Project Phase – 1 Review

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SECTION NO. 05   **BATCH NO - 04**

INTELLIGENT SURVEILLANCE ROBOT

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Abstract

The objective of this Project is to design and create an autonomous robot with a focus on conducting domestic surveillance, while also being versatile enough for various multi-application purposes. Robots have become increasingly integral in everyday life by reducing the need for manual labor and minimizing errors. The robot being developed can either be controlled manually by specifying the surveillance zone or it can operate autonomously based on the user-defined tasks. Its primary function is to navigate through areas, collecting audio and visual data, which is then relayed back to the user or owner. This robot can be managed remotely through either a smartphone or a desktop computer, leveraging Internet of Things (IoT) technology for communication. It is equipped with a wireless camera module used in the multiple directions for surveillance of real-time video transmission under all lighting conditions. Control commands are executed via an Arduino microcontroller, enabling both manual and automatic operation. The robot employs various sensors to collect data, which is processed by the Arduino microcontroller to direct the robot's actions. Moreover, the robot is equipped with metal detection capabilities, allowing the user to identify metal-based explosives in war Fields. This feature not only enhances its surveillance capabilities but also extends its utility to defense applications, offering a comprehensive solution for environmental monitoring and security.

Motivation behind the project:

The motivation behind this project stems from a multifaceted understanding of the evolving role of technology in enhancing security, efficiency, and convenience in both domestic and specialized environments. As societies become increasingly complex and interconnected, the demand for advanced surveillance and monitoring solutions has surged, not only for ensuring the safety and security of personal spaces but also for contributing to broader applications such as defense and environmental monitoring. Manual surveillance and data collection are prone to errors and can be labor-intensive. By automating these processes, the robot aims to reduce the likelihood of errors and the need for continuous human oversight, thereby increasing efficiency and reliability in data collection and surveillance tasks. In military operations, having accurate, real-time information about the battlefield and potential threats is crucial. An autonomous robot capable of conducting surveillance and can provide invaluable intelligence, enabling better-informed decisions and strategic planning.

Literature Survey

S.no	Author	Title	Problem	Summary
1	Min-Fan Ricky Lee	Autonomous Surveillance for indoor Security Robot	The performance and accuracy of these system is low	"Developing an Indoor Security Robot with Autonomous Surveillance Capabilities" This project focuses on creating a sophisticated indoor security robot equipped with autonomous surveillance features, enhancing its ability to patrol and monitor indoor environments for enhanced security.
2	Akilan.T	Surveillance Robot in Hazardous Place Using IoT Technology	IoT devices, including surveillance robots, can be susceptible to hacking and cyber-attacks.	This study introduces a surveillance robot integrated with IoT technology, providing a robust solution for monitoring and ensuring safety in hazardous places through real-time data collection and analysis.
3	G.Anandravise kar	IoT Based Surveillance Robot	Complexity of these systems require specialized personnel for maintenance and operation.	This project introduces a surveillance robot leveraging IoT technology, enhancing monitoring capabilities through real-time data collection and analysis. By integrating sensors and connectivity, the robot offers remote surveillance, enabling efficient monitoring and response in various environments for enhanced security.

Literature Survey

S.no	Author	Title	Problem	Summary
4	Yogesh Sandbhor	AI Surveillance Robot	The development, deployment, and maintenance of advanced surveillance robots integrated with IoT technology can be expensive.	This research presents an AI-powered surveillance robot designed for comprehensive monitoring and threat detection. Leveraging artificial intelligence, the robot autonomously navigates and analyzes its surroundings, offering enhanced surveillance capabilities for diverse environments.
5	Shaikh Sheob Maroof Nasima	Surveillance Robot Controlled Using an Andriod App	• performance is low • accuracy is low	This project introduces a surveillance robot controllable via an Android app, enabling remote monitoring and control capabilities. Users can navigate the robot and access real-time surveillance footage from their smartphones, enhancing convenience and flexibility in security operations.
6	Tamara Z. Fadhil	Design and implementation Surveillance Robot using ATmega328 Microcontroller	The complexity of these systems might require specialized personnel for maintenance and operation	This study presents the design and implementation of a surveillance robot utilizing the ATmega328 microcontroller. By integrating sensors and actuators, the robot offers autonomous navigation and surveillance capabilities, demonstrating the feasibility of using low-cost microcontrollers for robotic applications.

