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Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

School of Electronics Engineering (SENSE)

PROJECT BASED LEARNING (CAMP) - REPORT

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ABSTRACT:

This project presents a system that uses a motion sensor and ESP32 camera module to detect intruders and wirelessly transmit pictures to a smartphone for immediate viewing and response. The main objective is to enhance security measures by enabling real-time intrusion detection and while also gathering visual evidence. The motion sensor detects movement within a designated area and triggers the ESP32 camera module to capture images of the detected intruders. The ESP32 module establishes a wireless connection with a smartphone application, allowing the captured images to be transmitted seamlessly. The dedicated mobile application receives the images, provides real-time alerts, and enables users to take appropriate actions upon detecting an intruder. This system offers an affordable and easily deployable solution to bolster security measures and ensure prompt responses to potential threats.

INTRODUCTION:

A motion detection camera is a type of surveillance camera equipped with sensors and algorithms that can detect motion within its field of view. It is an essential component of modern security systems , providing an automated and proactive approach to monitoring activities in various environments.

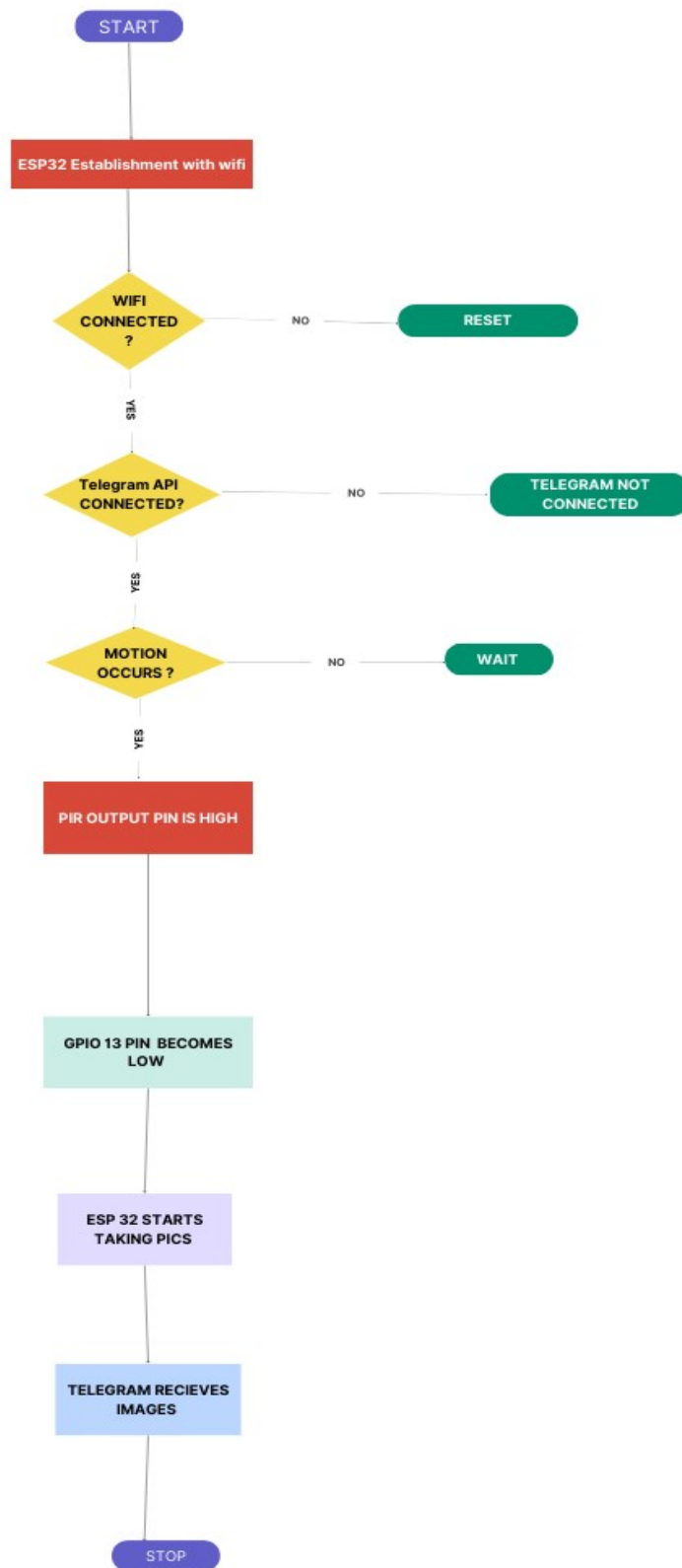
The primary objective of a motion detection camera is to capture images when it detects any movement or change in the scene. By detecting motion , these cameras can trigger specific actions, such as sending alerts. This capability is particularly useful in situations where continuous monitoring is impractical or inefficient , allowing efficient use of storage and resources.

