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Robotics and Industrial Automation

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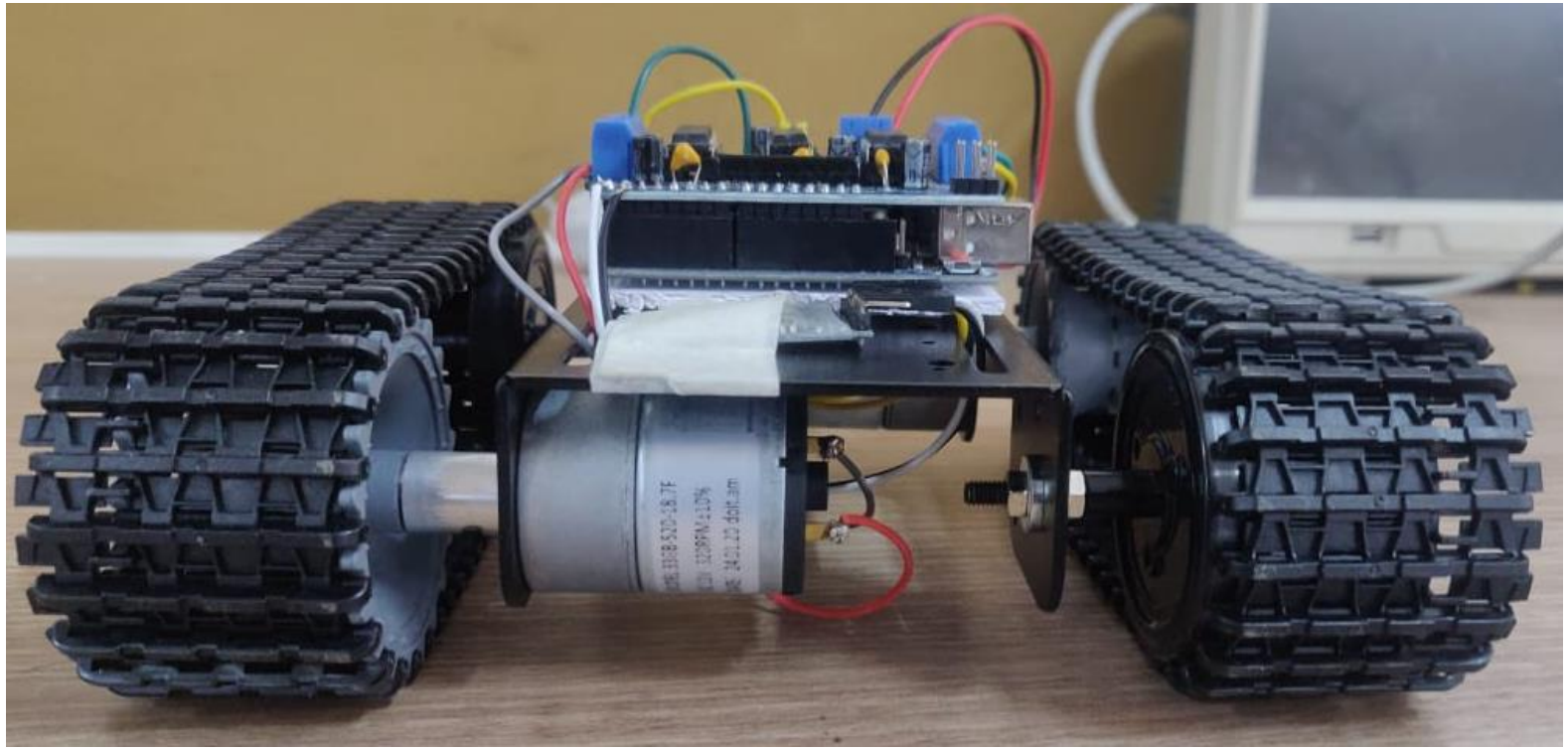
T.A.R.G.E.T
Tracking And Remote Guided Engagement Tank