Literature Survey

S.no	Author	Title	Problem	Summary
7	S M ASHISH	Automated Hybrid Surveillance Robot	Connectivity issues, i.e. Impair the robot Functionality and time analysis of collected data	This research introduces an innovative hybrid surveillance robot equipped with both autonomous and manual control features. By seamlessly blending AI-driven automation with human intervention, the robot enhances surveillance efficiency and adaptability across diverse environments, offering a comprehensive solution for security monitoring tasks.
8	Devjyoti Gosh	Web Controlled Surveillance Robot	surveillance robots, can be susceptible to hacking and cyber-attacks.	This research introduces an innovative hybrid surveillance robot equipped with both autonomous and manual control features. By seamlessly blending AI-driven automation with human intervention, the robot enhances surveillance efficiency and adaptability across diverse environments, offering a comprehensive solution for security monitoring tasks.
9	B.R.V Pradeep	Raspberry Pi Based Surveillance Robot	• performance is low • accuracy is low	This study introduces a surveillance robot powered by Raspberry Pi, offering enhanced processing capabilities and flexibility. Leveraging the Raspberry Pi platform, the robot integrates sensors and cameras for real-time monitoring and autonomous navigation, demonstrating the feasibility of utilizing single-board computers for surveillance applications.

Literature Survey

S.no	Author	Title	Problem	Summary
10	Dr. Nookala Venu	Iot Surveillance Robot Using ESP-32 Wi-Fi CAM & Arduino	The effectiveness of these robots often depends on continuous internet connectivity for data transmission.	This project details the development of a surveillance robot employing IoT technology, ESP-32 Wi-Fi camera, and Arduino for enhanced monitoring capabilities. The integration of these components enables real-time video streaming, remote control, and sensor data collection, showcasing advanced surveillance applications.
11	L Jyoti	Military Surveillance Robot	The robots themselves could be hijacked and used for malicious purposes.	This project focuses on the development of a state-of-the-art military surveillance robot designed for reconnaissance and monitoring in challenging environments.
12	Saurabh kumar	Wireless Surveillance robot	• performance is low • accuracy is low	This project introduces a wireless surveillance robot equipped with cameras and sensors for real-time monitoring. Utilizing wireless communication, the robot offers flexibility in navigation and surveillance, making it an efficient.

Literature Survey

S.no	Author	Title	Problem	Summary
13	Anand Nayyar	Smart Surveillance Robot for Real-Time Monitoring	Sensitivity and the efficiency is low	This research presents a smart surveillance robot designed for real-time monitoring and control in both industrial and environmental settings. With advanced sensors and control systems, the robot enhances situational awareness, offering a versatile solution for diverse applications in industries and environmental monitoring
14	Suraj V Ghropade	AI based Armed Surveillance Robot	The drawback of these systems can cause the Privacy issues.	This project introduces an AI-powered armed surveillance robot designed for enhanced security operations. Integrating artificial intelligence, the robot autonomously patrols and detects threats, providing a robust defense mechanism in critical environments
15	Basavana Goud V	Surveillance Robot	• performance is low • accuracy is low	This project introduces a surveillance robot equipped with sensors and cameras for monitoring environments. Designed for versatility and efficiency, the robot offers remote surveillance capabilities, making it suitable for various applications such as security, exploration, and environmental monitoring.

Existing System

The project aims to develop an autonomous surveillance robot, versatile for domestic and multi-purpose use, with manual or autonomous navigation for collecting audio and visual data. It is remotely controllable via IoT technology through smartphones or computers, equipped with a wireless camera in the fixed position. The robot's navigation and task execution are managed by an Arduino microcontroller processing data from various sensors. And thereby offering a comprehensive solution for environmental monitoring and security.

