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SECURITY MONITORING SYSTEM FOR REMOTELY ISOLATED AREAS

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Abstract: The Internet of Things is a network of connected physical objects that can communicate and exchange data without human intervention. As a result, the Internet of Things is considered an "information society infrastructure". The IoT infrastructure used accurate sensors and seamless connectivity to assist in the collection and analysis of real-time information, enabling effective decision making. By using this technology, we present the idea of Security Monitoring System for Remotely Isolated Areas is an IOT-based system that uses the Internet for various purposes. The proposed system shows the existence of a person if it is located on the premises and provides more security by capturing and recording activities on the frames after intruder is detected. When leaving the facility, the user enters a password to activate the system. The operation of the system starts with motion detection, presuming it is because of an intruder, then reports the presence of people to the owner. The corresponding notification will also be sent to Users via SMS. The hardware implementation of the proposed system Supported by Raspberry Pi. Meanwhile, the software used is OpenCV (for video surveillance), Raspberry Pi camera Module for surveillance and GSM module (for SMS notifications).

Index Terms - IoT, Smart Surveillance, Raspberry Pi, OpenCV.

I. INTRODUCTION

In recent years, images, videos and multimedia content have increased significantly, increasing by days. Image plays an important role in the field of innovation development. Image-based data is considered to be very useful in almost every area, including security, facial recognition, and therapeutic images, and images make people's lives easier. Supervision means supervising or tracking a particular gathering or special event. Therefore, video surveillance is considered the best option for surveillance and observations. Manual monitoring is busy and time consuming. With this monitoring system, it's easy to see what's happening in a particular location, and many locations can now be monitored remotely. This paper proposes an approach for both the classification of intruder detection. Video surveillance includes analysis, which includes a list of steps such as video preprocessing, object detection and motion detection. The videos and images collected by the camera require a large amount of memory to store and process them. The deep learning approach is suitable for processing and analyzing such large amounts of data. These approaches can perform analysis of image and video datasets stored on the system. These trained deep learning models may be able to achieve accuracy in excess of 95%. The proposed system has a Pi camera module for surveillance and detecting movement in a specific area, OpenCV for image and video analysis and processing to detect the motion in the frame, then GSM module is used for sending intruder detection notification to the owner and Raspberry Pi microprocessor to program and control the function of system.

II. LITERATURE SURVEY

[1] Jayashri and Arvind (2013) implemented a fingerprint-based authentication system to unlock the door. This system assists users by allowing only users whose fingerprints are authorized by the homeowner. The system can also be used to monitor people who have invaded your home using sensors. This system is combined with several other home protection features such as gas leaks and fire accidents. Fingerprint sensors are a great system, but they are expensive and complex to integrate into your IoT setup (because you need to increase the resolution of the sensor).

[2] S. Suresh, J. Bhavya, S. Sakshi, K. Varun, and G. Debarsh presented home monitoring and security system a Security system where a PIR sensor and a temperature and humidity sensor are connected to an Arduino Uno microcontroller. The system intends to apply changes in both motion and temperature in a monitored. If the temperature is above a set threshold and a change in motion is detected, an SMS message will then be sent to the owner's mobile phone via GSM.

[3] C M SRILAKSHMI1, DR M C PADMA PROPOSED IDEA OF IOT BASED SECURITY SYSTEM WHERE IOT BASED SECURITY SYSTEM ENABLES THE user to view the activity from the remote location and capture the image based on his interest. Android app facilitates the user to receive the notifications when intrusion is detected and view the image from remote area. PIR sensors are used to detect motion. The system works in both Auto and Manual mode, notifications are sent to the user only when Auto mode is enabled in order to avoid frequent interruptions.

[4] R. R. Ragade made a system called Embedded home surveillance system with pyroelectric infrared sensor using GSM. The sytem was designed with the use of PIR sensor and ultrasonic sensor to detect intruders in a home. If there is an intruder present, a buzzer will be triggered, and SMS will be sent and camera is used to capture image.

[5] Ghodke (2017) explain in their work on how the IoT network is based. The system sends photo information for everyone who comes near the door for the owner's home security.

