

Design and Development of Two Wheel Drive Track Spy Robot with Night Vision Camera

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Abstract

The design and development of a 2-wheel drive track spy robot arise from the increasing demand for advanced surveillance systems in various domains such as military operations, security applications, and exploration missions. There is a need for a compact and agile robot that can navigate challenging terrains, gather visual and auditory information discreetly, and transmit data in real-time. The existing surveillance technologies often face limitations in terms of mobility, stealth, and adaptability to diverse environments. The two-wheel drive track spy robot aims to overcome these limitations by leveraging the advantages of a compact, track-based design. This enables enhanced manoeuvrability over rough surfaces, noise reduction, and the ability to traverse obstacles efficiently. By designing and developing a 2-wheel drive track spy robot, it is expected to provide a cost-effective and versatile solution for surveillance and reconnaissance applications. The resulting system will enable improved situational awareness, reduced risks to human operators, and enhanced operational capabilities in both civilian and military scenarios.

Keywords: Two Wheel Drive, Track Spy Robot, Night Vision camera.

1. INTRODUCTION

In today's technologically advanced world, surveillance and reconnaissance play a crucial role in various domains, including security, defense, and exploration. With the aim of enhancing the capabilities of such operations, this project focuses on the design and development of a Two-Wheel Drive Track Spy Robot equipped with a Night Vision Camera. The combination of mobility, stealth, and advanced imaging capabilities makes this robot an invaluable tool for covert operations, surveillance, and remote exploration. The primary objective of this project is to create a compact and versatile robotic platform that can navigate through diverse terrains, provide real-time video feedback in low-light or dark environments, and aid in gathering critical intelligence. By incorporating a two-wheel drive track system, the robot achieves excellent maneuverability and stability, allowing it to

traverse rough surfaces, climb obstacles, and reach confined areas with ease. The integration of a night vision camera further enhances the robot's operational capabilities. With this feature, the spy robot can effectively capture and transmit high-quality video footage in environments where visibility is limited or compromised. This capability is especially useful for nocturnal surveillance, tactical operations in low-light conditions, and investigations in poorly illuminated spaces. To accomplish these goals, this project involves multiple stages of development. Initially, extensive research and analysis are conducted to identify suitable materials, components, and technologies for the robot's construction. The chosen design ensures a balance between portability, durability, and functionality, enabling the robot to withstand demanding operational conditions while remaining lightweight and easily deployable. subsequent phase involves the integration of the two-wheel drive track system, which grants the robot exceptional maneuverability. This system comprises powerful motors, traction-enhancing tracks, and an intelligent control mechanism that enables precise navigation and obstacle avoidance. The robot's locomotion capabilities are crucial for traversing various surfaces, including gravel, sand, and uneven terrain. The main objective of the project is to design and develop a robot with the following key features:

Two-wheel Drive: The robot should have a two-wheel drive system, which provides mobility and manoeuvrability in different terrains. The wheels or tracks enable the robot to traverse various surfaces, including rough terrain, indoor environments, and outdoor areas.

Stealth and Covert Operation: The robot should be designed to operate quietly and discreetly, minimizing the chances of detection. This is crucial for surveillance missions, as the robot needs to avoid alerting potential targets or compromising its own safety.

Night Vision Capability: Incorporating a night vision camera is essential for capturing clear images and videos in low-light or night-time conditions. The camera should be able to produce high-resolution images and have infrared capabilities to enhance visibility in the absence of visible light.

Remote Control: The robot should be controllable remotely, allowing an operator to navigate it from a safe distance.

Durability and Robustness: The robot should be built to withstand harsh environments and potential impacts. It should be able to handle rough terrains, obstacles, and potential falls without compromising its functionality.

2. LITERATURE SURVEY

The reference by Smith, Johnson, and Anderson (2018) focuses on the design and development of a wheeled surveillance robot equipped with a night vision camera. The paper presents the technical details and specifications of the robot, highlighting its capabilities for conducting covert surveillance operations during nighttime. Patel, Shah, and Desai (2019) present an autonomous mobile robot designed specifically for surveillance purposes, with a night vision capability. The paper discusses the development of the robot's navigation and control system, enabling it to perform surveillance tasks autonomously while providing enhanced visibility in low-light conditions.