The operation of a motion detection camera involves a combination of hardware and software components. Motion detection cameras offer various benefits in terms of security, convenience and efficiency.

ALGORITHM:

- The code is an arduino sketch for an ESP32 cam motion alert system that sends an image to the telegram app.
- The code contains the library of ESP32 and defines the pins of ESP32.
- In the setup function , the wifi connection is established by providing SSID and password in the code .
- The code checks if wifi connection is successful , if not it permits reset.
- If wifi is connected successfully , the code blinks a LED a few times.
- The PIR motion sensor state is read in loop() function.
- If motion is detected (sensor state = High) the alert telegram() function is called to send the image.
- Alert telegram() function establishes a secure TCP connection to a specified domain(Telegram API server) on port 443(HTTPS) and sends an HTTP POST request to a Telegram Bot API endpoint to send a photo.
- The loop divides the frame buffer into chunks of 1024 bytes and writes the data to the TCP connection using client_tcp.write() function.
- It waits for the server's response , and returns the response as a string.

Flow chart :



IMPLEMENTATION (REAL TIME):

- The Esp32 Camera sends the notification along with the image to the Telegram app.
- We use the TCP protocol standard as it is more reliable and connection oriented.
- Data Generation: The intruder detector system generates data, such as sensor readings or alarm signals, when it detects potential intrusions.
- Packetization: The generated data is divided into small units called packets. Each packet contains a portion of the original data and additional information required for transmission, such as the source and destination addresses.
- Network Layer Encapsulation: The packets are encapsulated at the network layer of the communication protocol stack. In the case of Wi-Fi, this would typically involve encapsulating the packets within Internet Protocol (IP) packets.
- Transport Layer Encapsulation: The encapsulated packets are further encapsulated at the transport layer, typically using the Transmission Control Protocol (TCP) . This includes adding appropriate headers and checksums for error detection and correction.
- Wi-Fi Transmission: The encapsulated packets are sent over the Wi-Fi network. Wi-Fi operates on the IEEE 802.11 standard, which defines how data is transmitted wirelessly between devices. The packets are modulated into radio waves and transmitted over the air using specific frequency channels.
- Reception and Decapsulation: The receiving device, such as a central monitoring station or another connected device, receives the transmitted packets. It then decapsulates the packets by removing the headers added during encapsulation.

- Processing and Analysis: The received data packets are then processed and analyzed by the receiving device. In the context of an intruder detector system, this analysis involves comparing sensor readings against predefined thresholds or patterns to determine if an intrusion has occurred.
- Alert or Response: Based on the analysis results, the receiving device can generate an alert or initiate a response. For example, it may trigger an alarm, send notifications to security personnel.

RESULTS & INFERENCES:

Feeding of code into ESP32 through FTDI232 serial interface :

```
Output  Serial Monitor
Writing at 0x00038000... (34 %)
Writing at 0x0003c000... (37 %)
Writing at 0x00040000... (40 %)
Writing at 0x00044000... (43 %)
Writing at 0x00048000... (46 %)
Writing at 0x0004c000... (50 %)
Writing at 0x00050000... (53 %)
Writing at 0x00054000... (56 %)
Writing at 0x00058000... (59 %)
Writing at 0x0005c000... (62 %)
Writing at 0x00060000... (65 %)
Writing at 0x00064000... (68 %)
Writing at 0x00068000... (71 %)
Writing at 0x0006c000... (75 %)
Writing at 0x00070000... (78 %)
Writing at 0x00074000... (81 %)
Writing at 0x00078000... (84 %)
Writing at 0x0007c000... (87 %)
Writing at 0x00080000... (90 %)
Writing at 0x00084000... (93 %)
Writing at 0x00088000... (96 %)
Writing at 0x0008c000... (100 %)
Wrote 950160 bytes (520978 compressed) at 0x00010000 in 8.1 seconds (effective 943.7 kbit/s)...
Hash of data verified.
Compressed 3072 bytes to 128...

Writing at 0x00008000... (100 %)
Wrote 3072 bytes (128 compressed) at 0x00008000 in 0.0 seconds (effective 1536.0 kbit/s)...
Hash of data verified.

Leaving...
Hard resetting via RTS pin...
```

