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ADVANCED SURVEILLANCE SYSTEMS WITH IOT INTEGRATION

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ABSTRACT

Security cameras benefit businesses, industries, institutions, and even private homes a lot. They have an advantage in storing data and are a very essential tool for security personnel, but they are also essential for automating processes within an industry such as the chemical sector where monitoring of each reaction is vital. Such cost-effective devices are therefore a must for preventing hazardous behavior and theft. In this study, we show how to design a smart surveillance system from scratch using Espressif's latest microcontroller, ESP32. The proposed system captures images of detected objects and sends them to the user via the Telegram app. We have also integrated smoke and gas detectors to monitor and alert users about potential gas leaks or fires.

Keywords: ESP32-CAM microcontroller, Telegram application,
Child safety, home security, Internet of Things.

I.INTRODUCTION

The Microcontrollers sensors used in the Differentiation focus 'intelligent spy program' provide for enhanced control and surveillance of a targeted area. The system is designed to provide real-time monitoring of a wide variety of sensors, such as cameras, motion detectors, and other monitoring gadgets, in order to detect and alert the user to any suspicious behavior. Users may access and administer the system from anywhere thanks to the ESP32 device's ability to link to a host computer and cloud-based platform. The system's flexibility and extensibility make it possible to tailor it to individual needs and requirements. The system provides a trustworthy and inexpensive means of enhancing security and monitoring in private residences, commercial establishments, and public areas. Many different types of establishments, from companies and governments to non-profits and private households, have benefited greatly from installing surveillance systems. Instead, they assist guards in doing their jobs. data storage capacity is the driving force. As an added bonus, they are also useful in the computerized procedures employed in the chemical industry, especially in cases where constant monitoring of certain chemical reactions is required. Theft along with other catastrophic events cannot be prevented without such devices, which may be deployed for a very little cost. In this work, we provide a complete hardware and software solution for a system such a smart surveillance system based on the ESP32, the most recent microprocessor from Espressif. The suggested system captures

real-time video, sends it over the internet using the microcontroller's built-in Wi-Fi, and displays the footage on an SPI TFT Panel.

II.LITERATURE SURVEY

[1] An Internet of Things-Enabled Smart Surveillance System. IoT has seen rapid global growth in recent years. An connected to the internet of security system enables the user to remotely monitor activities and gather photographs in accordance with his preferences. The Android app enables remote monitoring and push alerts in the event of an attack. The Sensor module picks up on any movement. The system may be run in either an Automatic or Manual mode, so it can adapt to different needs. When the visitor activates the Auto mode, only then will they get notifications. The visitor could certainly adjust the camera's location from the smartphone's window and take a fresh picture after it was confirmed that the Raspberry Pi could be controlled from a window.

[2] Internet Protocol (IP) camera used for closed-circuit television (CCTV).
In order to construct real-time security surveillance systems, this article details three different ways to configure, connect, and network a wireless IP-based camera. The IP camera may be configured, interfaced, and connected using one of three currently available execution software programs. The first is using a third-party application like WANSCAM or XXCAM selling software to connect to the IP-based camera; the second is using Internet Explorer® to connect to the IP-based webcam; and the third is using MATLAB and SIMULINK on a web-ready machine to connect to the Internet. In order to create a really intelligent surveillance camera system, the provided algorithms for video streaming in real time may be used for image identification, recognition, and tracking.
Additionally, the article provides an in-depth analysis of the three approaches used to accomplish video streaming via the results of IP-based cameras. Currently, the WANSCAM and XXCAM programs provide the best data from IP-based cameras, as shown by a comparison of their success to those of other approaches.

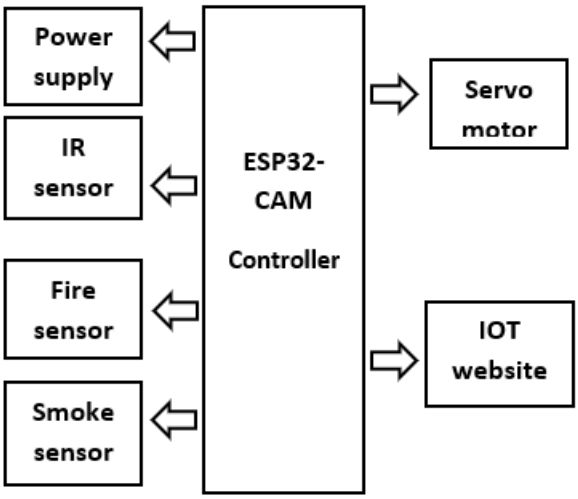
[3] Using a Monitoring Setup to Catch Criminal Activity.
CCTV cameras and other surveillance devices record 24 hours a day, 7 days a week. The vast bulk of the information collected is from periods of inactivity. In order to find the precise moment in time when a certain action was captured on film, the user needs examine the whole film. Using this approach speeds up a normally tedious process. It trims the region where activity has been detected by movement and other activities and eliminates idle data on movement using Action Recognition. It might be quite helpful in streamlining the process of analyzing footage from security cameras. A public implementation of this idea might speed up data analysis across government agencies to a breathtaking degree. With crime rates on the rise, this effort has the potential to revolutionize how evidence is gathered and processed, eventually helping to increase the frequency with which incidents are resolved.