Picture of tank chassis

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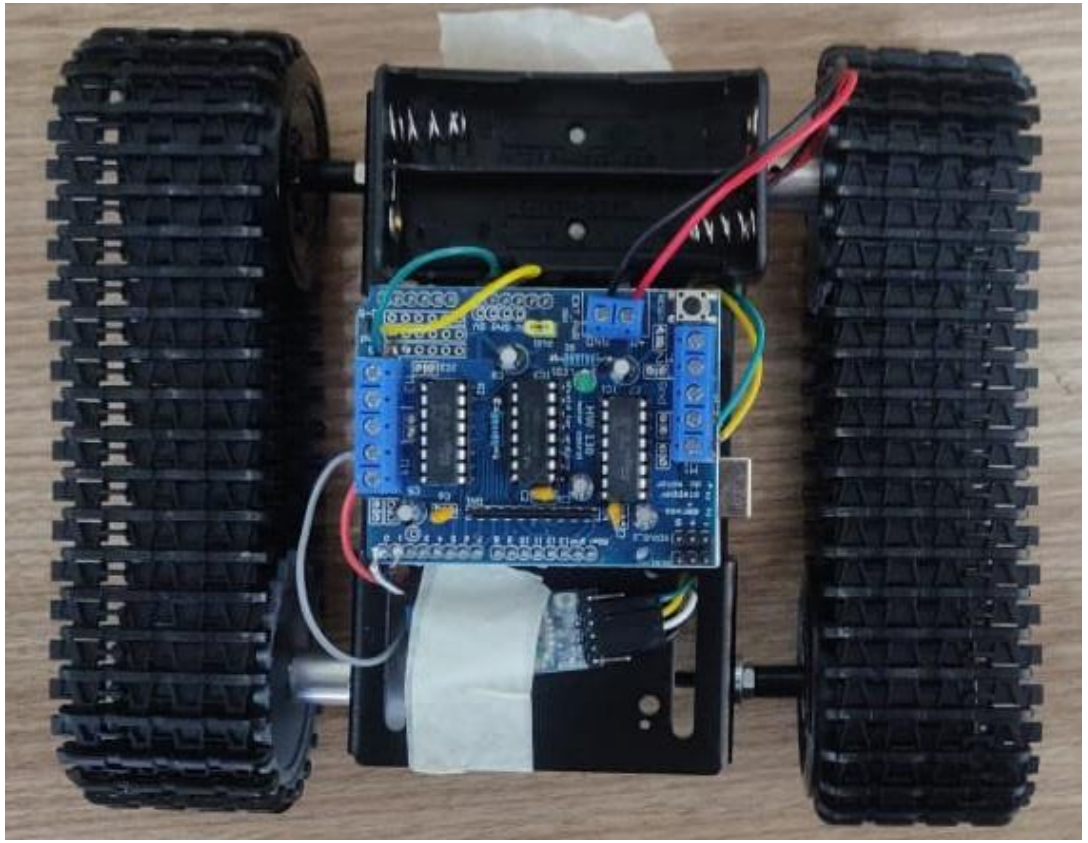

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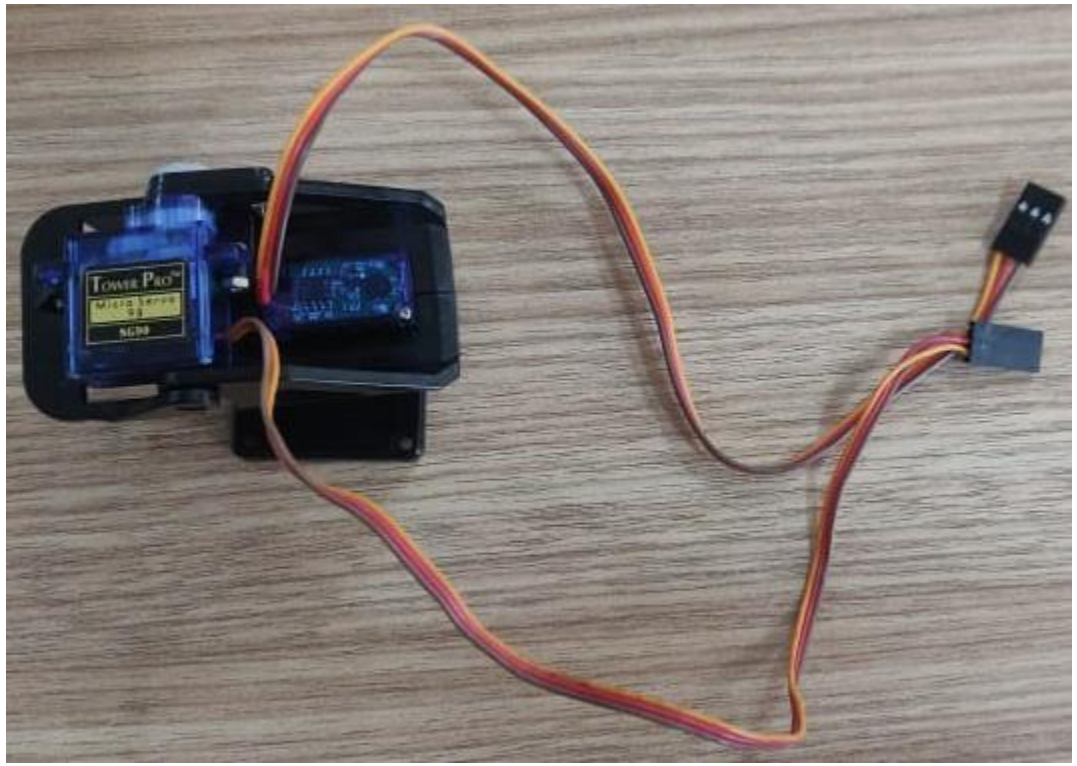

