Wi-Fi Security Camera using ESP32-CAM

Project Overview

This **Wi-Fi Security Camera** system uses an **ESP32-CAM module** to capture live video and stream it over Wi-Fi. It can be accessed remotely via a web interface, making it a cost-effective surveillance solution. The system can also include **motion detection** and **email alerts** for enhanced security.

Objectives

☑ **Stream live video** over Wi-Fi to any device (PC, smartphone).
☑ **Enable remote access** via a web browser.
☑ **Capture images when motion is detected** *(optional)*.
☑ **Store footage on an SD card** *(optional)*.
☑ **Send email notifications** when motion is detected *(optional)*.

Components Required

1. **ESP32-CAM Module** – Captures and streams video.
2. **FTDI Programmer** – Used to upload the code to ESP32-CAM.
3. **MicroSD Card (Optional)** – Stores images/videos locally.
4. **PIR Motion Sensor (Optional)** – Detects motion for alerts.
5. **5V Power Supply (USB Adapter/2A Power Source)** – Powers the ESP32-CAM.
6. **Jumper Wires** – For connections.

How the System Works

1. The **ESP32-CAM captures live video** and hosts a web server.
2. The **user connects to the camera's web interface** via an IP address.
3. The **video feed can be accessed from any device** connected to the same network.
4. If a **motion sensor is added**, the camera **captures images or sends alerts** when movement is detected.
5. The **data can be stored on an SD card or uploaded to a cloud service** *(optional)*.

Wiring Diagram

ESP32-CAM to FTDI Programmer Connection (for programming)

ESP32-CAM   FTDI Programmer

ESP32-CAM	FTDI Programmer
5V	5V
GND	GND
U0T (TX)	RX
U0R (RX)	TX
IO0	GND (for flashing mode)

Note: Remove IO0-GND connection after uploading the code.

ESP32-CAM Code for Wi-Fi Streaming

This code starts a **web server** that streams the camera feed over Wi-Fi.

```
#include "esp_camera.h"
#include <WiFi.h>

// Wi-Fi Credentials
const char* ssid = "Your_WiFi_Name";
const char* password = "Your_WiFi_Password";

void startCameraServer();

void setup() {
    Serial.begin(115200);

    // Connect to Wi-Fi
    WiFi.begin(ssid, password);
    while (WiFi.status() != WL_CONNECTED) {
        delay(500);
        Serial.print(".");
    }
    Serial.println("\nWiFi connected!");

    // Start Camera
    startCameraServer();
    Serial.println("Camera Ready! Stream at: http://" +
WiFi.localIP().toString());
}

void loop() {
    delay(10000);  // Keep the program running
}
```

How to Use the Wi-Fi Security Camera

1. **Upload the code** to ESP32-CAM using FTDI Programmer.
2. **Connect ESP32-CAM to Wi-Fi** (check the Serial Monitor for the assigned IP address).
3. **Enter the IP address in a web browser** (e.g., `http://192.168.1.100`).
4. **View the live video stream** on your mobile or PC.
5. (Optional) **Use a PIR sensor** to enable motion detection alerts.

Features & Benefits

✅ **Live video streaming** over Wi-Fi.
✅ **Remote access via browser** (no app required).
✅ **Motion detection support** for enhanced security.
✅ **SD card storage** for saving images/videos *(optional)*.
✅ **Cloud upload** using Google Drive or Firebase *(optional)*.

Future Enhancements

AI-based Face Recognition using OpenCV.
Cloud storage integration (Google Drive, Firebase).
Night Vision support using IR LEDs.
SMS/Email alerts for motion detection.

Would you like me to add **motion detection & email alerts** to the system?