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Tracker: The Robot Dog

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Abstract —

This document outlines the creation and design of a sophisticated robotic dog intended for surveillance and military defense roles. The robot features an different microcontrollers, a camera system for live monitoring, and motorized wheels for movement. Moreover, a compact shooting mechanism has been incorporated to bolster its defense capabilities. This system is crafted to autonomously traverse intricate environments, and relay real-time video to operators. The integration of autonomous functionalities alongside remote control options renders this robotic dog a flexible asset for high-risk operations, minimizing human risk while ensuring mission effectiveness. This project emphasizes the promise of affordable, customizable robotic platforms within contemporary defense technologies and contributes to the advancing discipline of robotic security systems.

Keywords — Robotic dog, Surveillance, Military defense, Safety, Shooting mechanism, Real-time monitoring, Robotic systems, Smart defense technology.

A.Introduction:

The fusion of robotics and wireless technology has paved the way for smart, interactive machines that can be controlled remotely with precision and ease. This project introduces an innovative robotic dog that simulates lifelike movements while offering a unique blend of functionality, control, and entertainment. Designed as a multifunctional prototype, the robot is capable of directional motion, dynamic head articulation, and even features a water-spraying mechanism for playful or practical applications. It is controlled through a custom-built web application, allowing users to operate the robot seamlessly over a Wi-Fi connection. The project aims to demonstrate how accessible components and creative engineering can bring robotic systems closer to real-world usability, bridging the gap between novelty and utility. With potential applications in surveillance, interactive learning, or just as a fun tech companion, this robotic dog serves as a compact example of how modern technology can breathe life into functional robotic companions.

B. Literature Review:

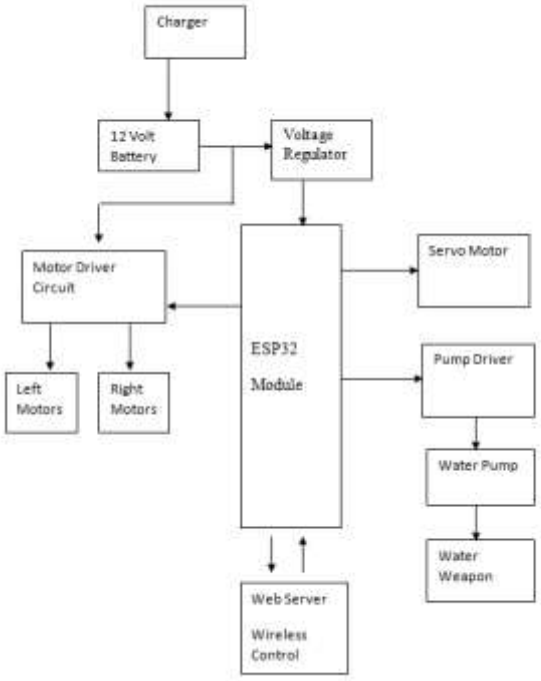
Recent advancements in robotics and IoT have led to the creation of smart, remotely controlled machines that combine mobility, interactivity, and real-time feedback. Studies have demonstrated the effectiveness of using microcontrollers like Arduino Nano and modules like ESP32-CAM for tasks such as wireless control and live video streaming. Servo motors are commonly used in animatronic projects to simulate natural movement, particularly in robotic pets. Research also supports the use of web-based interfaces for robot navigation, offering users seamless control over Wi-Fi without additional hardware. This project draws inspiration from these developments, integrating them into a compact, multifunctional robotic dog that adds novelty through its water-spraying feature.

C. System Architecture/Methodology:

The robotic dog system is designed with a modular architecture that integrates hardware components and a web-based control interface for real-time operation.

The robot connects to a local Wi-Fi hotspot, and the web application runs on a browser, providing a user-friendly interface with control buttons.
Core components:

- The robot uses **ESP32-CAM** for Wi-Fi connectivity and live video streaming.
- **Arduino Nano** controls motors, servo movement, and the water spray mechanism.
- Movement (forward, backward, left, right) is controlled via **DC motors**; head movement uses a **servo motor** (180° range).
- A **web application** sends commands over Wi-Fi,Mobile data which are processed by the ESP32 and forwarded to Arduino.



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The robot is programmed using Arduino IDE in C/C++, with a voltage regulator ensuring stable power. A Zero PCB holds the circuit, supported by basic components like capacitors, resistors, and wires for proper connectivity and signal flow.

D. Implementation:

The system operates using wireless communication, sensor-based navigation, and motor control. The **RF 433MHz remote** sends control signals, which are received by the **RF 433MHz receiver** and processed by the Arduino microcontroller. Based on these signals, the Arduino directs the **L293D motor driver module** to control the left and right motors, enabling movement in different directions.
The **ultrasonic sensor** continuously scans for obstacles, and if detected, the **Arduino** adjusts the robot's path accordingly to avoid collisions. The **wireless camera** provides real-time video feedback for surveillance, while the **toy water spray gun** can be activated remotely for specific actions.

