DEVELOPMENT OF REMOTELY CONTROLLED RC TANK PLATFORM

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Introduction

The RC tank project is an ambitious undertaking that merges cutting-edge microcontroller technology with wireless communication and imaging capabilities. Developed as a culmination of a graduation project, this RC tank demonstrates a comprehensive integration of hardware and software elements, creating a versatile and engaging platform for various applications.

Specifications and Design Requirements

Hardware Components:

STM microcontroller for overall control.

nRF24L01 for joystick input communication.

ESP32-CAM for camera functionalities.

Dual motor drivers for tank movement control.

Tank Movement Control:

Utilizes joystick input received via nRF24L01.

Two motor drivers independently control tank movements based on joystick data.

Motors adjusted according to joystick values for smooth control.

Shooting System:

Incorporates a shooting mechanism controlled by a separate motor driver.

Triggered by commands received through nRF24L01.

Ensures precise control over the tank's shooting capabilities.

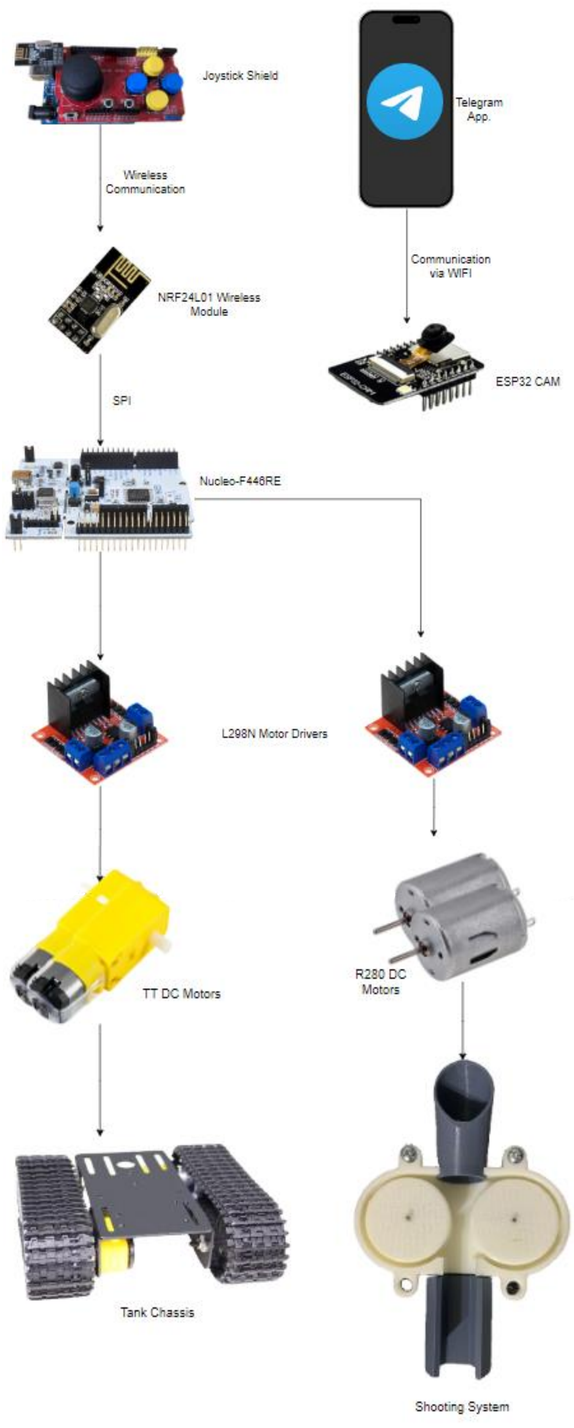
Camera Integration:

Features an ESP32-CAM module for live streaming and photo capture.

Connected to Telegram for remote control.

Can capture photos or activate the flash based on commands from the Telegram app.

Solution Methodology



Joystick Shield: The sensitivity and precision of the joystick can impact the control of the RC tank.

L298N Motor Driver: The L298N is a high voltage, high current dual full-bridge driver that can handle significant current and is well suited for driving DC Motors. Its choice depends on the compatibility with the motors used in the RC tank platform.

NRF24L01 module: The choice of NRF24L01 depends on factors like transmission range and data rate. For the tank, a model with an adequate range for the intended operating environment would be preferred.

Nucleo-F446RE: It has a processor speed of 180 MHz , ample memory capacity, numerous GPIO pins, and supports various communication protocols. These features enable the tank to successfully perform complex tasks

Motors:The TT DC motor operates at 12V and 500 rpm. PWM control allows starting at 50% PWM, adjustable with buttons. Its geared design ensures sufficient torque for turning the tank's tracks.The R280 DC motors operate at 12V and 15000 rpm, ideal for the firing system due to high rpm even at low power.

The firing system, created through careful 3D printing, involves two DC motors rotating in opposite directions to launch a projectile. It operates at 60% PWM due to its high rotation speed.

The ESP32-CAM, an ESP32-based development board with an integrated camera module, is used to view the tank's surroundings and take photos. With its Wi-Fi capabilities, it processes data and manages tasks such as capturing and sending photos when commanded through Telegram using the chat ID.

RC Tank Platform: The design and size of the tank platform, as well as the type of terrain it can handle, are important design choices. Factors such as size, weight, durability, and cost should be considered. The platform should also provide enough space to accommodate all components.

