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REAL-TIME SURVEILLANCE WITH SPY ROBOT USING ESP 32

Prasad Bajarang Shinde[*1]

[*1]Student, Department Of Electronics & Telecommunication Engineering Government Polytechnic Karad, Satara, Maharashtra, India.

ABSTRACT

A In recent years, the demand for advanced surveillance systems has surged due to increasing security concerns in both residential and commercial environments. This paper presents the design and implementation of a Real-Time Surveillance SPY Robot powered by the ESP32 microcontroller, which integrates wireless communication, video streaming, and autonomous navigation capabilities. The ESP32, known for its dual-core processing power and built-in Wi-Fi and Bluetooth functionalities, serves as the backbone of the robot, enabling seamless data transmission and remote control.

Keywords: ESP 32, Ultrasonic sensor HC-05, GPS Module NEO-6m, Motor Driver - L298N 2A, Battery -Li-ion.

I. INTRODUCTION

This paper introduces a “Real -Time Surveillance SPY Robot designed using the ESP32” microcontroller, which combines advanced features such as remote video streaming, autonomous navigation, and user-friendly control interfaces. The SPY robot is equipped with a high-definition camera that allows for live video capture and transmission, enabling users to monitor their surroundings from virtually anywhere. The integration of obstacle detection sensors further enhances the robot's ability to navigate complex environments, ensuring safe operation during surveillance missions.

II. METHODOLOGY

This project integrates various components and technologies to automate Real time surveillance using spy robot. ESP 32: The ESP32 is a powerful and versatile microcontroller featuring dual-core processing, integrated Wi-Fi, and Bluetooth capabilities, making it an ideal choice for SPY robots. With its high processing speed and ample GPIO pins, the ESP32 can efficiently handle multiple tasks, such as real-time video streaming, sensor data processing, and motor control. Its low power consumption and extensive library support facilitate seamless integration with various peripherals, enhancing the robot's functionality. The ESP32's ability to connect to the internet allows for remote monitoring and control, making it a perfect solution for advanced surveillance applications. Ultrasonic Sensor: An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object’s proximity. Here we use it We have used the ultrasonic sensor like a radar system and by using it we can detect the object on the field. GPS module-NEO-6m: The NEO-6M GPS module is a compact and highly accurate positioning device widely used in robotics and navigation applications, including SPY robots. It features a built-in antenna and provides real-time location data enabling precise tracking even in challenging environments. Its easy integration with microcontrollers like the ESP32 allows for seamless communication and enhanced functionality in surveillance missions. Motor Driver- L298N-2A: The L298N-2A motor driver is a versatile dual H-bridge controller designed for driving DC motors and stepper motors in robotics applications, including SPY robots. It can handle up to 2A per channel, allowing for robust control of motor speed and direction. With its built-in thermal protection and voltage range of 5V to 35V, the L298N ensures reliable operation in various conditions. It's easy interfacing with microcontrollers like the ESP32. it is an ideal choice for in surveillance missions. Li-ion Battery: A lithium-ion (Li-ion) battery is a lightweight, rechargeable power source ideal for spy robots. It offers high energy density, delivering long operating times on a single charge. Li-ion batteries are known for their stable voltage output, ensuring consistent performance. A SPY robot operates by utilizing a combination of sensors, cameras, and communication modules to gather and transmit information discreetly. The core components include a microcontroller (like the ESP32) that processes data and controls the robot's movements. It typically employs a motor driver (such as the L298N) to maneuver its wheels or tracks, while a GPS module (like the NEO-6M) provides location tracking. The robot can be remotely controlled or programmed for autonomous navigation,

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allowing it to explore environments and capture video or audio for surveillance purposes. Data collected is transmitted wirelessly to a remote user for real-time monitoring and analysis

III. BLOCK DIAGRAM

A block diagram for the IOT-Based Plant Watering System typically includes the following components:

1. Power Supply: Provides power to all components in the system, including the ESP 32, ultra sonic sensor, GPS module, and motor driver.
2. Ultrasonic Sensor: the ultrasonic sensor like a radar system and by using it we can detect the object on the field.
3. ESP8266 (Node MCU): This microcontroller acts as the "brain" of the system, processing the sensor data and controlling the all sensors and actuators.
4. GPS Module Neo-6m: It features a built-in antenna and provides real-time location data enabling precise tracking even in challenging environments.
5. Motor Driver: allowing for robust control of motor speed and direction.
6. Firebase Server: This cloud-based platform enables remote monitoring and control of the system through a smartphone app.