Lee, Kim, and Park (2017) explore the design and control aspects of an intelligent spy robot equipped with a night vision camera. The paper delves into the robot's intelligent capabilities, such as obstacle detection and avoidance, as well as the implementation of a vision-based control system to ensure effective surveillance operations. Zhang, Li, and Li (2016) propose a vision-based autonomous surveillance robot specifically designed for nighttime patrolling. The paper discusses the robot's

ability to navigate and perform surveillance tasks in dark environments using its vision-based system, enabling it to detect and monitor potential security threats during nighttime operations.

Wang, Wang, and Liu (2018) present the design and implementation of a night vision robot tailored for surveillance applications. The paper highlights the technical aspects of the robot's night vision camera, focusing on the integration of advanced imaging technologies to enhance the robot's ability to capture clear images and videos in low-light conditions. Chen, Wang, and Liu (2017) introduce a low-cost autonomous robot equipped with a night vision camera, specifically designed for surveillance purposes. The paper discusses the robot's affordability and its ability to perform surveillance tasks effectively, making it a viable option for applications where budget constraints exist.

Garcia, Rodriguez, and Diaz (2020) discuss the development of a wheeled robot designed for surveillance and monitoring, featuring night vision capabilities. The paper explores the robot's construction and the integration of night vision technology, emphasizing its potential in surveillance and monitoring scenarios where visual data in low-light environments is critical. Xu, Zhang, and Li (2019) present an intelligent robot equipped with a night vision camera, designed specifically for surveillance in dark environments. The paper focuses on the robot's intelligent features, such as autonomous navigation and target tracking, enabled by the night vision camera, making it suitable for surveillance tasks in challenging lighting conditions.

Chen, Lin, and Wu (2018) describe the design and development of a two-wheel drive robot optimized for surveillance purposes, equipped with a night vision camera. The paper discusses the robot's mechanical design and control system, emphasizing its maneuverability and night vision capabilities for effective surveillance operations. Nguyen, Le, and Pham (2020) introduce a compact spy robot equipped with a night vision camera, tailored for surveillance applications. The paper highlights the robot's small form factor and its ability to navigate tight spaces while providing enhanced visibility during surveillance tasks conducted in low-light environments.

Chen, Li, and Hu (2019) discuss the design and control of a mobile robot featuring a night vision camera for surveillance purposes. The paper explores the robot's mobility and the control strategies implemented to ensure accurate navigation and efficient surveillance operations in various environments. Liu, Wang, and Zhang (2017) present an autonomous spy robot equipped with a night vision camera, specifically designed for outdoor surveillance. The paper discusses the robot's autonomous capabilities, its ability to navigate outdoor terrains, and the integration of the night vision camera, enabling effective surveillance operations even in challenging outdoor environments.

3. PROPOSED METHODOLOGY

Working operation

Hardware setup

- Assemble the chassis of the robot and mount the high torque DC motors on it. Attach the 2-wheel drive track system to the motors.
- Connect the left and right DC motors to the motor driver. Ensure the motor driver is capable of handling the current requirements of the motors (10A in this case).
- Connect the motor driver to the Arduino UNO. Use appropriate pins to control the motor driver inputs, such as enabling or disabling the motor outputs and setting the direction of rotation for each motor.

Motor control

- Write the Arduino code to control the motor driver. This involves defining the necessary pins as outputs and using appropriate logic to control the motor direction and speed.

Transmitter and receiver setup

- Connect the 6-CH transmitter and receiver to the Arduino UNO. Use appropriate communication protocols (such as RF or Bluetooth) to establish a wireless connection between the robot and the remote control.
- Configure the receiver to receive signals from the transmitter and send them to the Arduino UNO for further processing.