Application Areas

Educational Environments:

The project serves as an interactive educational tool in classrooms or workshops, engaging students in hands-on learning about microcontrollers, wireless communication, and robotics.

Hobbies and Entertainment:

Ideal for hobbyists and enthusiasts seeking an entertaining and engaging remote-controlled tank experience. The customizable features provide endless opportunities for creative exploration.

STEM Education:

Aligning with STEM principles, the project fosters an interest in science, technology, engineering, and mathematics among students. It promotes problem-solving and critical thinking.

IoT and Wireless Communication:

Showcasing the integration of IoT principles, the project demonstrates wireless communication using the nRF24L01 module, emphasizing the application of modern technologies.

Results and Discussion

Joystick Control: The joystick control system proved effective, enabling precise control over the tank's movements.

Wireless Communication:The NRF24L01 wireless communication module demonstrated reliable data transfer between the control system and the tank.

Motor Performance: The L298N motor drivers effectively managed the TT DC motors and R280 DC motors

ESP32-CAM Integration: The ESP32-CAM module successfully captured images and responded to Telegram commands.

The presented poster effectively communicates the project's major achievements.

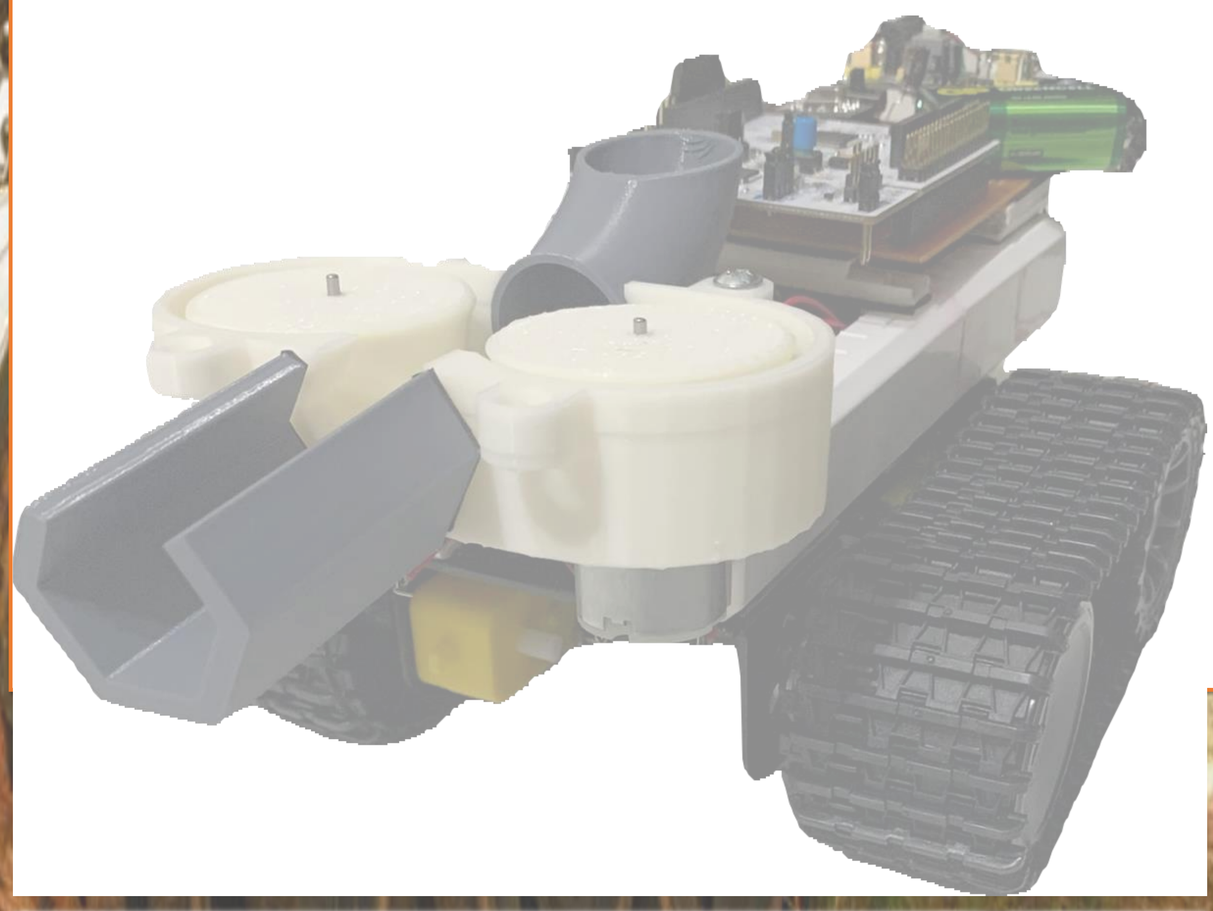
Implications of Project Results:

-Robust Control:The achieved precision in control and wireless communication opens opportunities for deploying similar systems in more complex environments, such as surveillance or exploration.

- Modularity:The modularity of the design allows for easy upgrades or adaptations for different applications. This flexibility ensures the project's relevance in various scenarios.

Despite the project's success, there are avenues for future improvement and expansion:

-Enhanced Sensor Integration: Integrate additional sensors, such as proximity sensors or infrared sensors, to enhance the tank's environmental awareness.



Acknowledgements

❖This project was completed within the context of ELE401-402 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering.

❖I thank Prof. Dr. Uğur BAYSAL for his invaluable contributions to our project.