BLOCK DIAGRAM.

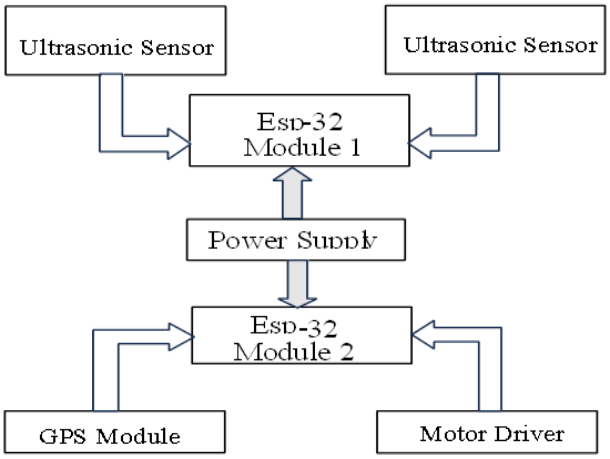

Figure 1: Block diagram

CIRCUIT DIAGRAM

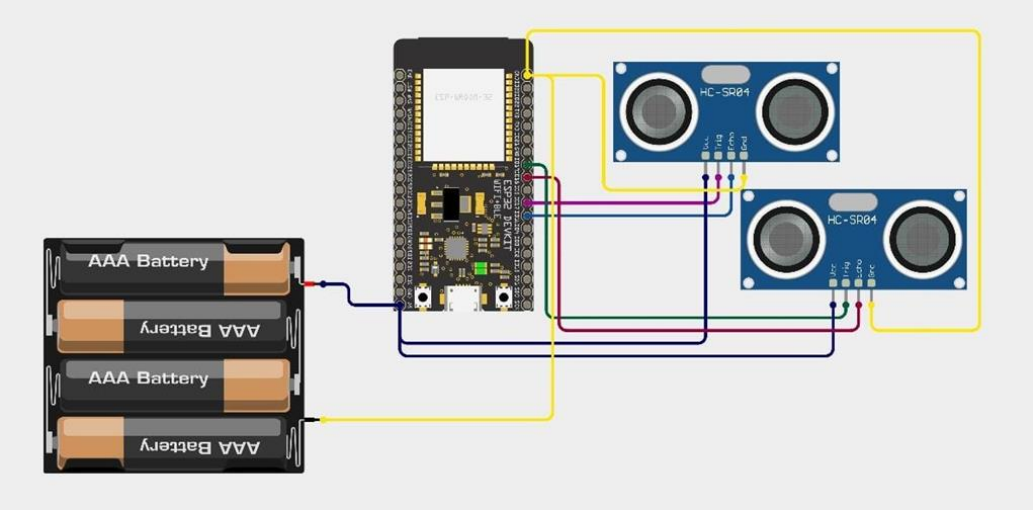

Figure 2: Interfacing of ultra-sonic sensor with ESP-32

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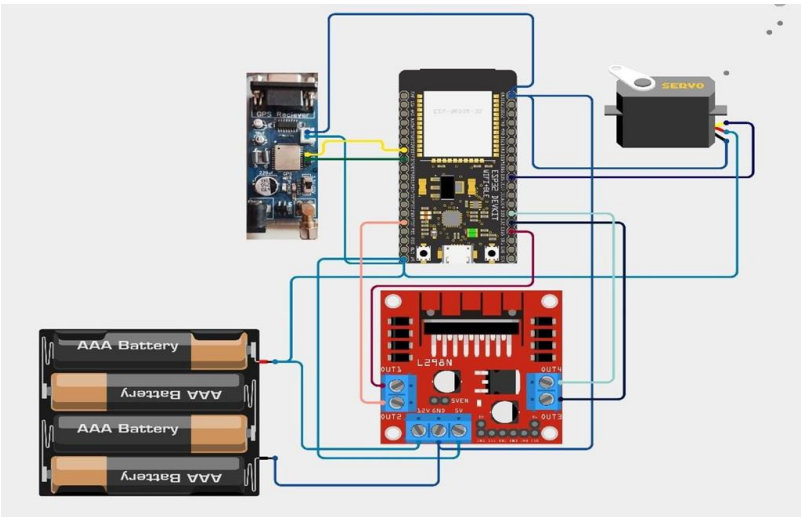