[4The Safety of a Facial Recognition System In recent times, the need for increased safety has led to a heightened reliance on IoT-based technologies. Accuracy, large memory banks, and powerful computers have all contributed to the rapid development of face recognition technology. Computers are presently superior than humans in many tests of face recognition. There is a finite number of faces that the human mind can store. However, in circumstances when huge facial information databases are needed, computers may be used. Possible applications of a face-recognition system include public and airport surveillance, private security, and a more natural human-computer interface. This kind of solution is perfect for enhancing home automation control with both security and convenience in mind. The goal of this work is to develop an efficient, low-cost, and straightforward full-face recognition system. The primary objective is to function as an alert for home visitors and provide details about their visits through a website and mobile app. It may also be utilized in other settings, such as businesses, offices, and even airports, to track down specific individuals. Facial recognition technology has an important edge over other biometric methods since it is simple to use.

III.PROPOSED APPROCH

Acquisition simulation use an Arduino IR sensor. A single chip contains the whole control system. In this project, we'll use the ESP32-CAM to create a surveillance system that can detect the presence of undocumented workers. Using the ESP32-S microprocessor, the ESP32-CAM is a tiny camera module. Using the ESP32-CAM module, we can build a face recognition system with little effort and cost. Here, an Arduino Microcontroller will be used with an ESP32 lenses with Transmitter. In the event that the sensors detect an unwelcome visitor, they will alert a user through the IoT network. Features intended for the design; we separated the system into data gathering and control modules. The ESP32 Camera is used to show the data in real time, with the GSM Module and SIM900A under the supervision of the data processors.

IV.BLOCK DAIGRAM OF THE SYSTEM



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V.HARDWARE TOOLS

A. ESP32-CAM

The ESP32-CAM research board comprises an ESP32-S CPU, an OV2640 lens, a slot for microSD cards, and numerous GPIOs for peripheral connectivity. The ESP32-CAM is a tiny camera module that costs roughly $10 and works on the ESP32-S microcontroller. Besides with the OV2640 camera and several GPIOs for attaching peripherals, the AI-Thinker ESP32-CAM offers a microSD card for storing images.

Fig 1: ESP-32 CAM Module

B. IR SENSOR

An infrared light-emitting thermal sensor is an electronic device used to detect various environmental factors. A thermal detector is a heat sensor that can also detect motion. This sensor type, known as a "quiet IR sensor" due to its lack of infrared emission, is used mostly for monitoring purposes.

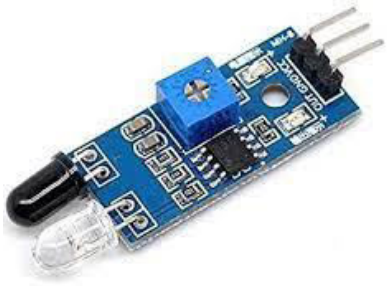

fig 2: IR Sensor

C. SERVO MOTOR

Robots and other devices that need precise control over movement and motion parameters often use a kind of motor called a micro motor. Servo motors are a special kind of actuator that may be guided to rotate to an angle specific and hold that position until further instructions are given to change the angle.

Fig 3:Servo motor

D. POWER SUPPLY

A power source is any device that allows one or more batteries to be charged using electricity from the grid. Conversion from one kind of electrical production to another is a common use, but other forms of energy, such as mechanical or chemical energy, may also be converted. Depending on your location, most computer power supply will accept either 110v/115v or 220v/240v from the wall outlet. This switch position is critical due to the fact that power outlets in various nations provide electricity with varying polarity.

E. FTDI PROGRAMMER

The FTDI programmer facilitates the transfer of data to the 32- ESP CAM during the programming process.

VI. SOFTWARE TOOLS

A. Arduino IDE

The Arduino microcontroller is often programmed via the IDE, which is a piece of Arduino.cc software used for writing, developing, and uploading code. This open source software is interoperable with nearly all Arduino modules; it requires no compilation and can be set up in no time.