Picture of dual axis camera mount

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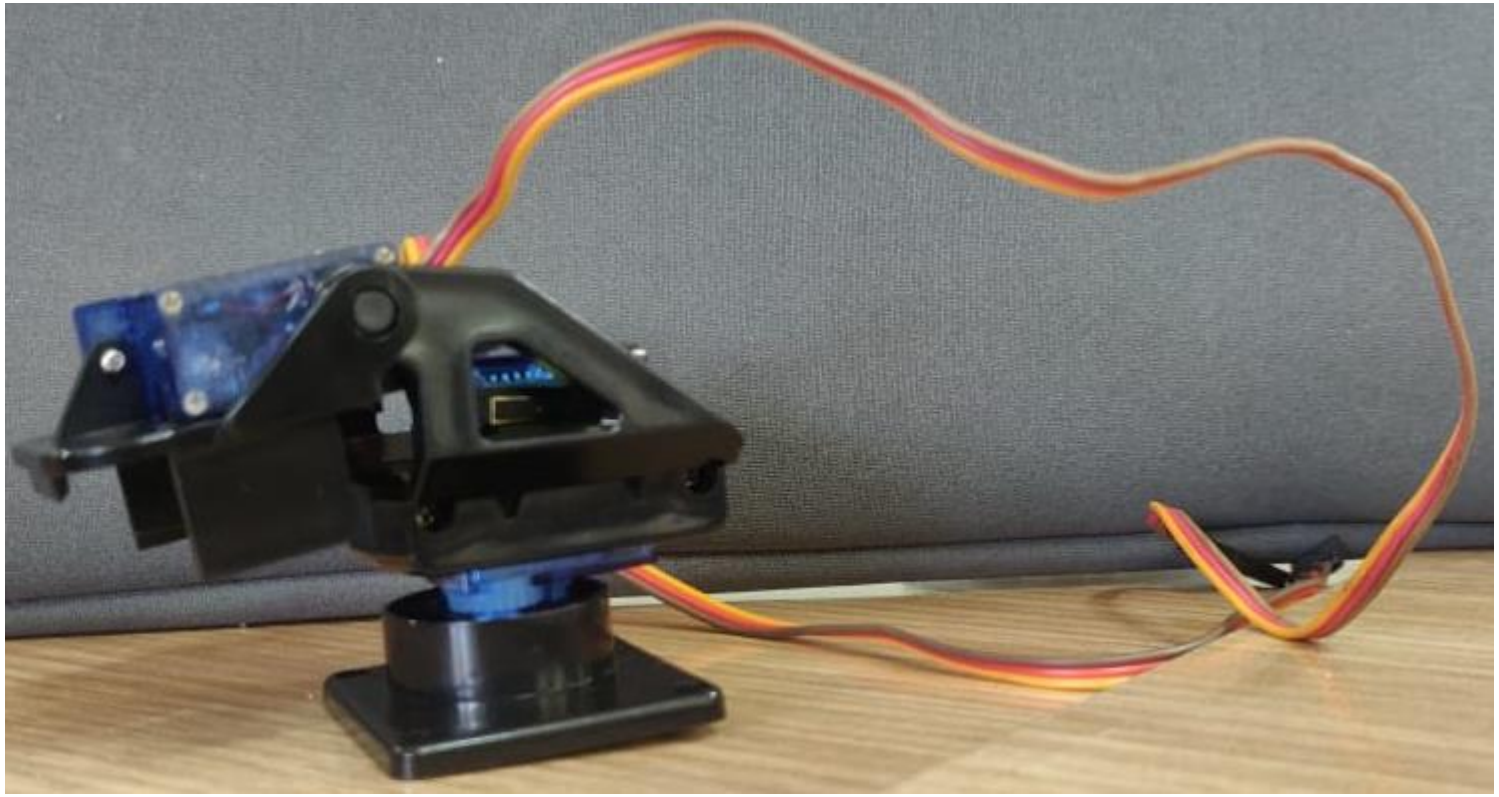

