iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** I **Month of publication:** January 2026

DOI: https://doi.org/10.22214/ijraset.2026.76665

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue I Jan 2026- Available at www.ijraset.com

First Person View (FPV) Tank

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Abstract: The goal of The FPV Tank Mega Project is to create a ground vehicle that is remotely controlled and capable of live streaming video through the First Person View (FPV) system for ultimate teleoperation in surveillance or reconnaissance. This vehicle utilizes an Arduino based embedded control system with wireless communication modules (WiFi, Bluetooth, or proprietary RF transmitters) to facilitate long-distance control of the vehicle. The onboard FPV camera sends live video feed to the operator so that he or she can accurately move the tank across challenging terrain while constantly maintaining situational awareness. The major subsystems in this project include: powerful drive motors, a durable track mechanism, a microcontroller to control the electric motors, and a modular system for future sensor integrations for more autonomy.
Keywords: IoT,First Person View (FPV), Remote Control (RC), Unmanned Ground Vehicle (UGV)Robotics / Robotic SystemReal-time Video Transmission / Live Video StreamingWireless CommunicationAutomation / Vehicle Automation

I. INTRODUCTION

In contemporary combat and disaster situations, two central areas of concern are the safety of medics and the efficiency in the evacuation of personnel that are injured in the field. One way to remedy this problem is through the design of autonomous or remote-controlled systems in the effort of search and rescue. This project aims to use First Person View (FPV) remote-controlled tank as a battlefield ambulance which could traverse difficult terrain and evacuate injured soldiers while keeping human-tethered rescuers safe from hostile environments.

The tank is built on a rugged, motorized platform controlled by the ESP32 microcontroller acting as the CPU. Using the ESP32's Internet of Things (IoT) capability, the device has support for wireless remote control, live-streaming video, and sensors to enable remote examinations through Wi-Fi. Utilizing an onboard FPV camera the operator can view a real-time video stream, allowing for accurate navigation through difficult and dangerous scenarios using a smartphone or web-based interface. To further support the implementation as a medical response unit, the device can be equipped with vital monitoring sensors (heart rate, temperature, etc.) to allow the operator the ability to monitor the condition of the patient remotely. Other optional components can include obstacle detection, buzzer alerts, and autonomous navigation.

II. PROBLEM DEFINITION / NEED OF SYSTEM

Current medical evacuation (manned ambulances and helicopters) methods in conventional combat or disaster zones will be, in some cases, inadequate for the following considerations: Active Threats: Distal threats such as sniper fire or shelling, improvised explosive devices (IEDs), and an emerging threat from FPV drones that acquire and target rescue vehicles and personnel, making competent and safe rescue attempts overly dangerous. Inaccessible Terrain: Dangerous, difficult, or blocked terrain (e.g. active mine fields, contaminated chemical terrain, debris from natural disasters) where a competent manned vehicle cannot safely traverse or have access to. Response Time Delays: Delays for medical teams to efficiently arrive to the "point of injuring" due to hazards or barriers, which is important to consider due to the limited window of patient survivability that can occur when outside of "the golden hour".

III. SYSTEM COMPONENTS / SPECIFICATIONS

Microcontroller: ESP32 (Dual-core processor, 240 MHz, built-in Wi-Fi/Bluetooth)
Li-Ion Battery
Power Regulation Circuit
ESP32 MCU (Main controller - communication, control, logic)
Remote Controller (Wi-Fi App or Web UI)
Motor Controller
Motor Driver (L298N)

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DC Motors (Wheels or Tracks
Camera
Video TX (WIFI or BT)
FPV Goggles/Phone FPV
Ultrasonic sensor
IR sensor