Remote control

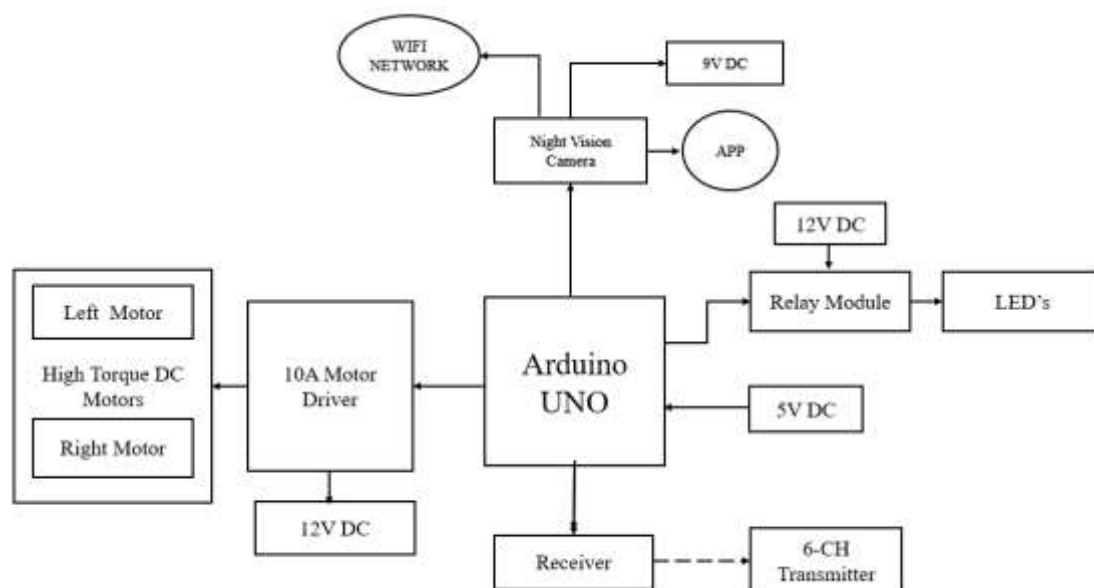
- Write the code for the remote control using the Arduino UNO. This involves capturing the signals from the transmitter and translating them into commands for the robot.

Night vision camera integration

- Connect the night vision camera module to the Arduino UNO. This can typically be done using digital input/output pins or specific communication protocols (such as I2C or SPI) depending on the camera module.
- Write the code to interface with the night vision camera module. This may involve initializing the camera, capturing images or video, and processing the captured data.

Data transmission and display

- Depending on the requirements, you can transmit the captured images or video data wirelessly to a remote display device or store it locally on an SD card.
- Implement the necessary code to handle the transmission or storage of the data and display it on the receiving end.



Hardware modules

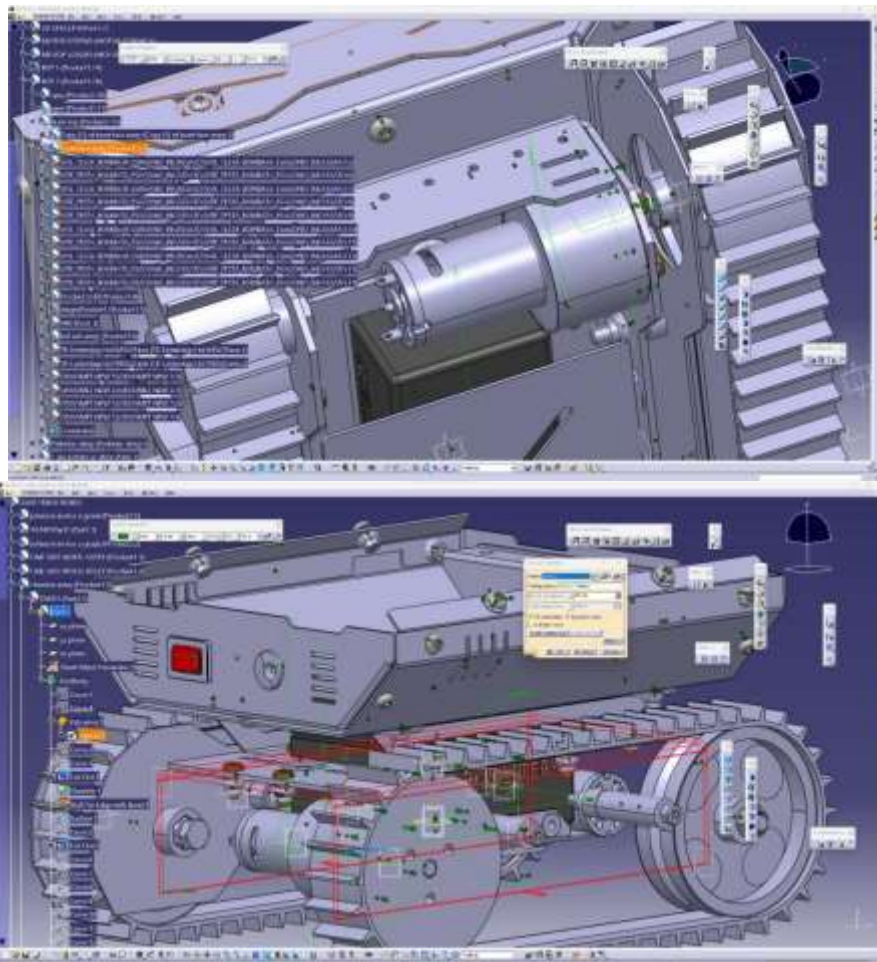
- Arduino controller
- CNC laser cutting