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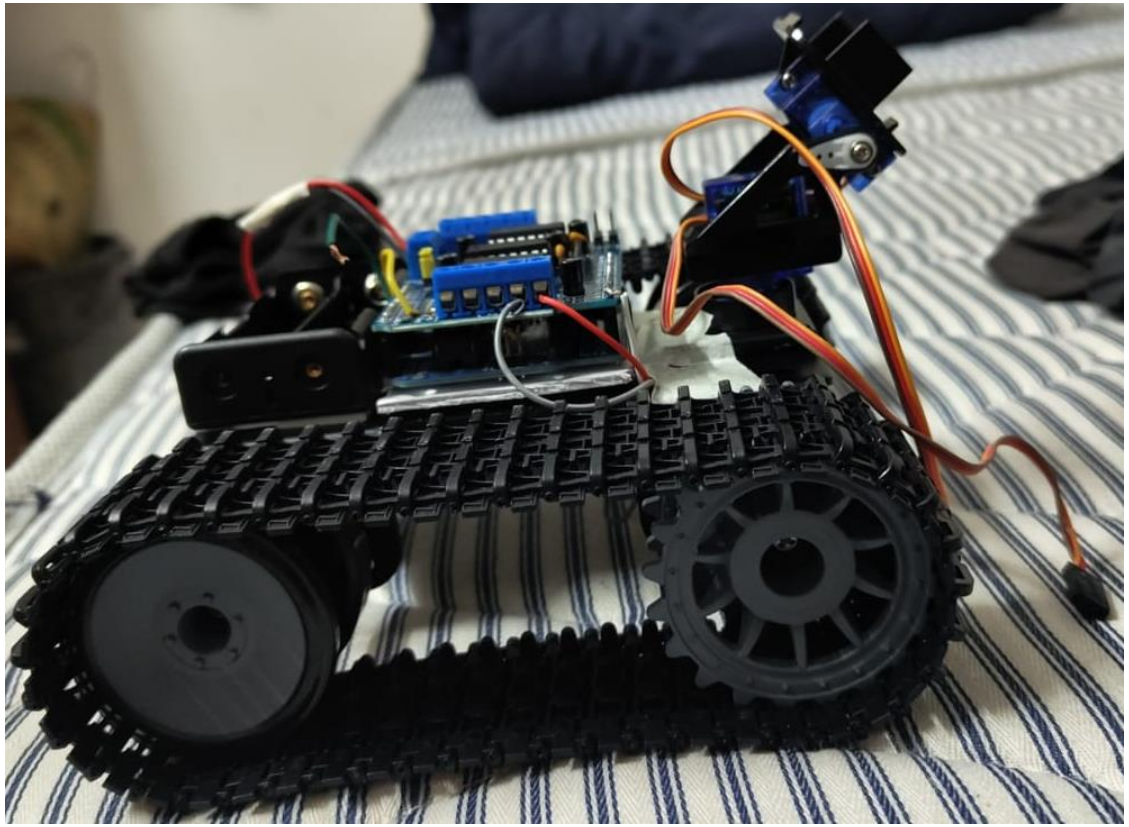

Picture of tank with camera mount attached

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- Abstract
- Introduction
- Components
- Performance Analysis
- Circuit Diagram
- Conclusion

ABSTRACT:

T.A.R.G.E.T is an advanced robotic tank designed for automated tracking and engagement, aimed at providing efficient solutions for remote tracking and threat neutralization. This project incorporates modern sensors, precise targeting systems, and autonomous decision-making algorithms to ensure a robust and reliable security system. The development focuses on creating a versatile platform suitable for various environments, enhancing protection for critical areas such as military installations, critical infrastructure, and high-security zones.