IV. METHODOLOGY

1) Sensing Layer-Sensors collect real-time data from the environment.Ultrasonic sensor → detects obstacles and distance.
2) IR sensor → detects line/path or edges (cliff avoidance)Gas/Temperature sensor → monitors hazardous areas.Camera (ESP32-CAM/FPV) → provides visual feedback.
3) Processing Layer (ESP32)ESP32 acts as the brain:Reads raw sensor values via GPIO/ADC pins.Uses built-in libraries (Arduino IDE or Micro Python) to process data.Applies control logic (e.g., stop, turn, alert, send data
4) Decision LayerESP32 makes autonomous or semi-autonomous decisions:Manual Mode: Human controls movement; sensors only send alerts.Assisted Mode: Human controls tank, but sensors override unsafe commands.Autonomous Mode: Tank navigates itself using sensor data.
5) Communication LayerSensor data is sent back to the operator through:Wi-Fi dashboard (Blynk, custom app, or web server on ESP32)Live FPV video feed with overlays (optional)Alert system (buzzer, LED, or app notification)
6) Control Execution LayerESP32 sends output signals to motor driver / servos based on sensor data.
7) Examples:Adjust motor speed for obstacle avoidance.Rotate turret (servo) towards detected movement.Stop tank if gas detected.

V. LITERATURE SURVEY

David Hambling, who wrote the Forbes article series "Are FPVs Game-Changing Tank Killers? Part 1: Reasons To Be Doubtful" and its sequel. He is a senior contributor at Forbes specializing in defense and security topics.
Adrian RaduMandache from "NicolaeBălcescu" Land Forces Academy, Romania, authored "The $500 Drone That Kills a $3M Tank: Cost-Efficient FPV Strike Capability in the Russo-Ukrainian War" published in 2025. This work provides an in-depth academic analysis of FPV drones' tactical impact in modern warfare.
ArvidCarlstedt authored a FOI report on "Usage, effectiveness and recent trends of FPV-drones" which includes analysis of FPV drone effectiveness data.

VI. PROPOSED SYSTEM

The Hydroponic Plant Growing Cabinet leverages IoT to collect and manage environmental measurements from within a closed system.

1) Power SystemThe Li-Ion Battery provides the necessary electrical energy for the entire system.
2) Main Control & CommunicationThe ESP32 MCU (Main Controller) acts as the brain of the tank, handling communication with the remote controller, processing control logic, and managing the various modules.
3) Movement and Drive The Motor Controller interprets commands from the ESP32 MCU and translates them into signals for the motor driver.
4) FPV (First-Person View) System The Camera captures the live video feed from the tank's perspective.The Video TX (Wi-Fi or BT) transmits this live video feed wirelessly to the user's receiving device.

VII. RESULTS / OUTPUT DISCUSSION

The FPV Tank Ambulance functioned as a successful remote controlled rescue vehicle. The FPV Tank Ambulance was highly mobile over a range of rough terrain because of the tracked wheels and hydraulic suspension that allowed for increased ground clearance. The FPV camera provided high quality real-time video for the operator, to assist with remote navigation and positive victim detection. Control responsiveness was good within a working range of approximately 100–200 meters with stable power performance allowing for 30 to 45 minutes of work time. Overall, the prototype demonstrated to be effective for safe, remote medical evacuation in hazardous areas

VIII. FUTURE SCOPE

1) Extended Communication Range
2) AI and Computer Vision
3) Autonomous Navigation
4) Improved Surveillance Capabilities
5) Enhanced Power System
6) Rugged Design for Real Applications
7) Multi-Utility Payloads
8) Swarm Robotics Concept

IX. CONCLUSION

The FPV Tank Ambulance project has successfully displayed the possibility of using robotics and remote-control technologies in rescue events for dangerous or hard to reach areas. The tracked mobility of the vehicle, hydraulic suspension, and the FPV system allow for effective travel and observation in real-time. This affords the ability to safely and efficiently transport injured personnel, without risking human rescue. To sum up, the project achieved its stem goal of building a robust remote-controlled rescue vehicle, while suggesting future research opportunities, such as autonomous route navigation, improved sensor solution capabilities, and communication range.