Proposed Method

An autonomous surveillance robot with multi-application capabilities involves integrating various hardware components, sensors, and software tools to create a versatile, intelligent machine. This system combines robotics, IoT (Internet of Things), and AI (Artificial Intelligence) technologies to perform tasks ranging from domestic surveillance.

The Proposed method outlines the key components and Functionalities are

- **Camera Module:** A multi-directional wireless camera module for real-time video streaming, capable of operating under various lighting conditions.

- **Communication Module:** An ESP32 module for Wi-Fi and Bluetooth connectivity, enabling remote control and data transmission over the Internet.

- **Microphones:** For audio surveillance and voice command recognition.

- **Light Sensors:** To adjust camera settings based on the lighting conditions.

- **Domestic Surveillance:** For home security, monitoring, and eldercare.

- **Defense and Security:** Detecting hazardous materials and surveilling sensitive areas.

Proposed Method

- **Motors:** For movement and navigation.

- **Servos:** To control the camera's pan and tilt for multi-directional surveillance.

- **Power Supply:** Battery pack with a power management system for efficient energy use and long operation times.

- **Robot Operating System (ROS):** For more complex navigation and task execution, ROS can provide a flexible framework for writing software, including simulation, visualization, and advanced robotics functionalities.

- **Surveillance and Monitoring:** Continuously collects audio and visual data, analyzing it in real-time for surveillance purposes. Users can remotely access this data and receive alerts for specific events or anomalies.

- **Autonomous Navigation:** The robot can navigate through designated areas autonomously, avoiding obstacles and optimizing its path based on sensor inputs.

- **Metal Detection:** Utilizes the metal detection capability for security applications, particularly useful in scenarios requiring the identification of dangerous objects.

This proposed system represents a comprehensive approach to building an autonomous surveillance robot, emphasizing versatility, user interaction, and the integration of advanced technologies for a wide range of applications.