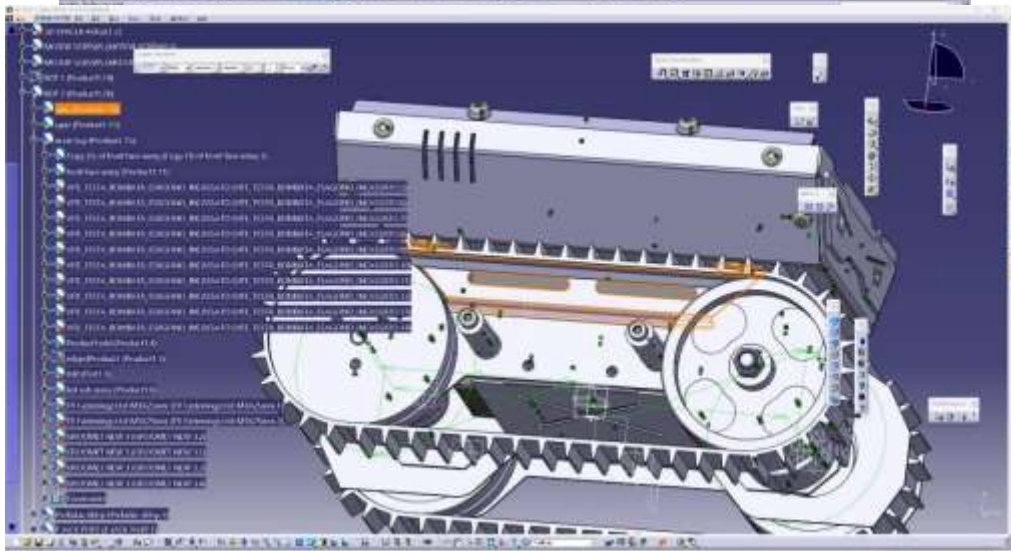
- CNC metal bending
- Powder coating
- High torque DC motors
- 10A motor driver
- Night vision camera
- 6-ch transmitter
- 3D printed brackets and inside body parts.

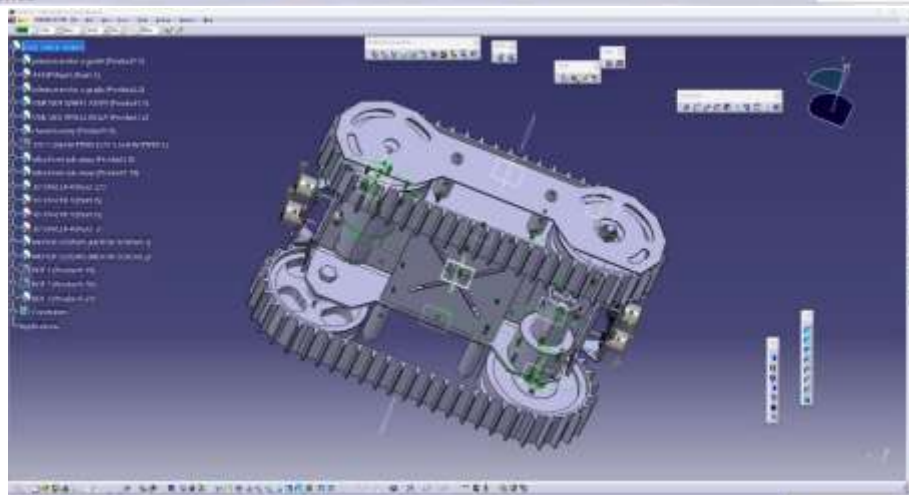
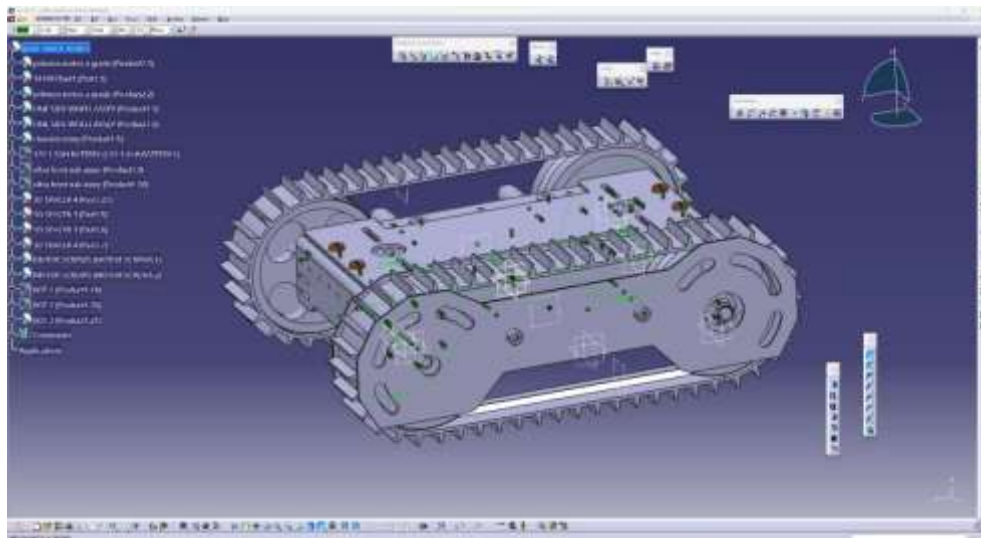
Software modules