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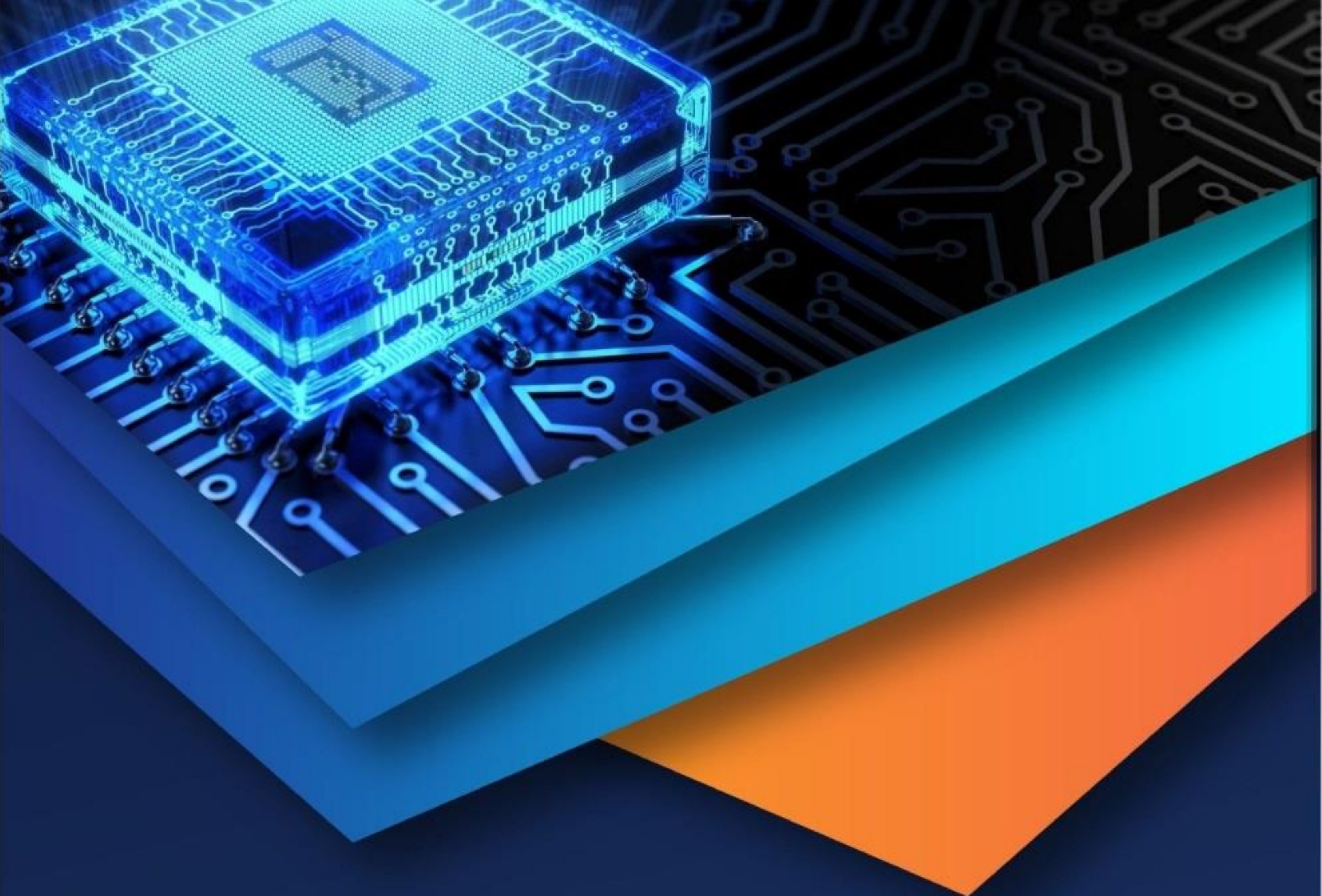

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