

## DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

### Industry Oriented Mini Project

**Title** : ESP32-CAM Based Surveillance System

**Under the Guidance of** ~ Ms.M.Bhavana

**Presented by Batch : A-19**

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# Abstract

The **ESP32-CAM Based Surveillance System** offers a cost-effective and efficient solution for real-time remote monitoring. Utilizing the ESP32-CAM microcontroller, the system streams live video over Wi-Fi, accessible via smartphones or personal computers. An integrated motion detection feature enhances security by automatically triggering video recording or sending instant alerts when movement is detected within the camera's field of view. Recorded footage can be stored locally on a microSD card or remotely through cloud services, providing flexible storage options based on user needs. Beyond its practical applications in securing homes, laboratories, and small offices, the successful development of this system highlights the potential of affordable embedded technology in smart monitoring applications. Designed, implemented, and deployed with a focus on simplicity and reliability, the ESP32-CAM Based Surveillance System demonstrates how accessible components can be seamlessly integrated to create intelligent and responsive surveillance solutions.

# Equipment

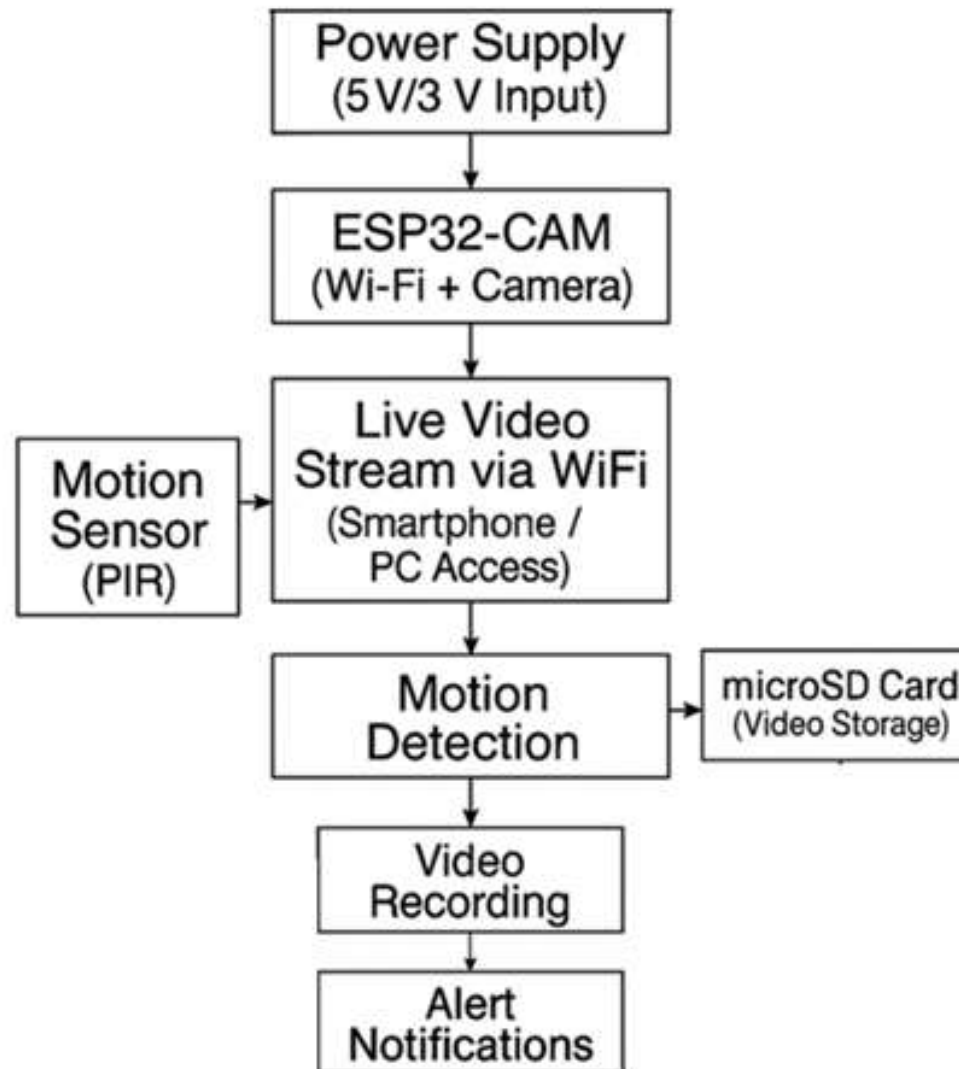
## **Hardware :**

1. ESP32-CAM
2. FTDI Module (USB to Serial Converter)
3. PIR (Passive Infrared) Sensor
4. LEDs
5. Storage : microSD Card