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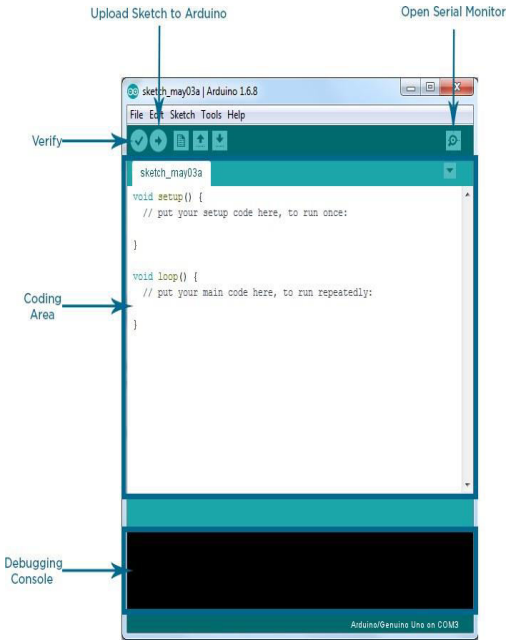
FIRST STEP: ARDUINO IDE Setup The software is available for free download on the Arduino website. Be careful to get the version of the software compatible with your computer's operating system; the application is available for many, including Os x, Microsoft, as well as and MAX.

- **The PC application version requires Window os or Windows 10 for installation; Windows 7 and earlier versions of Windows are not supported.**
- **There are three distinct sections in the IDE's working area.**
  - **1. Menu Bar**
    - **2. Text Editor**
    - **3. Output Pane**

After you download and launch the IDE programme, it will look like the image below..



Arduino IDE (Integrated Development Environment) is an open-source software development platform that allows users to write and upload code to Arduino boards. It provides a simple and user-friendly interface for programming and debugging Arduino boards. Arduino boards are microcontroller-based development boards that can be used for a variety of projects, such as The Arduino (Integrated Development Environment, or IDE) is a free and open-source software development environment for writing and uploading code to Arduino boards. It provides an easy-to-use platform for programming and troubleshooting Arduino devices. Arduino ide are arduino development boards that may be used for robotic systems, smart appliances, other Internet - of - things (Internet of Things) applications.

Step 2: To post the outline, you must first choose the adequate board and harbours for that software. The diagram below depicts what occurs when you select Tools from the Menu.

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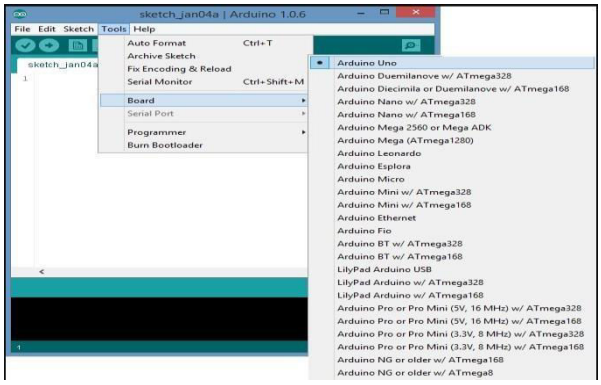

VII.EXPERIMENT SETUP

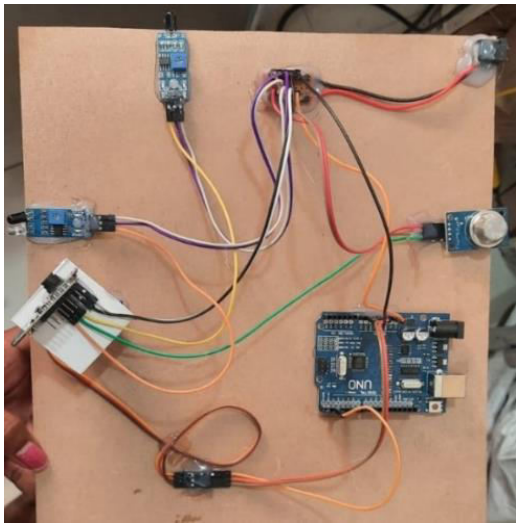

Figure 1. Experimental Setup using ESP32.

Figure 1 depicts an experimental setup of a Bot-managed movement detection method for the safety of youngsters left alone at home or at the workplace. It consists of an infrared (IR) sensor, an ESP32-CAM, plus a servo motor that is used for camera rotation. The ESP32CAM is first set up with the RX and TX pins connected to an FTDI programmer. After the code has been uploaded, connect the Infrared lens with ESP32-CAM GPIO 13 & the ground and 5V pins. The ESP32 CAM production line sends pictures to a Telegram bot. Infrared (IR) sensors, fire (and smoke) detection sensors, and so on monitor the whole building.