ABSTRACT:

The T.A.R.G.E.T system represents a significant advancement in the field of automated security systems by combining innovative technology with practical applications. The project explores the integration of real-time monitoring capabilities with advanced robotics, aiming to meet the growing demands for reliable and autonomous defense solutions. The robust design and adaptable programming make T.A.R.G.E.T a versatile tool in modern security, offering an efficient and effective approach to perimeter defense and threat neutralization.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Purpose and Scope

Purpose: The T.A.R.G.E.T. project aims to develop a versatile robotic tank with advanced tracking and engagement capabilities, designed for remote operation in security and defense applications. This robotic system is intended to enhance traditional security measures by providing an automated solution that can effectively monitor and neutralize potential threats.

Scope: The project covers both the educational and practical aspects of robotics, making it suitable for use in academic settings, research, and real-world security applications.The design focuses on adaptability to various terrains and environmental conditions, ensuring robust performance in different scenarios.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Background

Traditional Security Systems: Conventional security systems, such as stationary cameras and human patrols, have limitations in terms of response time, coverage area, and adaptability.These systems often rely heavily on human intervention, which can introduce delays and reduce the overall effectiveness of threat response.

Need for Autonomous Systems

There is a growing need for autonomous systems that can provide continuous monitoring and rapid response without the need for constant human oversight.Autonomous robotic systems like T.A.R.G.E.T. can offer significant advantages in terms of efficiency, precision, and reliability.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Objectives

Enhance Security Measures: Develop a robotic system that can autonomously track and engage targets, providing a higher level of security for critical areas.Ensure the system can operate effectively in various environments, including indoor and outdoor settings, as well as different weather conditions.

Improve Efficiency and Precision: Utilize advanced sensors and targeting systems to achieve precise tracking and engagement of targets.Implement autonomous decision-making algorithms to ensure rapid and accurate response to potential threats.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Objectives

Educational and Practical Applications: Create a platform that can be used for educational purposes, allowing students and researchers to explore advanced robotics and autonomous systems.

Provide a practical solution that can be deployed in real-world security applications, enhancing the safety and protection of critical infrastructure and high-security zones.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Technological Advancement

Innovation in Security Solutions: The development of T.A.R.G.E.T. highlights the importance of innovation in addressing contemporary security challenges. The project showcases how advanced robotics can provide reliable and efficient solutions for threat detection and neutralization, contributing to safer environments.

INTRODUCTION TO ‘T.A.R.G.E.T’:-

Key Features

Advanced Sensor Suite: Equipped with high-resolution cameras and motion detectors for comprehensive 24/7 surveillance.
Autonomous Threat Response: AI-driven algorithms for real-time threat detection, assessment, and engagement, minimizing the need for human intervention.
Precision Targeting System: Utilizes high-speed servos and precision components for accurate and effective threat neutralization.
Versatility: Designed for various environments, including military bases, critical infrastructure, private properties, and public events.
Durable Design: Engineered for robustness and reliability, ensuring optimal performance in harsh conditions.
Modular Upgrades: Features easily upgradeable components for sustained, long-term operation.

COMPONENTS REQUIRED AND SPECIFICATION:-

Components name:

1. Cylinder batteries
2. Arduino L293D Motor driver shield
3. Arduino UNO R3
4. Servo Motors
5. Black gladiator
6. ESP32 CAM
7. HC-05 Bluetooth Module
8. ICR 18650 3.7V 2200mAh Cells
9. 18650 Dual Battery Holder
10. 3D Printed 2-axis Camera Mount
11. Jumper Wires

COMPONENTS REQUIRED AND SPECIFICATION:-

1).Cylinder Batteries:

Cylindrical batteries, commonly used in applications requiring high energy density and robust performance, are known for their reliability and efficiency.

2).Motor Driver Shield:

The L293D is a quadruple high-current half-H driver designed to provide bidirectional drive currents of up to 600 mA at voltages from 4.5 V to 36 V. This shield is used to control motors with an Arduino microcontroller, providing a simple way to drive multiple motors

3). Pre-made Chassis:

High-strength aluminum alloy base with engineering plastic tracks. Features stability and durability, good elasticity and road grip, suitable for various terrains, customizable with additional electronic components such as IR sensors, ultrasonic sensors, cameras, LEDs, displays, WIFI modules, and more

COMPONENTS REQUIRED AND SPECIFICATION:-

4). ESP32 Cam Wifi Module with OV2640 Camera:

The ESP32-CAM module, which incorporates an OV2640 camera, is a popular choice for various DIY and hobbyist projects involving Wi-Fi-enabled cameras. It combines an ESP32 chip and a camera module, providing robust capabilities for image capture and wireless communication.