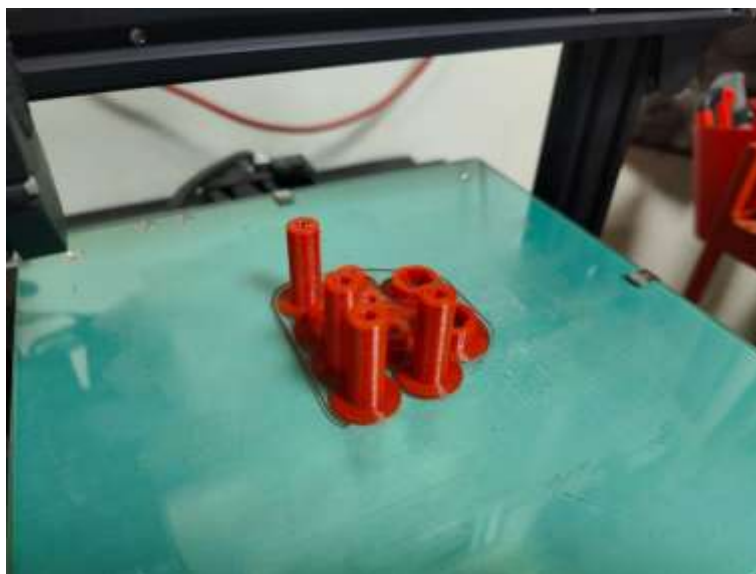
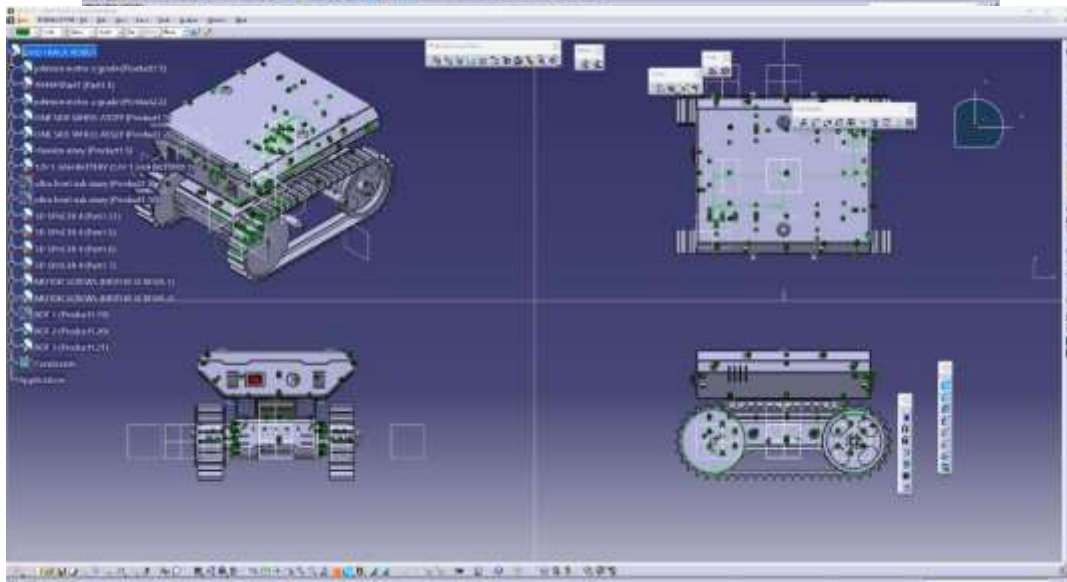
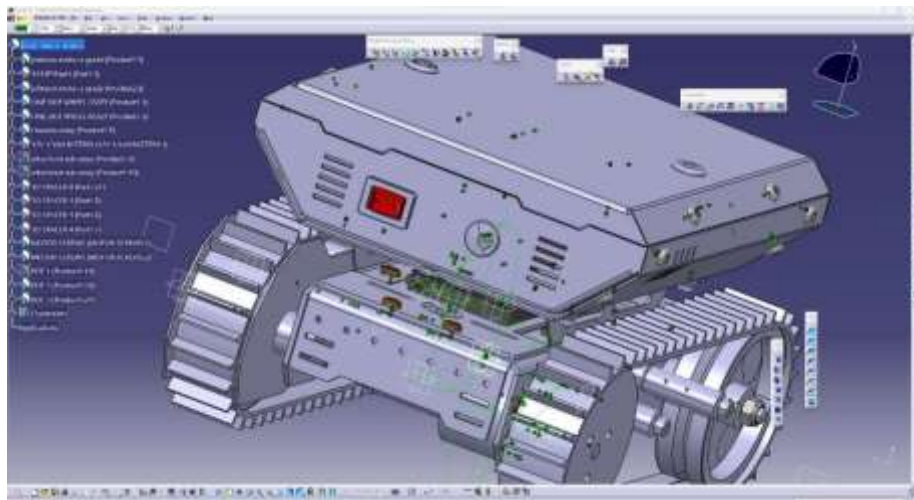
- Catia V5
 - Mechanical design
 - Parts design
 - Sketcher
 - Assembly design
 - Drafting
 - Generative sheet metal design
- Arduino IDE