[6] Prof. Uma Nagaraj, Sayali Sonawane, Prachi Kalbhor,Sonali Diware, Shweta Iskande (2012)Remote monitoring system for mobile application. There is a growing interest in performing surveillance using video cameras. Services of this system are useable for clients with not only PC's but also mobile devices which has GPRS. It is often used as a force multiplier or asset protection device for areas where it is not possible, practical, or affordable to install a cable network. [7] Tanaya and Kishore (2016) explain home upgrades security system with face recognition technology using hair open resume algorithm for detecting approvals or designs make people who are not allowed.

III. METHODOLOGY

To use the built-in real-time monitoring system for effective monitoring and alerting, the system requires at least two features. These features are detection and alarm mechanisms. Therefore, the Raspberry Pi-based security system consists of two main parts. Hardware and software requirements. Based on the Raspberry Pi, this intelligent surveillance system represents the idea of monitoring a specific location at a remote location. This project runs this process very quickly with identification using OpenCV for object detection. here we used a background subtraction algorithm to find the object. Background subtraction is a wide range of methods for detecting moving objects with various static cameras. As the name implies, background subtraction is the process of separating the foreground color from the background of the video frame line. Video stream-based foreground IDs are the first step in computer vision applications such as real-time tracking and event analysis.

Background modelling is an efficient way to preserve foreground objects. Separates the foreground object from the background in a series of video frames. Steps related to background subtraction:

- Background initialization: The first goal when creating a background model is to determine the number of frames. This model can be designed in several ways (Gaussian, fuzzy, etc.).
- Foreground detection: The next frame processes the comparison between the current frame and the background frame. This summary subtraction
- leads to the calculation of the foreground of the scene. Background maintenance: During this capture process
- , the image is analyzed and the background model formed during the initialization step frames. This model can be designed by various ways (Gaussian, Fuzzy etc.). Foreground detection: In the next frames, a comparison is processed between the current frame and background frame. This
- subtraction leads to the computation of the foreground of the scene.
- Background maintenance: During this detection process, images are also analyzed in order to update the background model learned at the initialization step, with respect to a learning rate. An object not moving during long time should be integrated in the background.

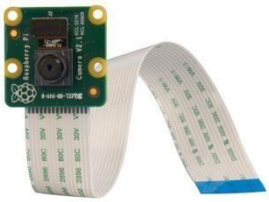
A background subtraction algorithm should be able to cope with a number of the critical situations. It is updated with respect to the learning rate. Object that doesn't move for a long time needs to be integrated into the background. The background of the subtraction algorithm has to deal with many important situations. Important situations can be handled in various steps of background subtraction (background initialization, foreground detection).

IV. HARDWARE REQUIREMENTS

4.1 RASPBERRY PI

Raspberry Pi is a low cost, credit card-sized singleboard computer developed by the Raspberry Pi Foundation in the United Kingdom. It is known as a single-board computer as it contains Central Processing Unit (CPU), Random Access Memory, Graphics Processing Unit (GPU) and other peripherals included in a single circuit. It was initially designed to improve programming skills in pre-university level students. It has a 64-bit ARM processor and uses Raspbian, a Linux distributed debian based 32-bit operating system. Raspberry Pi can also be plugged into a TV or monitor together with a keyboard, mouse, speakers, and camera can be used like a computer. Although it is not as powerful as a normal desktop computer, for the size of a credit card, it is considered powerful enough for embedded systems.

4.2 RASPBERRY PI CAMERA MODULE



The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. The Pi camera along with a ribbon cable, this cable has to be connected to the CSI (Camera Serial Interface) port of the Pi. This port can be found near the HDMI port just connect cable to it.

4.3 GSM MODULE

GSM modem is introduced to rectify the main limitation of the dial up modem based on its acceptance of a sim card. It is almost equivalent to a mobile communication system as operates over a subscription to a mobile operator. From the mobile operator perspective, a GSM modem looks just like a mobile phone. Using the transmission and reception pins, a modem can receive and send the messages and it could be interfaced with the PC or to a microcontroller. Here we used GSM module to send SMS to user whenever it detects human object.

