TITLE: DITECTIVE MILITARY ROBOT

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1 . Introduction:

The Detective Military Robot is an innovative IoT-based solution designed to enhance security and surveillance in sensitive and high-risk areas such as borders, restricted zones, and military operations. Equipped with an ESP32 camera module, the robot provides real-time video monitoring, enabling remote observation and threat detection without putting human lives at risk. This system can be controlled and monitored through a **web-based frontend interface**, making it accessible and user-friendly for defense personnel

Hardware Components:

ESP32-CAM Module- Used for capturing live video feed and recording images for real-time surveillance.

L298N Motor Driver- Controls the motion of the robot by regulating the speed and direction of the motors.

DC Motors with Gear Mechanism- Provides movement to the wheels, allowing the robot to navigate various terrains.

Servo Motor- Enables precise angular movement for specific tasks such as camera positioning or object handling.

Metal Detector Module- Used for basic bomb or metal detection, enhancing the robot's threat detection capabilities.

Jumper Wires-
Facilitates all internal circuit connections between components.

Software Tools:

Programming Language: C++-
Used for coding the embedded logic of the robot on the ESP32-CAM microcontroller.

Frontend Technologies: HTML & CSS-
Designed and developed a user-friendly **web-based interface** to remotely monitor and control the robot.

2. Objectives

- To develop a mobile robotic system capable of real-time surveillance using an ESP32-CAM module.
- To enable remote monitoring and control through a user-friendly web-based frontend interface.
- To integrate a metal detection feature for identifying potential bomb threats in restricted or dangerous areas.
- To design a robot that can navigate rough terrains and confined spaces using motorized wheels and servo control.
- To ensure continuous operation using a rechargeable battery system and efficient power management.
- To enhance the safety of military personnel by reducing human involvement in high-risk surveillance tasks.
- To demonstrate the application of IoT and embedded systems in defense and security operations.

3. Data Collection And Methodology

3.1 Methodology

The methodology for this project was based entirely on secondary data collected from reference books related to robotics, embedded systems, and Internet of Things (IoT). These books provided essential knowledge on the working principles of components like the ESP32-CAM, motor drivers, metal detectors, and servo motors. The concepts learned were applied to design the hardware structure and functionality of the robot. Programming logic for the ESP32-CAM was implemented using C++ as guided by embedded systems literature. Additionally, web development books were referred to while creating a simple and responsive user interface using HTML and CSS for remote control and monitoring. The insights gained from these academic resources shaped the complete design and execution of the Detective Military Robot.

Books including:

"Programming the ESP32" by Mike McRoberts – For understanding ESP32 architecture and camera module integration.

"Internet of Things: A Hands-On-Approach" by Arshdeep Bahga and Vijay Madisetti – For IoT design, data handling, and real-time monitoring.

"Introduction to Embedded Systems" by Shibu K.V. – For embedded programming using C++ and microcontroller fundamentals.

3.2 Data collection

Roles And Responsibilities:

1. Problem Identifier and Researcher

At the initial stage of the project, I took on the role of a problem identifier and researcher. I focused on recognizing a real-world issue that required attention—enhancing surveillance in sensitive areas such as borders and restricted zones. Understanding the importance of security in such environments, I shaped the concept of a mobile robot equipped with monitoring and detection features. To strengthen my knowledge base, I studied academic books on IoT, robotics, and embedded systems. This helped me gain technical clarity and guided me in selecting a feasible and meaningful direction for the project.

2. Project Designer and Planner

As the project moved forward, I assumed the role of a designer and planner. I created a structured blueprint for the development process, which included defining project goals, timelines, and technical needs. I carefully selected each hardware component such as the ESP32-CAM, L298 motor driver, servo motor, and metal detector—based on functionality and compatibility. This phase helped establish a clear path for implementation and ensured that every step aligned with the ultimate goal of building a reliable and responsive surveillance robot.

3. Hardware Developer

Taking on the role of hardware developer, I physically assembled the robot by integrating all electronic components. I ensured accurate connections between the camera module, motor driver, wheels, and servo using jumper wires. I paid close attention to voltage levels and power supply requirements by using 2500mAh batteries with a charging module. I made sure the setup was stable and functional for real-time operations. My focus was on building a mobile unit that could operate reliably on various terrains and perform essential surveillance tasks.

4. Documenter and Presenter

I fulfilled the role of documenter and presenter by compiling the entire process into a detailed research proposal for the Avishkar Research Convention. I documented the project's objectives, methodology, materials used, and outcomes clearly and professionally. This step was essential in communicating the practical relevance and

innovation behind the robot. Preparing the final presentation helped me articulate the vision, technical journey, and potential impact of the project in both academic and real-world contexts.

5. Programmer
   In the role of programmer, I was responsible for coding the ESP32-CAM using C++. This code managed the live video streaming, movement of the robot, and sensor responses. I implemented logical sequences for motor control and ensured smooth streaming from the camera. The programming also included integrating the metal detector's response system, allowing the robot to identify potential threats effectively. This role required logical precision and testing to make sure the robot functioned as expected during live operation.

4. Content Analysis

4.1 Roles and Responsibilities – Analysis and Findings

1. Problem Identifier and Researcher
I recognized the real-world challenge of ensuring effective surveillance in border and restricted areas. To gain clarity and technical direction, I referred exclusively to academic books on IoT, robotics, and embedded systems. This role helped me understand the scope of the issue and shaped the foundation of the project idea — developing a mobile robot with surveillance and bomb detection capabilities.