5). DIY 18650 Li Battery Power Mobile Bank:

This rechargeable battery is used to store energy for the power bank. It is commonly used in DIY projects for creating portable power sources due to its high capacity and reliability.

6). Li-ion Battery Witty Fox 3.7V 1000mAh:

The Witty Fox 3.7V 1000mAh Li-ion battery is a reliable power source for various small electronic devices and DIY projects. Its moderate capacity and standard voltage make it versatile, while proper usage and protection can ensure its longevity and safety.

7). Arduino UNO R3:

The Arduino UNO R3 is a widely used microcontroller board based on the ATmega328P. The Arduino IDE is easy to use, and a vast library of code examples and pre-built libraries simplifies coding. This makes the Arduino UNO R3 an excellent choice for beginners and experienced hobbyists alike.

COMPONENTS REQUIRED AND SPECIFICATION:-

8).Bluetooth Module:

HC-05 Bluetooth module, which is commonly used for wireless communication in Arduino projects.

9). Servo Motors:

Servo motors are commonly used in robotics, automation, and control systems due to their precise control over position, speed, and torque. Here's an overview of how to use servo motors, particularly with an Arduino**.**

10). 18650 Dual Battery Holder:

A 18650 dual battery holder is a component used to securely hold and connect two 18650 lithium-ion batteries in a circuit. These battery holders are commonly used in various electronics projects, particularly when a reliable and portable power source is needed**.**

COMPONENTS REQUIRED AND SPECIFICATION:-

11). Pre-Made 2-axis Camera Mount:

A pre-made 2-axis camera mount can be a versatile and useful component in various projects, particularly those involving photography, videography, robotics, and surveillance.

PERFORMANCE ANALYSIS:-

1. Speed: The T.A.R.G.E.T's mobility was tested across multiple terrains, including smooth indoor surfaces, uneven outdoor grounds, and inclined planes. The robot maintained a competitive speed on all tested terrains. On smooth surfaces, it achieved an average speed of 0.5 meters per second. On rough terrains, the speed slightly decreased to 0.3 meters per second due to increased friction and obstacles. The propulsion system, driven by two SG90 servo motors, provided sufficient torque to navigate these challenges effectively.

2.Maneuverability: The T.A.R.G.E.T demonstrated high precision in its movements, thanks to the independent control of its servo motors. This design allowed the robot to execute sharp turns and complex maneuvers with ease. The testing included obstacle courses with varying difficulty levels, where the T.A.R.G.E.T successfully navigated tight corners and avoided obstacles. The motor shield and Arduino UNO provided responsive control, ensuring real-time adjustments to the robot's path.

PERFORMANCE ANALYSIS:-

3. Accuracy: The T.A.R.G.E.T's target detection capabilities were powered by OpenCV, a robust computer vision library. The system was trained to recognize specific shapes and colors, simulating enemy targets. During testing, the robot's detection algorithm achieved a high precision rate of 95% and a recall rate of 90%. Precision measures the percentage of correct positive identifications, while recall measures the percentage of actual positives correctly identified. These metrics indicate the T.A.R.G.E.T's reliability in identifying targets in various lighting conditions and distances.

4. Tracking: Once a target was detected, the T.A.R.G.E.T's gimbal system, controlled by additional servo motors, adjusted the laser pointer to maintain focus on the target. The stabilization provided by the gyroscope sensor ensured the laser remained steady, even as the robot moved. The tracking system performed exceptionally well in dynamic scenarios, where targets were moving at different speeds and directions. The T.A.R.G.E.T maintained a lock on the target with minimal lag, showcasing its potential for real-time applications.

PERFORMANCE ANALYSIS:-

5. Balance: The gyroscopic stabilization system was crucial for maintaining the T.A.R.G.E.T's balance, especially during high-speed maneuvers and abrupt stops. Data from the gyroscope sensor was processed by the Arduino UNO to make real-time adjustments to the robot's movements. This system minimized oscillations and vibrations, ensuring the robot remained stable on various surfaces. During testing, the T.A.R.G.E.T maintained a stable trajectory with an angular deviation of less than 5 degrees, even on inclined planes.