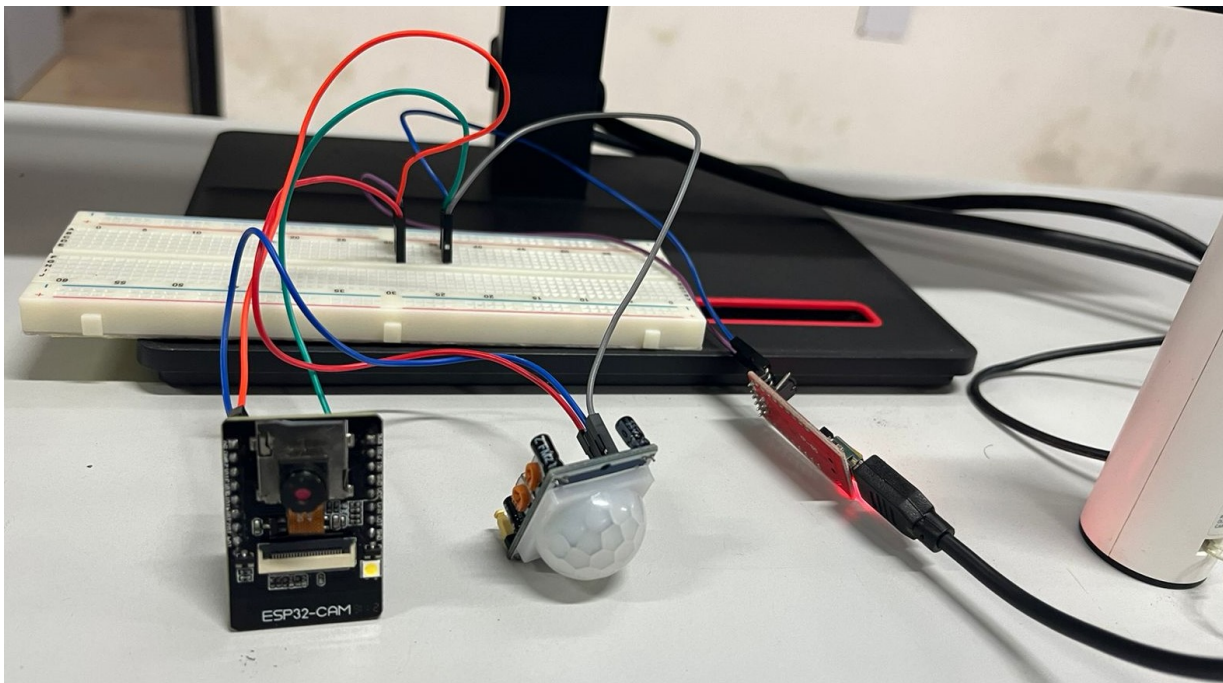
WIFI and Telegram API connection establishment with ESP32 :

```

16:50:34.944 -> Connecting to Mi A2
16:50:35.948 ->
16:50:35.948 -> STAIIP address:
16:50:35.948 -> 192.168.43.233
16:50:35.948 ->
16:50:38.336 -> 1
16:50:42.549 -> Connected to api.telegram.org
16:50:47.426 -> .....
16:51:08.409 -> 1
16:51:12.021 -> Connected to api.telegram.org
16:51:40.701 -> .....
16:51:45.716 -> {"ok":true,"result":{"message_id":2,"from":{"id":5826723062,"is_bot":true,"first_name":"camDJAS","username":"camDJAS_bot"},"chat":{"id":55837
16:51:56.763 -> 1
16:51:58.707 -> Connected to api.telegram.org
16:52:01.222 -> .....
16:52:02.825 -> {"ok":true,"result":{"message_id":3,"from":{"id":5826723062,"is_bot":true,"first_name":"camDJAS","username":"camDJAS_bot"},"chat":{"id":55837
16:52:13.899 -> 1
16:52:15.920 -> Connected to api.telegram.org
16:52:18.380 -> .....
16:52:19.613 -> {"ok":true,"result":{"message_id":4,"from":{"id":5826723062,"is_bot":true,"first_name":"camDJAS","username":"camDJAS_bot"},"chat":{"id":55837
16:52:30.584 -> 1
16:52:32.706 -> Connected to api.telegram.org
16:52:37.016 -> .....
16:52:38.320 -> {"ok":true,"result":{"message_id":5,"from":{"id":5826723062,"is_bot":true,"first_name":"camDJAS","username":"camDJAS_bot"},"chat":{"id":55837
16:52:49.406 -> 1
16:52:51.752 -> Connected to api.telegram.org
16:52:55.441 -> .....
16:52:56.657 -> {"ok":true,"result":{"message_id":6,"from":{"id":5826723062,"is_bot":true,"first_name":"camDJAS","username":"camDJAS_bot"},"chat":{"id":55837
16:53:07.624 -> 1