Block Diagram
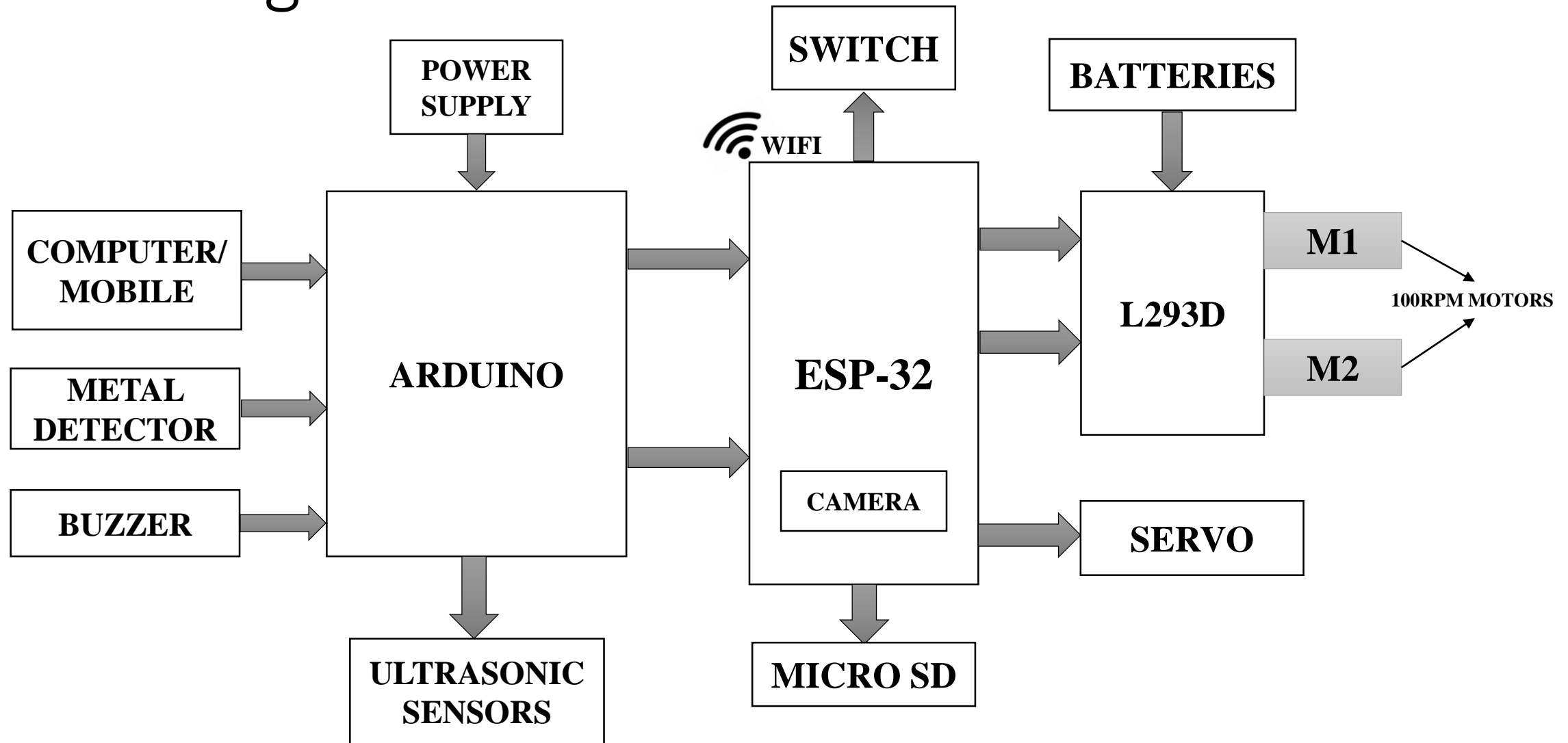
Hardware Details

- Arduino Uno
- ESP-32 Camera Module
- SG-90 Servo Motor
- L293N Motor Drive IC
- Micro SD Card
- Rechargeable Batteries
- 100RPM Motors
- Mountain Wheels
- Metal Detector
- Switch
- Jumper Wires and Connecting Wires
- Mobile and Laptop

Software Details

- Arduino IDE

- ROS (Robot Operating System)

Applications

- **Data Collection:** It can be used in various fields of research for data collection tasks, ranging from sociology (observing human interactions) to environmental science.

- **Site Surveillance:** The robot can monitor construction sites or industrial facilities for safety compliance, detecting potential hazards or unauthorized access.

- **Explosive Detection:** Its metal detection feature can be used for identifying and neutralizing mines and IEDs in war zones, enhancing the safety of military personnel.

- **Home Monitoring:** Can be used for Basic Surveillance in Home Automation, Recording video and can be easily controlled by Mobile or Desktop.

- **Construction Site Security:** Beyond safety inspections, the robot can also provide overnight security for construction sites, protecting valuable equipment and materials from theft or damage.

- **Security at Public Events:** At concerts, sports events, or public gatherings, the robot can provide an additional layer of security, monitoring for suspicious activities or items and ensuring the safety of attendees.

- **Office Surveillance:** Businesses can use the robot for after-hours surveillance, monitoring office spaces for unauthorized access or security breaches.

Expected Output

The expected outcomes from deploying an autonomous robot designed for military purposes are multifaceted, aiming to significantly enhance operational capabilities, safety, and strategic outcomes in military engagements. The project focusing on improving reducing personnel risk, detecting hazards, and ensuring technological superiority. Specifically, the expected outputs include:

1. The autonomous robot is expected to provide comprehensive real-time surveillance and reconnaissance data, thereby greatly improving situational awareness on the battlefield.

2. By taking over high-risk surveillance and reconnaissance missions, the robot is anticipated to significantly reduce the risk of casualties among military personnel.

3. The robot's multi-application design ensures that it can be deployed for a wide range of military tasks, beyond just surveillance and reconnaissance.

4. The robot is expected to provide wide-ranging and continuous surveillance coverage.

5. The integration of advanced sensors and cameras, coupled with IoT technology, enables the immediate transmission of collected data.

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Thank you