Figure 3: Interfacing of GPS module, motor driver and servo motor with ESP-32

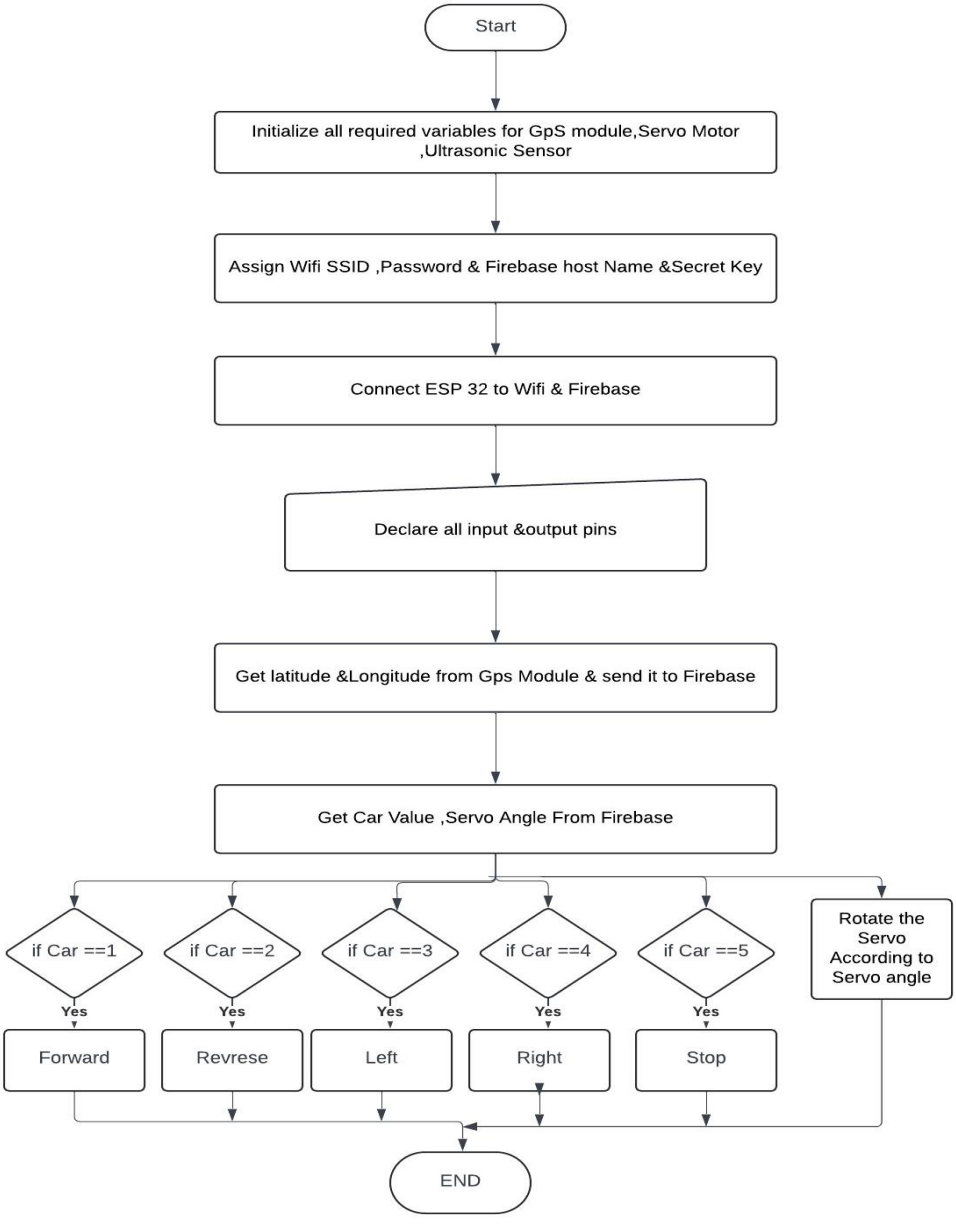

Figure 3: Flow-chart it shows how the all function are to be executing

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IV. RESULT

The ESP32 captures real-time video or images using a camera module. Simultaneously, it collects data from other sensors like ultrasonic, infrared, or temperature/humidity sensors. The microcontroller processes this data, performing tasks like image analysis, obstacle detection, and line following. Based on the processed data, the ESP32 sends control signals to the motor driver, which in turn controls the robot's movement. The captured video or images, along with sensor data, can be transmitted wirelessly to a remote device using Wi-Fi or Bluetooth. The remote device then displays the received data, enabling remote monitoring and control of the robot.

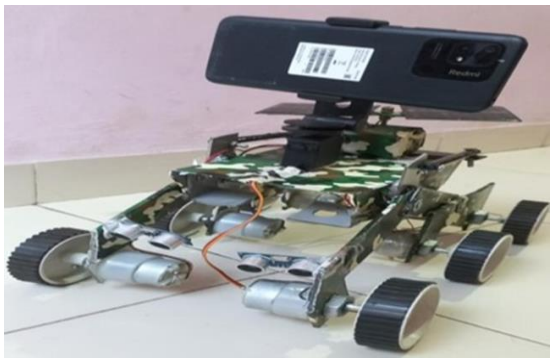

Figure 4: Actual Module of SPY Robot

Figure 5: GPS tracking system using MIT interface

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V. FUTURE SCOPE

AI Integration: By incorporating AI and machine learning, robots can make autonomous decisions, navigate complex environments, and adapt to changing conditions. Obstacle Avoidance: Advanced sensor fusion (e.g., LiDAR, ultrasonic, and camera sensors) will enable robots to navigate obstacles with greater precision and efficiency. Encrypted Communication: Robust encryption techniques will protect sensitive data transmitted by the robot. Network Resilience: Advanced networking protocols will ensure reliable and secure communication, even in challenging environments.