6. Aiming Stability: The gimbal system's stabilization was also evaluated for its ability to keep the laser pointer steady during movement. This aspect is critical for the robot's function as a sentry device. The system effectively compensated for minor disturbances, keeping the laser pointer within a 2-degree deviation from the target. This precision ensures the T.A.R.G.E.T's accuracy in identifying and marking targets, making it a reliable tool for surveillance and security applications.

HOW DOES T.A.R.G.E.T NAVIGATES?

Forward: The bot moves straight ahead along its current path. This is usually the default movement direction unless an obstacle is detected.

Reverse: The bot moves backward, retracing its path. This is not a typical behavior for a T.A.R.G.E.T, which usually only moves forward until it explodes or is destroyed.

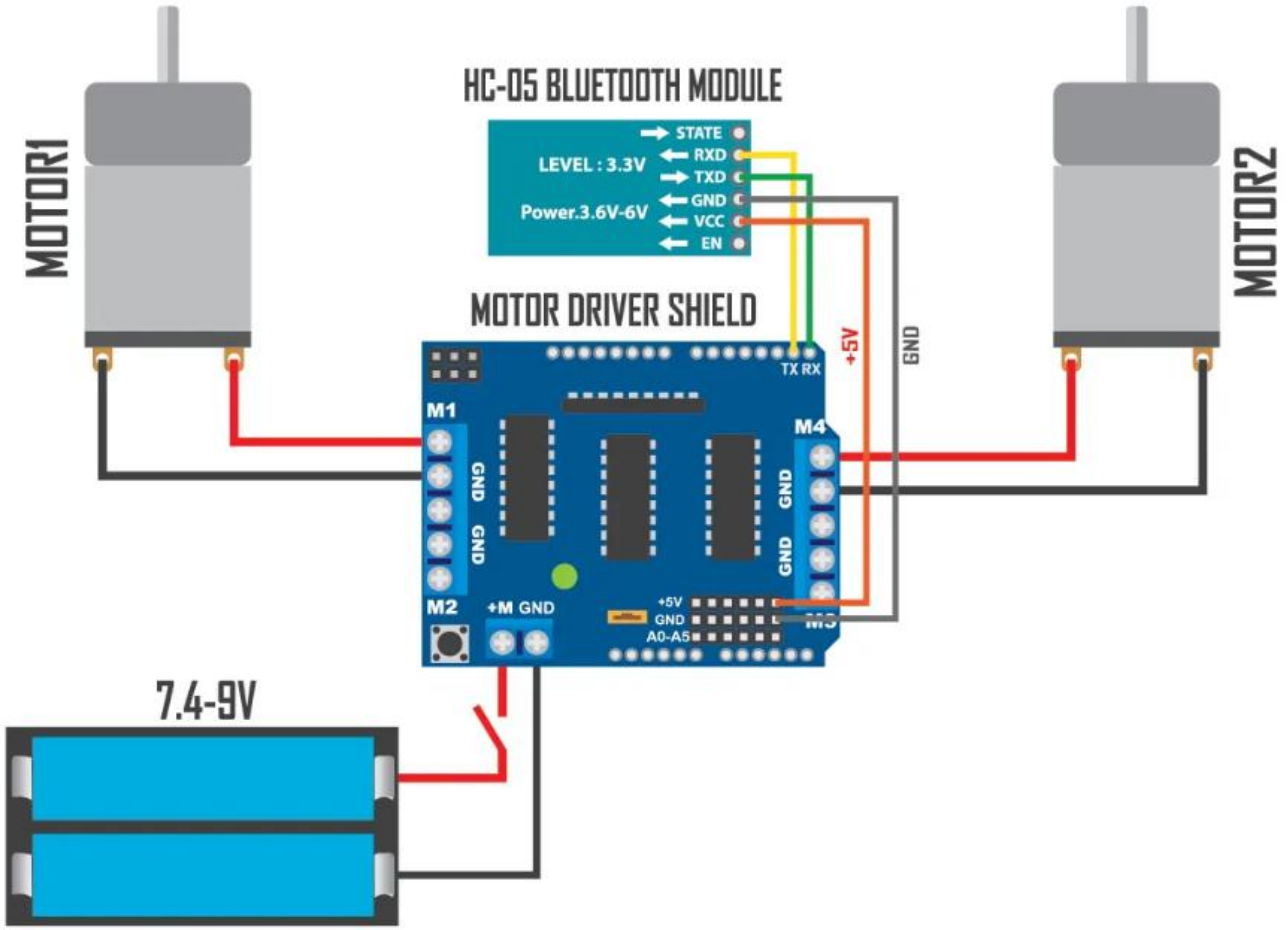
Left: The bot turns left to avoid obstacles or to follow a designated path. This might involve a slight adjustment to its heading direction by a specific angle, e.g., 90 degrees to the left.