The system is powered by a **12V battery**, with a **7805 voltage regulator** ensuring stable voltage for components. This design allows for efficient remote operation, making it suitable for surveillance, security, and military applications.
This project involves the design and development of a smart robotic dog that combines mobility, interactivity, and remote control through web-based communication.

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E.Features:

Here are the main features of your robotic dog project:

- Surveillance System: Fitted with a camera

for real-time video transmission and remote observation, allowing operators to monitor environments from afar.

- Shooting Mechanism: A compact, controlled firing system designed for self-defense, able to aim at and neutralize threats upon command.
- Autonomous Navigation: Features motorized wheels and sensor-driven navigation that enables the robot to operate independently, steering clear of obstacles and adjusting to different terrains.
- Remote Control Operation: Can be operated manually through a wireless interface, providing flexibility for human operators during critical situations.
- Real-Time Feedback: Transmits live video along with sensor information to a control station, improving situational awareness and facilitating decision-making.
- Energy Efficiency: Managed power systems optimize battery usage to extend operational time without needing frequent recharges.
- Compact and Agile Design: The lightweight and durable structure enhances maneuverability,
- Customizable and Scalable: Built on an Arduino framework, allowing for simple hardware or software updates to accommodate changing needs.

- Low-Cost, High-Impact Solution:Balances affordability with advanced features, making state-of-the-art defense technology both accessible and practical.

F.Components:

1.Power Supply Components:

- 12V Battery – Provides power to the entire system
- 7805 Voltage Regulator – Converts 12V to 5V for certain components

2. Microcontroller

Arduino (nano) – Central processing unit for controlling the system.

- **Microcontroller**: ATmega328P
- **Operating Voltage**: 5V

Credits:Amazon

ESP32 Cam Module

Credits:Amazon

The ESP32-CAM is a compact, low-cost development board that combines Wi-Fi, Bluetooth, and a built-in camera. It's widely used in IoT projects for real-time video streaming, surveillance, and wireless control.

ESP32-CAM Features in Web Application Integration

1)Live Video Streaming

- Streams real-time video feed directly to the web browser
- Enables remote monitoring and navigation.

2)Wi-Fi Connectivity

- Acts as a Wi-Fi client or access point, allowing the robot to connect to a local network or hotspot.

3)Remote Command Handling

- Receives commands (e.g., movement, shoot, head rotation) from the web app and forwards them to Arduino via serial.

3. Wireless Communication

- RF 433MHz Transmitter (Remote Control):
- Sends control signals
- RF 433MHz Receiver Module:
- Receives signals and transmits them to Arduino
- Antenna – Enhances the wireless signal range

4. Motor Control System

- L298ND Motor Driver Module – Controls the motors
- Left Motors (2 units) – Drive the left side of the robot
- Right Motors (2 units) – Drive the right side of the robot

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5. Peripherals

- Wireless Camera – Captures and transmits live video feed
- Toy Water Spray Gun – Controlled by Arduino for spraying water

6.Servo Motors

The SG90 is a lightweight, low-cost servo motor widely used in robotics and DIY electronics for precise angular movements. It is ideal for small-scale projects due to its compact size and reliable performance. In this robotic dog project, the SG90 is used to control the head movement, allowing it to tilt up and down within a specified angle range.

Credits:Amazon

G.Conclusion and Future Scope:

This project represents a creative step toward building intelligent and interactive robotic systems that can be controlled remotely with ease. By focusing on user engagement, mobility, and responsive behavior, the robotic dog offers a compelling demonstration of how robotics can be applied in practical, educational, and recreational settings. The project not only enhances understanding of system integration and remote interfacing but also lays the groundwork for future innovations in smart, connected machines. Its successful implementation reflects thoughtful design, problem-solving, and the potential for further expansion.

- Improved Mobility – All-terrain movements using motors, sensors, and adaptive navigation for rough terrains.
- AI & Autonomous Navigation – Machine learning for threat detection and intelligent decision-making.

- Secure & Long-Range Communication.

H.Acknowledgement

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I.Reference

[1] P. Singh, “Development of Autonomous Robots for Military Surveillance,” International Journal of Robotics and Automation, vol. 15, no. 2, pp. 101–110, 2024.

[2] A. Kumar, “Wireless Communication Systems in Defense Robotics,” Journal of Emerging Technologies in Military Science, vol. 8, no. 3, pp. 200–210, 2023.

[4] M. Verma et al., “Advanced Surveillance Systems in Tactical Robotics,” Defense Technology Innovations, vol. 12, no. 1, pp. 55–65, 2021.

[5] L. Roy, “Integration of Water-Based Defense Systems in Robotic Vehicles,” Journal of Military Engineering and Technology, vol. 5, no. 4, pp. 88–96, 2020.

[6] K. Patel, “AI-Driven Robotics for Border Surveillance and Security,” Journal of Artificial Intelligence and Defense Strategies,vol.14,no.2, pp. 120– 130-2020