VI. CONCLUSION

In conclusion, the development and implementation of the spy robot project represent a significant advancement in the field of robotics, surveillance, and reconnaissance. Through meticulous design, engineering, and testing, we have successfully created a versatile and capable platform capable of addressing a wide range of applications and scenarios. The spy robot's mobility, sensor capabilities, communication systems, and stealth features combine to provide a robust solution for various real-world challenges.

ACKNOWLEDGEMENTS

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VII. REFERENCE

[1] https://youtu.be/9IO2vdpOdI0?si=UEAG3NN3TE00yXQo
[2] https://youtu.be/pD2VFKUlWC8?si=GBBaZ07mK2viEzDP
[3] https://www.elprocus.com/robots-in-military-a-spying-robot/
[4] https://www.irjmets.com/uploadedfiles/paper/issue_6_june_2023/42795/final/fin_irjmets1688281501.pdf
[5] "Robotics: Modelling, Planning and Control" by Bruno Siciliano and Lorenzo Sciavicco: This comprehensive textbook covers the fundamentals of robotics, including sensing, planning, and control, which are essential for designing a spy robot.
[6] "IEEE Transactions on Robotics" and "Journal of Field Robotics": These academic journals publish cutting-edge research in robotics, including articles on sensors, algorithms, and applications relevant to spy robots. They provide valuable references for incorporating the latest advancements into your project.