actual construction, it can carry slightly heavier loads (3kg) to increase some flexibility.
Body weight	2 kg	Most of that weight comes from the battery and drive system.
Maximum speed	0.7 m/s	Ensure fast and safe movement in crowded environments.
Ground clearance	3 cm	Enough to avoid the edges of small obstructions such as wires or carpets.
Minimum continuous operation time	4 hours	Use larger capacity batteries or fast charging technology to increase the working time of the robot.
Drive configuration	Differential drive	Simple and flexible enough for a robot of this size.
Shape of chassis	The square has four corners cut off	Avoid collision between four protruding right angles and obstacles.
Size of chassis	200x200x7 mm	Stable and provides enough space for all components.
Navigation and obstacle avoidance	Ultrasound and camera	Use ultrasound and cameras to detect and avoid obstacles.
Size of the robot	266x200x114 mm	The overall shape of the robot is flat.

2. Robot design and model

Figure 1 shows the robot modeled in Solidworks. The car has a total of two layers, there is enough space to place the required components, the middle can be placed battery, drive, development board and other important components, the upper layer in addition to the camera can also be installed Lidar and other sensors for detecting obstacles, according to the needs of the task can also be installed such as temperature sensors, smoke sensors and other components. As for the parts design of the car, the drawing includes the chassis, wheels, motors, universal wheels, ultrasonic sensors and cameras. A detailed description and explanation of each part is included in the appendix.

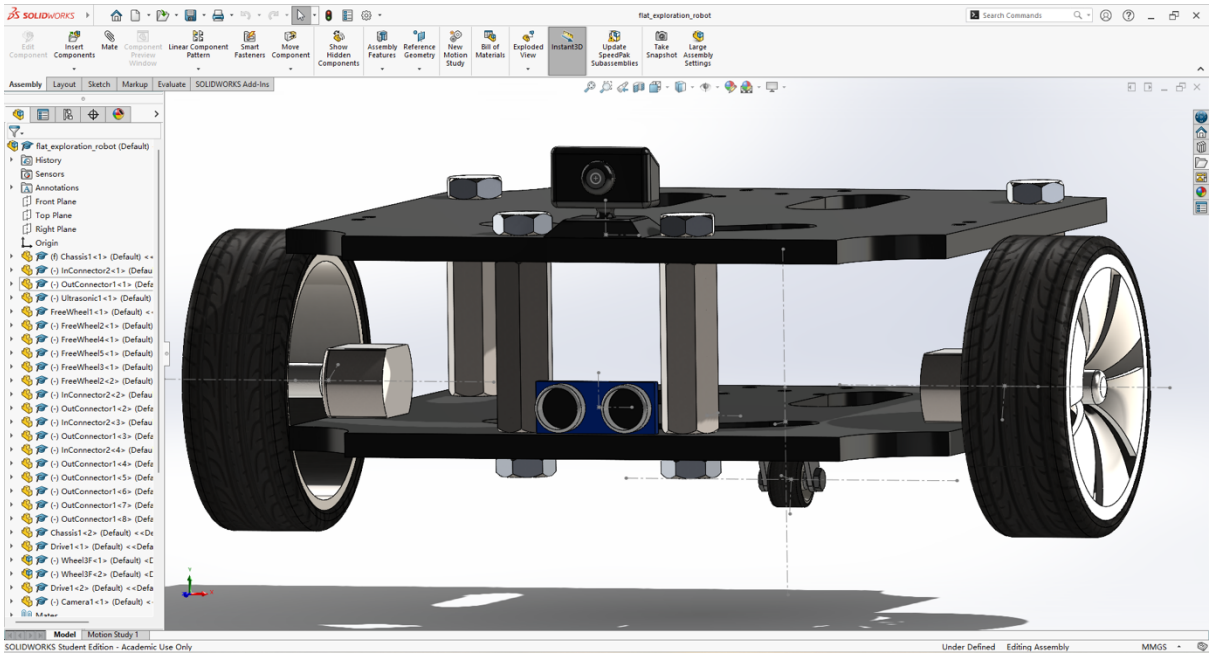

Figure 1. Flat exploration robot

3. Discussion and reflection design and model

The overall design of the robot is flat, small volume and low center of gravity are conducive to the stability of the robot operation, three wheels can ensure the smooth operation of the car, the choice of differential drive makes the small robot can move simply and flexibly in a crowded environment. The two-story design provides ample space for the required components, and ultrasound and cameras are designed to allow the robot to safely navigate, explore and identify objects in an indoor environment. In addition, it is also considered to install infrared sensors on the bottom layer and lidar on the top layer to allow the robot to achieve more accurate autonomous navigation and detection tasks. If operating in a relatively flat indoor environment, the design of 3 cm off the ground of the car chassis is sufficient, but if there are other obstacles in addition to small obstacles such as wires, consider raising the ground clearance to more than 5 cm.

4. Conclusion

When designing and deploying robots for rescue missions, thinking through ethical, social and economic perspectives is imperative. From an ethical point of view, it is important to ensure that the robot's operation does not endanger any individual, and that the robot's behaviour is consistent with the ethical standards of the human rescuer. This requires that our design must have a high degree of reliability and accuracy to avoid accidental damage. From a societal perspective, the deployment of robots can greatly accelerate rescue missions, reduce the risk to human rescuers, and provide them with strong support in the event of a disaster. There is also a need to ensure transparency to increase public trust in these robots and understand their operations' purposes and limitations. Finally, from an economic point of view, the use of robots can greatly reduce the cost of rescue missions, especially in high-risk environments, reducing casualties and other related economic losses. In conclusion, designing and deploying rescue robots requires balancing and trade-offs on multiple fronts to ensure that robots can deliver the greatest benefits to humans.