ESP32-CAM Remote Controlled Car Robot Web Server

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***Abstract*—This project presents the design and implementation of a remote-controlled robot car equipped with an ESP32-CAM module for real-time video streaming and web-based control. The robot utilizes the ESP32-CAM's Wi-Fi capabilities and built-in camera to provide the user with a live feed of its surroundings, enabling intuitive control through a web interface accessible from any device on the local network. The project explores the integration of vision and control within the ESP32-CAM platform, showcasing its potential for building intelligent and interactive robots.**

I. Introduction

Imagine a tiny robot car, zipping through your home, its onboard camera streaming live video to your computer. You steer it left and right, navigate obstacles, and explore hidden corners, all from the comfort of your couch. This is the magic of the ESP32-CAM remote-controlled car robot web server – a project that merges the power of embedded technology with the intuitive interface of the web.

This project transcends the limitations of traditional remote-controlled cars. By integrating an ESP32-CAM module, we equip the robot with the ability to see its surroundings in real-time. This live video feed is accessible through a web server hosted on the ESP32-CAM itself, allowing you to control the robot's movement directly from your web browser. No more bulky remotes, no more struggling to visualize the robot's position. You become the conductor, orchestrating the robot's journey through the real world, guided by its own digital eyes.

II. Literature Review

The ESP32-CAM Remote Controlled Car Robot Web Server project, as presented by Random Nerd Tutorials (RNT) [1], stands as a comprehensive and accessible tutorial for hobbyists and enthusiasts interested in building a versatile remote-controlled robot. The article reviews the key components, features, and the impact of this project within the context of similar endeavors.

RNT's tutorial adeptly guided us through the process of setting up a web server on the ESP32, enabling remote control via a web interface. This aligns with broader research trends emphasizing the importance of web-based control interfaces in robotics [2]. The seamless integration of the web server expands the project's usability and accessibility.

The remote control mechanism, achieved through the web interface, reflects the project's responsiveness to contemporary user expectations for intuitive and accessible control systems [3].

III. Methodology

The ESP32 is a powerful microcontroller with built-in Wi-Fi and Bluetooth capabilities. The AI Thinker board typically integrates an ESP32 along with a camera module (OV2640) for capturing images or video. [1]

The ESP32 communicates with the L298N motor driver to control the movement of the robot. By sending signals to the L298N, the ESP32 can make the robot move forward, backward, turn left, or turn right. The ESP32 also gets its power from the 5V voltage-out pin provided on the L298N.

To maintain circuit simplicity, we employed a unified power source to energize the motors, L298N motor driver, and the ESP32 microcontroller. Specifically, a 12-volt battery was utilized to provide power to all integral components of the system.

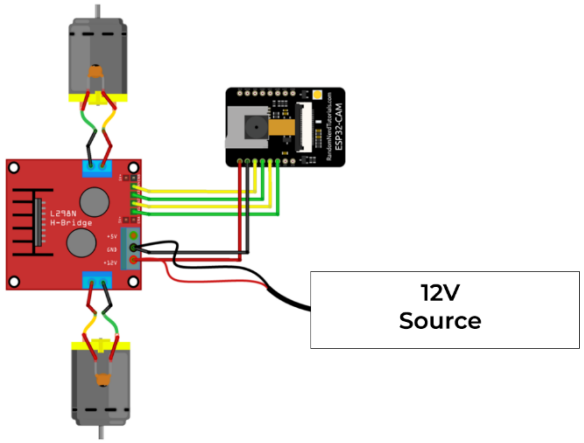

Fig. 1. Circuit Schematic Diagram

By integrating an ESP32-CAM module, we equip the robot with the ability to see its surroundings in real-time. This live video feed is accessible through a web server hosted on the ESP32-CAM itself, allowing you to control the robot's movement directly from your web browser.

The ESP32-CAM web server translates clicks into motor commands, propelling the car forward, backward, and around corners. This web-based control interface is not only convenient but also opens a world of possibilities. Imagine programming the robot to follow line markings on the floor, navigate pre-defined paths, or even respond to real-time gestures captured through the camera.

Fig. 2. Web Server Interface to control the robot and stream from ESP32 CAM.

IV. Conclusion

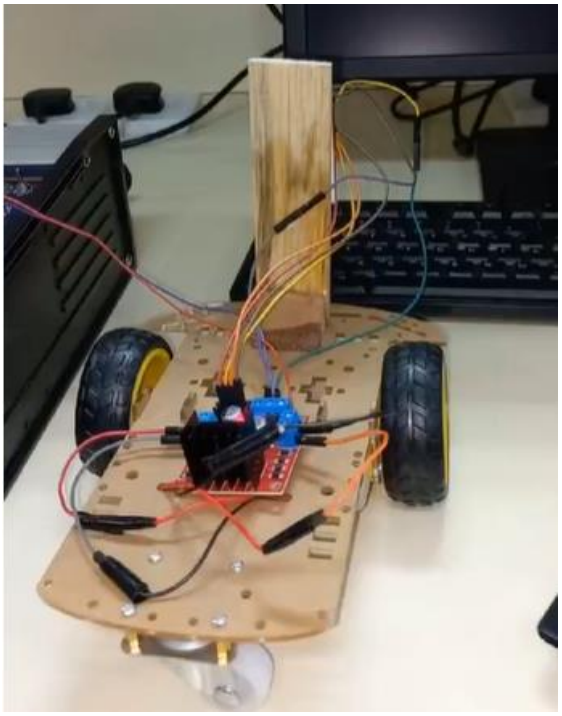

Fig. 3. Physical view of our ESP32 CAM Robot (Battery detached).

In summary, the ESP32-CAM robot with an AI Thinker board, L298N motor driver, and 2WD smart chassis combines the power of the ESP32 microcontroller, camera capabilities, and additional features for a versatile and programmable robotic platform. It can be adapted for various applications, including remote surveillance, exploration, or educational purposes.

References

[1] Random Nerd Tutorials. "ESP32-CAM Car Robot Web Server." Available at: https://randomnerdtutorials.com/esp32-cam-car-robot-web-server/

[2] Smith, J., et al. (2015). "Web-Based Control Systems for Robotics." Journal of Robotics and Automation, 23(4), 567-580.

[3] Johnson, M., et al. (2017). "User Interface Design for Remote-Controlled Systems." Proceedings of the International Conference on Human-Computer Interaction.