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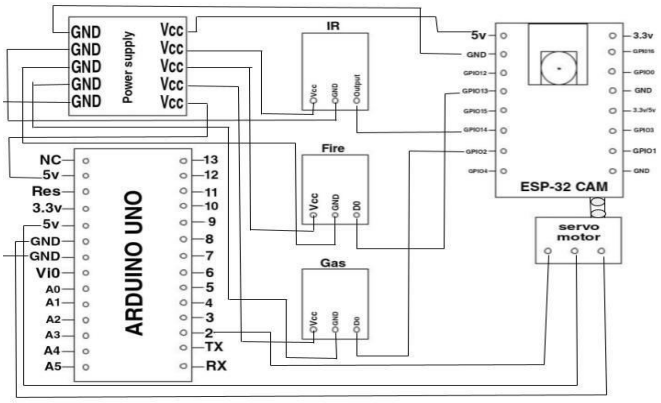
VIII. **ARCHITECTURE**



LED flash pin 4 is the connector for the power supply of the kit. When the light is activated, so do the detectors.

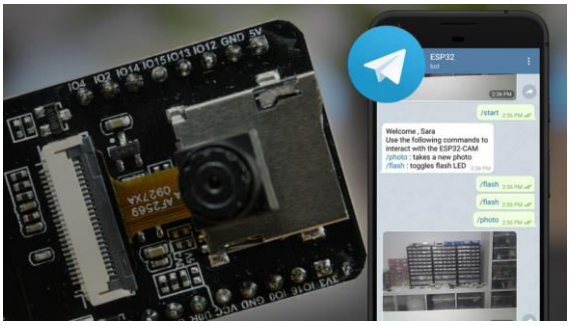
Pin 14 of the GPIO connector is connected to the IR sensor's orange signal.

The ESP32-CAM microcontroller's GPIO2 is connected to the output of the Gas sensor (pin15) for use in smoke detection.

The ESP 32-CAM microcontroller's GPIO13 port receives the sensor's output when a fire is detected.

Connecting the Servo motor's output wire to Uno pin2 acts as a motor driver, allowing the camera to be turned.

Overview of experimental setup:



1. The first step is to program a bot for Telegram for the ESP32.
2. The ESP32 is linked to an infrared (IR) motion detector.
3. Third, the ESP32 alerts your telegram account whenever the sensor detects motion.
4. Fourth, anytime motion is detected, you will get a notification on your Telegram account.

You'll program an ESP32 to act as a bot on Telegram.

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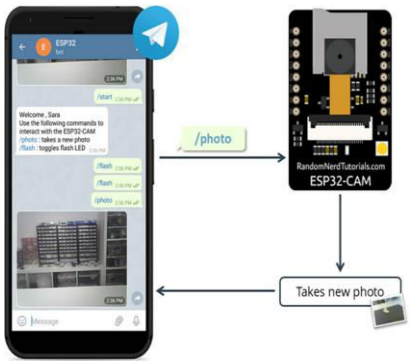

The ESP32-CAM AI-BASED Thinking module board, an infrared (IR) sensor, and a few more pins make up this little hardware-based solution. Prior to deployment, the ESP32-CAM had its code put into it through FTDI, and this method was also used to reload the code. Infrared sensors are used for this purpose since they are the only ones capable of detecting human motion. Our ESP32-CAM Chat Bot allows remote control of the camera and flash from any internet-connected device. A new photo and an alert notice may be sent to you whenever real-world motion is detected. The flame sensor can detect fires of any kind. The camera may be tilted in any direction with the help of a servo motor.

IX. CONCLUSION AND FUTURE SCOPE

The proposed solution takes use of Internet of Things-enabled devices to provide consumers with a lightweight, low-cost surveillance option. The suggested solution is cost-effective, simple to install, and effective when used in close proximity to a soft access point. Following detection, the system takes a picture using the infrared sensor and sends it to the user using the Telegram app. A smoke and fire detector does just that.

In the future, it will be possible to install a face recognition system that will be able to identify potential invaders and compile information about them from a database. Servo motors let us stop at any position and instantly post photos to the IoT platform.

X. RESULTS

In this project, we are using the ESP32-CAM module to create a sophisticated surveillance system. As a result, the IoT platform Telegram can send you a speedy alert on your mobile device if an intruder breaks into your home or if any suspicions are roaming your home or place of business. The ESP32 microcontroller underpins this system's processing and detection capabilities. A screenshot from the messaging app Telegram was included in the report on network security for text messages. This is how we made our observations within a set of restrictions. In this method, we used an Ir detector to detect motion and an ESP32-CAM to take pictures.

Figure: Displays the collected photographs of movement detection, when the Infrared sensor detects motion as shown in and notifies the user.

XI. REFERENCES

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