## **Software :**

1. Arduino IDE

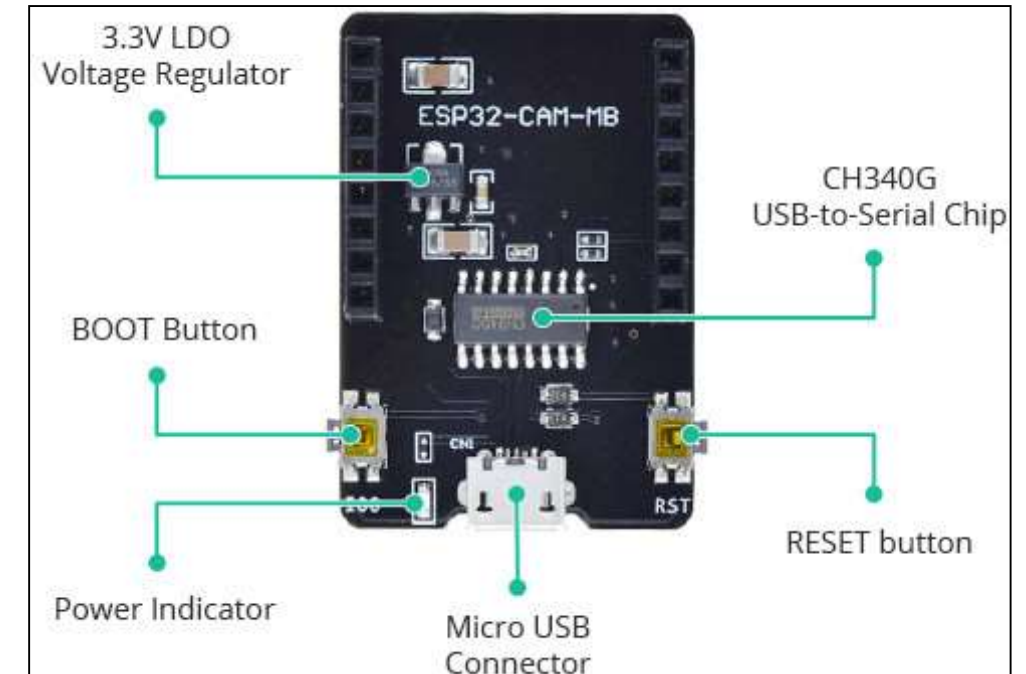
# Block Diagram



# Pin Diagrams

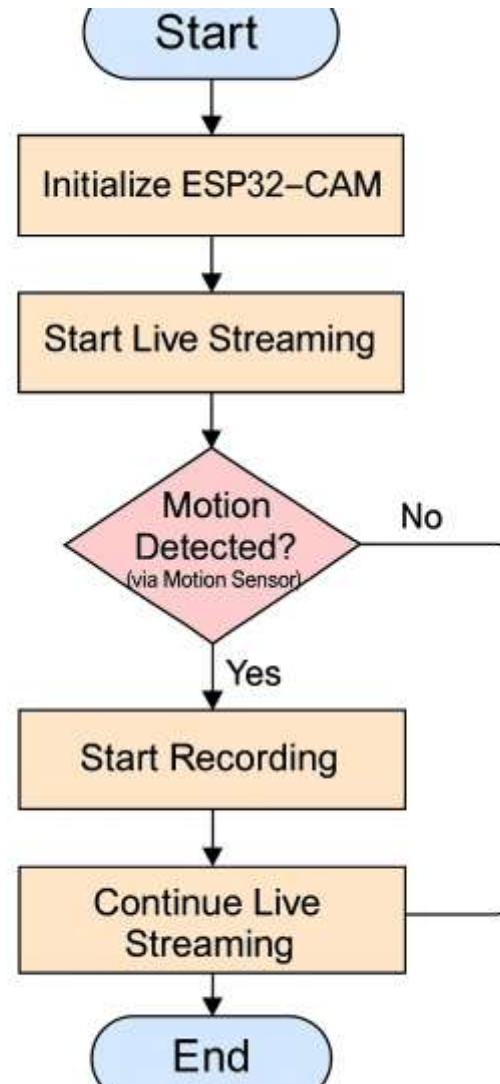


**ESP32cam**

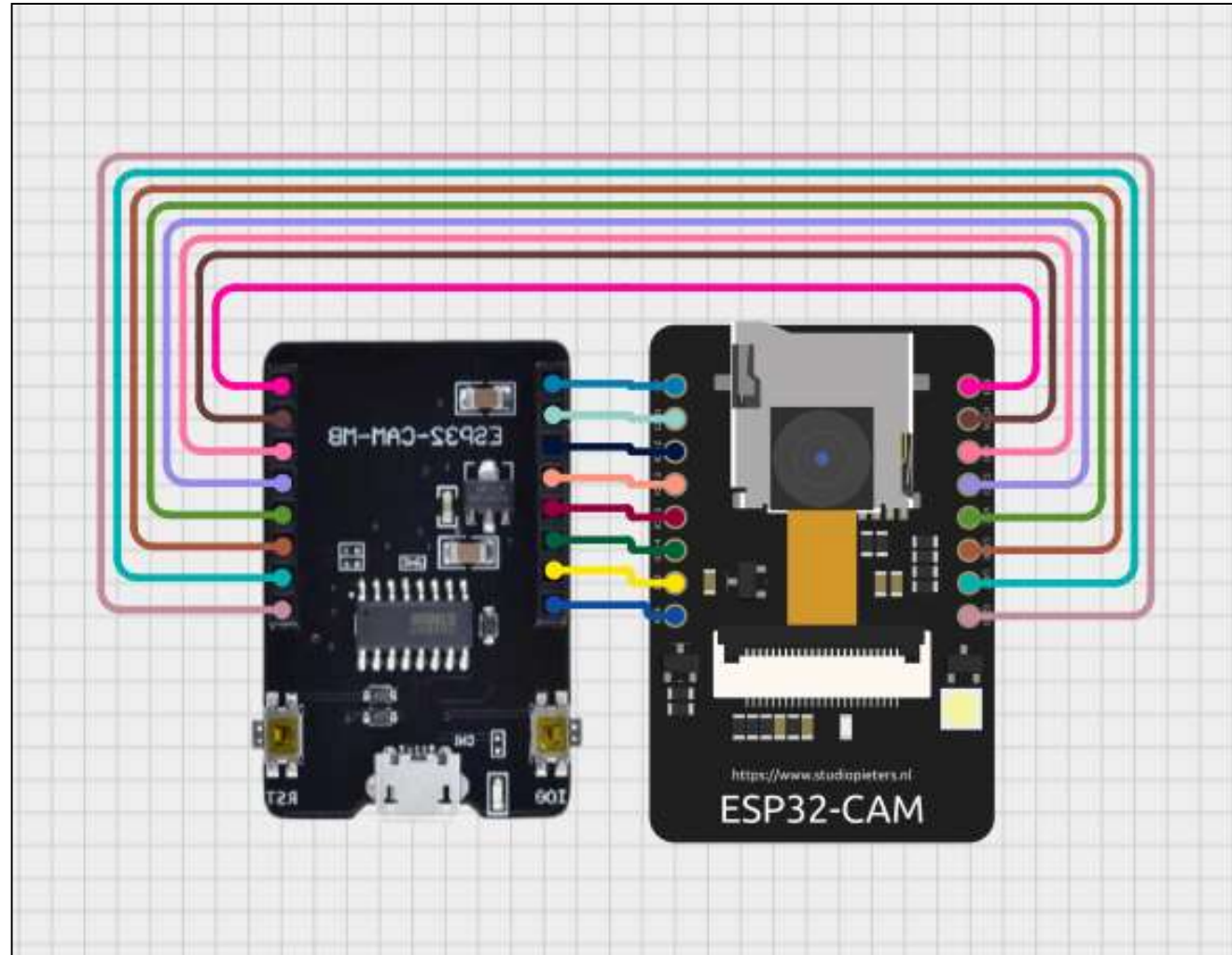


**ESP32cam  
Mother Board**

# Flow Chart



# Circuit Diagram





# Working Process:

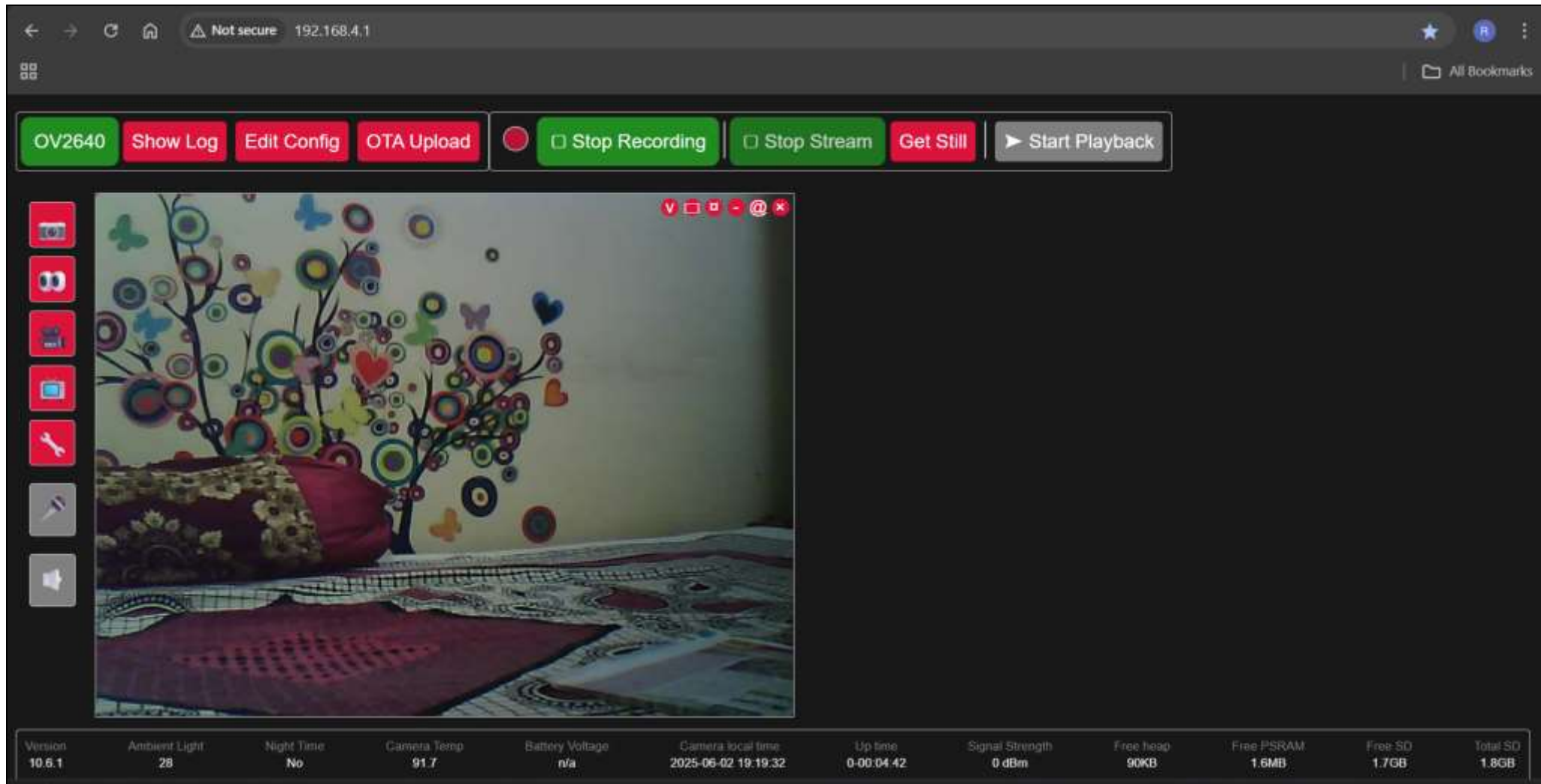
- The **ESP32-CAM Based Surveillance System** operates by utilizing the ESP32-CAM microcontroller module, which is programmed and interfaced using an FTDI USB-to-Serial Converter. Once powered on and connected to a Wi-Fi network, the ESP32-CAM module initiates a live video stream accessible via a smartphone or personal computer.
- A **PIR (Passive Infrared) Sensor** is integrated with the system to detect motion within its range. When motion is detected, the PIR sensor sends a signal to the ESP32-CAM, triggering it to perform a predefined action — either start recording video footage or send an instant alert notification to the user through the connected network.
- The recorded video data can be stored locally on a **microSD card** inserted into the ESP32-CAM or optionally uploaded to a **cloud storage service** for remote access and backup. Additionally, **LED indicators** are incorporated to display system states such as power status, recording mode, or motion detection alerts.
- This system allows users to remotely monitor environments in real-time, offering a reliable, budget-friendly, and customizable surveillance solution suitable for home, office, or laboratory applications.