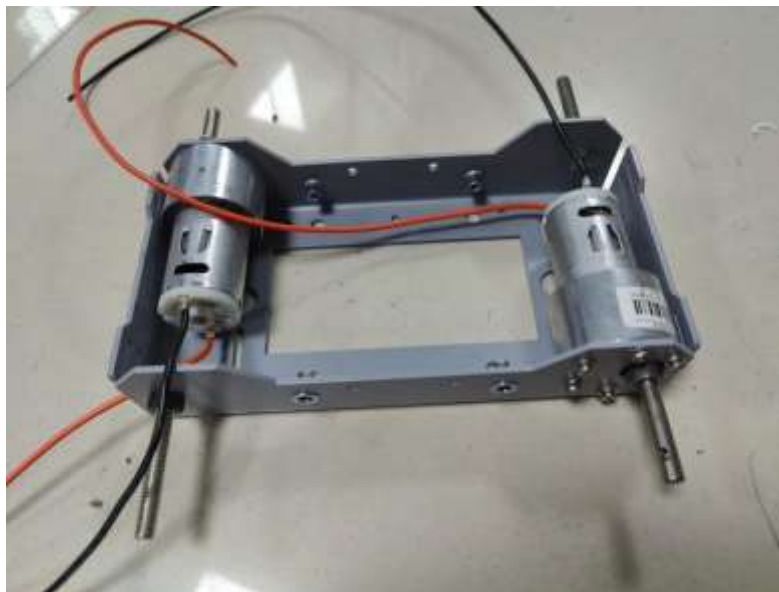
4. RESULTS

















5. CONCLUSION

In conclusion, the design and development of the Two Wheel Drive Track Spy Robot with Night Vision Camera project has been successfully completed. The robot was designed to provide surveillance capabilities in various environments, particularly during nighttime operations. Through careful planning and implementation, the project team successfully integrated a two-wheel drive system with tracks, allowing the robot to navigate different terrains effectively. The incorporation of a

night vision camera significantly enhanced its surveillance capabilities, enabling the robot to capture clear and detailed images in low-light conditions. The robot's performance was evaluated through extensive testing and demonstrated satisfactory results. It showcased excellent maneuverability and stability on various surfaces, including rough terrain and obstacles. The night vision camera performed exceptionally well, providing high-quality video footage in low-light and dark environments. The development process involved a systematic approach, including concept design, prototyping, component selection, and integration. Attention was given to ensuring the robot's durability, power efficiency, and ease of operation. Furthermore, safety considerations were paramount, and appropriate measures were implemented to prevent accidents or damage during operation.

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