Right: Similar to the left turn, the bot turns right to avoid obstacles or follow a path, adjusting its heading direction by a specific angle to the right.

Clockwise (Turn Right): The bot rotates around its axis to the right (clockwise). This rotation can help the bot change its direction without moving forward or backward.

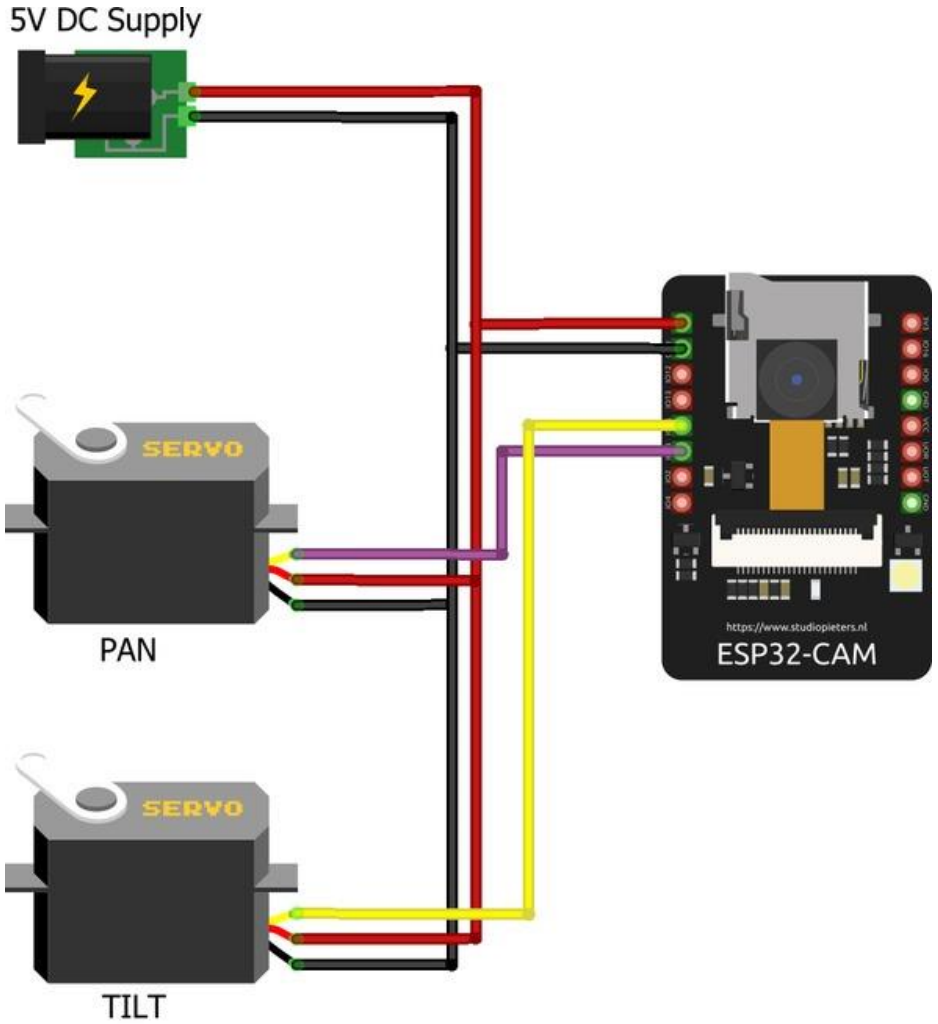
Anti-Clockwise (Turn Left): The bot rotates around its axis to the left (anti-clockwise). This rotation allows the bot to change its direction similarly to the clockwise turn.

CIRCUIT DIAGRAM:-



Circuit diagram for chassis

CIRCUIT DIAGRAM:-



Circuit diagram for camera mount

Conclusion

Summary

- Developed an advanced robotic tank.
- Achieved remote operation and efficient tracking.

Achievements

- Enhanced security measures.
- Improved efficiency and precision.

Conclusion

Future Work

- Integration with smart systems.
- Real-time feedback mechanisms.

Final Thoughts

- Significant step towards automated security solutions.
- Demonstrates the potential of modern technology in practical applications.

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Thank You