2. Project Designer and Planner
In this phase, I outlined a structured plan for executing the project. I defined clear objectives, milestones, and timelines. I selected the appropriate hardware components based on their compatibility, function, and relevance to the surveillance task. This planning ensured a smooth workflow during development and prevented delays or mismatches in the later stages.

3. Hardware Developer
I assembled and wired the electronic components, such as the ESP32-CAM, L298 motor driver, wheels, servo motor, and metal detector. I ensured proper power distribution using a 2500mAh battery and charging module. The physical assembly of the robot required careful attention to stability and efficient integration of each part to maintain mobility and performance.

4. Programmer
Using the C++ programming language, I wrote the embedded logic for the ESP32-CAM. The program handled live video streaming, robot movement, and metal detection feedback. I ensured the correct sequencing of commands, sensor data interpretation, and interaction between modules to allow real-time functionality.

5. Concluding Remark

The *Detective Military Robot* was envisioned as a compact, mobile surveillance system that could assist in safeguarding borders and restricted areas—regions that are highly sensitive and often too risky for human patrolling.

The project's aim was not only to create a functional prototype but also to address critical real-world challenges such as threat detection, autonomous navigation, and remote monitoring. Equipped with an ESP32-CAM for live streaming, a metal detector for bomb detection, and a web-based interface for ease of control, the robot embodies the fusion of embedded systems and frontend development in one cohesive solution.

Developing this robot required a deep understanding of hardware integration, embedded programming in C++, frontend design using HTML/CSS, and system optimization for terrain mobility and battery efficiency. Each phase of the project—from identifying the problem and studying IoT systems through academic resources, to planning, prototyping, testing, and presenting—was a learning experience that pushed both technical and creative boundaries. This experience under Avishkar helped in cultivating not just engineering skills, but also project planning, documentation, and presentation abilities, which are crucial for any research or innovation. It highlighted how grassroots-level student research can bring forward impactful contributions to national security, automation, and robotics.

The Detective Military Robot is not just a project—it's a representation of how students can contribute to society by applying academic knowledge to practical, socially relevant problems. The insights and feedback received during Avishkar have laid the foundation for potential future enhancements, including better automation, multi-sensor integration, and real-time AI processing, if scaled further.

This journey reaffirmed that with dedication, innovation, and the right platform like Avishkar, even a single student can engineer solutions that make a difference.

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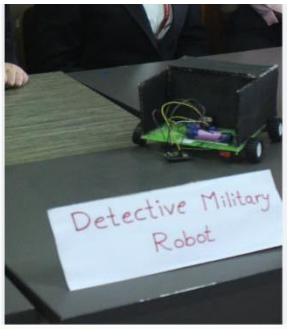
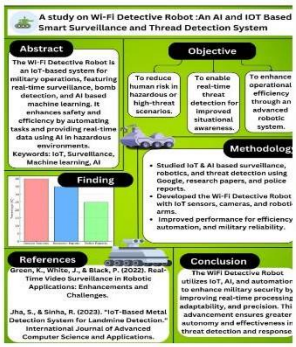

Detective Military
Robot


DETECTIVE MILITARY ROBO


A study on Wi-Fi Detective Robot :An AI and IOT Based Smart Surveillance and Thread Detection System
Abstract
The WI-FI Detective Robot is an IoT-based system for military operations, featuring real-time surveillance, bomb detection, and AI based machine learning. It enhances safety and efficiency by automating tasks and providing real-time data using AI in hazardous environments.
Keywords: IoT, Surveillance, Machine learning, AI
Objective
To reduce human risk in hazardous or high-threat scenarios.
To enable real-time threat detection for improved situational awareness.
To enhance operational efficiency through an advanced robotic system.
Methodolog
Studied IoT & AI based surveillance, robotics, and threat detection using Google, research papers, and police reports.
Developed the Wi-Fi Detective Robot with IoT sensors, cameras, and roboti arms.
Improved performance for efficiency automation, and military reliability.
Finding
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Conclusion
The WiFi Detective Robot utilizes IoT, AI, and automatior to enhance military security by improving real-time processing adaptability, and precision. Thi advancement ensures greater autonomy and effectiveness ir threat detection and response


University of Mumbai
19th Aavishkar
Inter-Collegiate / Institute / Department Research Convention
(Zonal Round)
Academic Year 2024-25
Certificate of Participation
This is to Certify that Ms. Nawale Prachi Santosh of Chetana's Hazarimal Somani College of Commerce and Economics, Smt. Kusumtai Chaudhari College of Arts, Bandra has participated and presented a Research Project titled Detective military robot in Engineering and Technology Category and UG Level at 19th Aavishkar: Inter-Collegiate / Institute / Department Research Convention (Zonal Round) organized by the University of Mumbai at Bhanumati Kishandas Shroff College of Arts and Maganlal Hargovinddas Shroff College of Commerce, Kandivli, Mumbai on December 13, 2024for Zone III (Mumbai III).
Dr. Minakshi Gurav
OSD,
Aavishkar,
University of Mumbai
Dr. Sunil Patil
Director,
Department of Students' Development,
University of Mumbai
December 13, 2024
Kandivli, Mumbai