# Simulation Model



# Simulation Output



# Advantages & Applications

## **Advantages :**

1. Provides real-time remote video monitoring via smartphone or PC.
2. Detects motion using a PIR sensor, triggering alerts or recordings.
3. Serves as a budget-friendly surveillance system for homes and offices.
4. Suitable for monitoring sensitive areas in laboratories.
5. Offers a customizable solution for various environmental monitoring needs.

## **Applications :**

1. Home security – Monitor doors and rooms for intrusions.
2. Office monitoring – Watch over sensitive areas after hours.
3. Lab surveillance – Track activity near equipment.
4. Elderly/baby care – Remote monitoring for safety.
5. Remote property watch – Guard farms or construction sites.

# Conclusion

The ESP32-CAM Based Surveillance System demonstrates how low-cost, readily available hardware can be effectively used to create a reliable and intelligent remote monitoring solution. By combining real-time video streaming, motion detection, and flexible storage options, the system provides an efficient and customizable surveillance tool suitable for various environments. Its successful implementation underscores the potential of embedded systems in enhancing security and automation, making advanced monitoring accessible to a wider range of users.

# Future Scope

1. Integration with advanced AI/ML for smarter object recognition and analytics.
2. Improved low-light performance for enhanced nighttime surveillance.
3. Development of self-powered versions using batteries or solar energy.
4. Seamless integration with existing smart home ecosystems.
5. Enhanced data security and encryption for video streams and storage.

# References

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- [2] A. Agarwal and P. Kumar, “Smart Surveillance System Using ESP32,” *Journal of Embedded Systems and Processing*, vol. 5, no. 2, pp. 12–17, 2024. [Online]. Available: <https://journalspub.com/wp-content/uploads/2024/07/1-9-SMART-SURVEILLANCE-SYSTEM-USING-ESP32-3.pdf>
- [3] M. R. Patel, “Smart surveillance system using ESP32 and camera-based motion detection with IM technology,” *ResearchGate*, May 2024. [Online]. Available: [https://www.researchgate.net/publication/382266789\\_Smart\\_surveillance\\_system\\_using\\_ESP32\\_and\\_camera-based\\_motion\\_detection\\_with\\_IM\\_technology](https://www.researchgate.net/publication/382266789_Smart_surveillance_system_using_ESP32_and_camera-based_motion_detection_with_IM_technology)
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