```

Circuit :



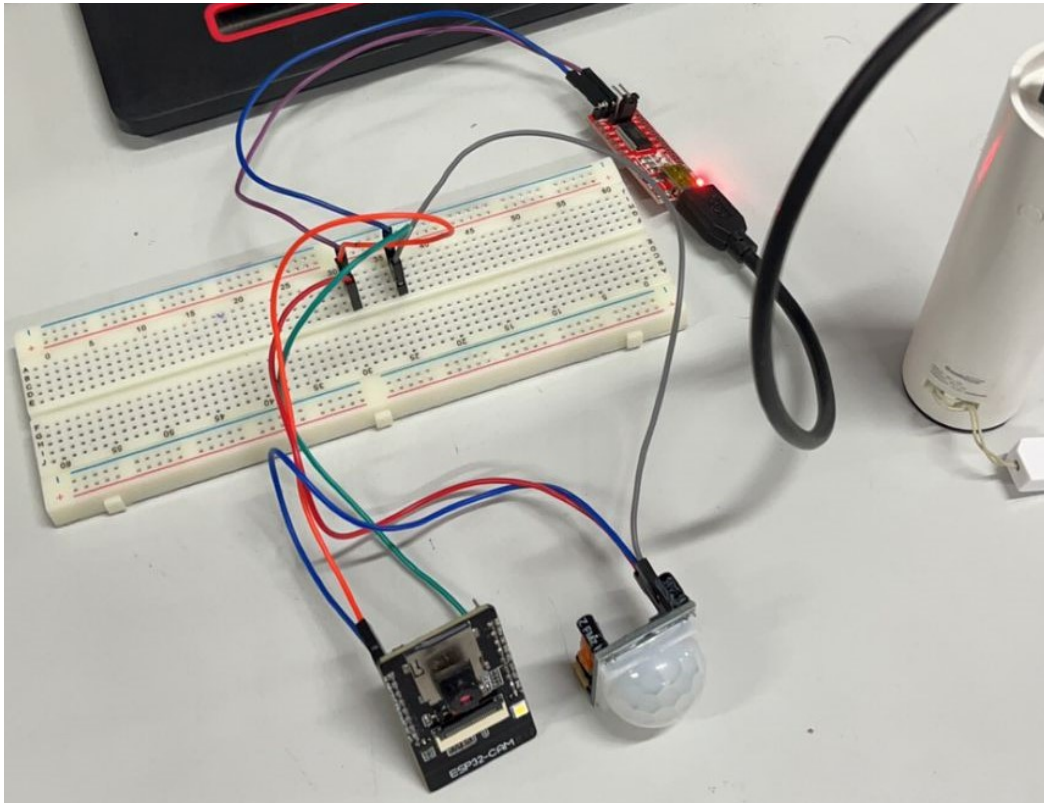


Image sent to the Telegram by motion detection :



APPLICATION ORIENTED LEARNING:

- 1.Home Security: The system can be implemented to enhance home security by detecting unauthorized entry or intrusions.
- 2.Office or Workplace Security: This system can be employed in offices or workplaces to monitor sensitive areas or restricted zones.
- 3.Retail Stores and Warehouses: Retail stores and warehouses can benefit from this system to prevent theft and unauthorized access.
- 4.Outdoor Surveillance: The project can be utilized for outdoor surveillance purposes, such as monitoring parking lots, gardens, or perimeters.
- 5.Construction Sites: Construction sites are vulnerable to theft and vandalism.

6.Public Spaces: Public spaces, such as parks or recreational areas, can utilize this system for security monitoring.

7.Personal Safety: The system can also be utilized for personal safety purposes, such as monitoring a child's room or elderly individuals.

- Cost Expenditure - Rs.2000-3000/-

CONCLUSION:

- There is an issue in uploading the code into ESP32 through FTDI 232 Serial Interface cable.
- In this way we created an intrusion detection and monitoring model which has many real life applications as mentioned .
- As far as future scope is concerned , this model can be integrated with AI(Artificial Intelligence) so that it could classify intruders based on whether the intruder is human or animal or a random thing which can really ease the users in their operation.
- The IoT refers to the network of devices and objects that can communicate and exchange data. As technology progresses, we can expect to see a greater number of connected devices, enabling smart homes, smart cities and improved automation overall.
- Forest scientists and researchers can opt and install this model in forests and caves in order to take pictures, analyze and study different species of animal kingdom.

REFERENCES:

- <https://journalofcloudcomputing.springeropen.com/articles/10.1186/s13677-018-0123-6>
- <https://www.instructables.com/Arduino-Simple-Intrusion-Detection-System/>