V. SOFTWARE REQUIREMENTS

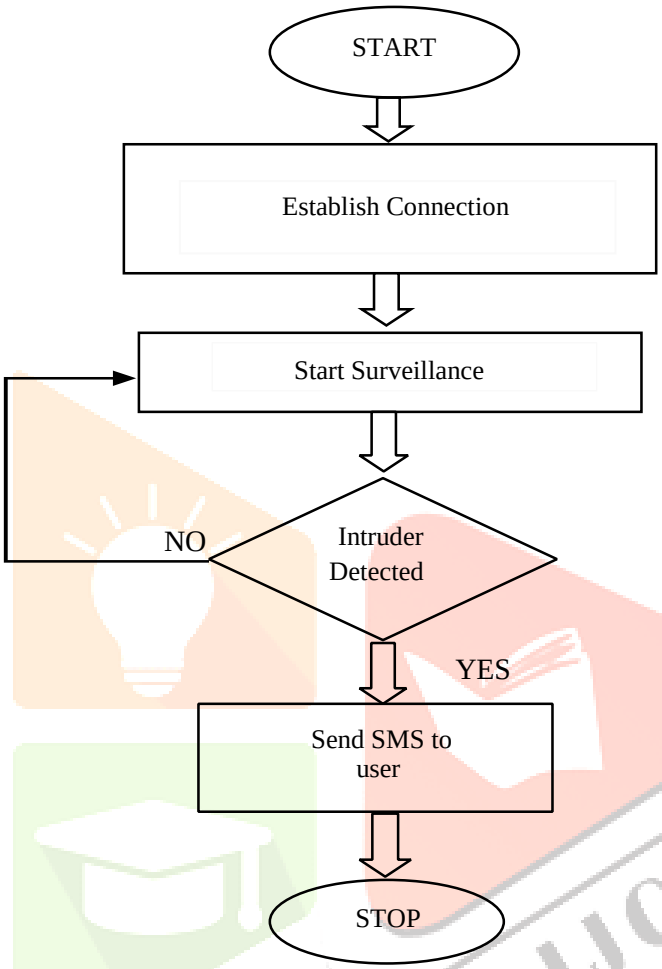
5.1 RASPBIAN OS

Every Raspberry Pi board comes with the official Raspberry Pi OS. Initially titled Raspbian, it is an Operating System made specifically for the Raspberry Pi. Although the first instances of the board weren't running this OS, the Raspberry Pi Foundation quickly created it, so any board after June 2012 was compatible with it. The initial version of the Raspbian OS was made by Mike Thompson and Peter Green as an entirely independent endeavour. The Operating System was rooted in Debian, which is a kind of Linux operating system. This puts the Raspbian OS firmly into the UNIXLike family of operating system.

5.2 OPEN CV

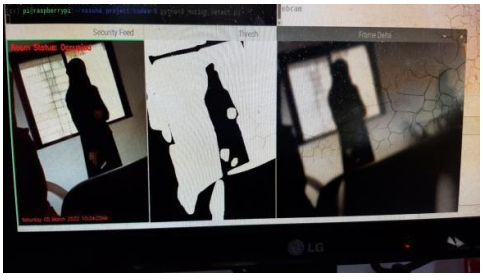
OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more. It supports multiple languages including python, java, C++.

VI. FLOW CHART



VII. RESULTS

After importing necessary packages. imutils package, which is a set of convenience functions that have been created to make basic image processing tasks easier. We often find small regions of an image that have changed substantially, likely due to noise or changes in lighting conditions. In reality, these small regions are not actual motion at all so we defined a minimum size of a region to combat and filter out these false-positives. then grab a reference to the webcam and wait for it to warm up. So now that we gave a reference to our webcam stream, we started looping over each of the frames. And also defined a string and initialized it to indicate that the room we are monitoring is "Unoccupied". If there is indeed activity in the room, we can update this string. Also, converted the image to grayscale because the colours have nothing to do with the motion detection algorithm. Finally, apply Gaussian blur to smooth the image. even successive frames of a video stream are not the same! Also, due to slight differences in digital camera sensors, the two frames will not be 100% identical, and some pixels will certainly have different intensity values. However, we had to apply Gaussian smoothing to the average pixel intensity in the 21 x 21 area.



Again, let's assume that the first frame of the video stream is static and is a good example of what the background looks like. If the first frame is not initialized, save it as a reference and continue processing the next frame in the video stream. Since we modelled the background using the firstFrame variable, we used it to calculate the difference between the first frame from the video stream and the new frames that follow. Calculating difference between two frames is a simple subtraction, where we take the absolute value of their corresponding pixel intensity differences.

$$delta = |background\_model - current\_frame|$$

The background of the image is usually black. However, areas of motion (for example, areas where we walk in space) are much brighter. This indicates that the larger the frame delta, the more motion the image has. Then we started looping through each contour, excluding small, irrelevant contours. If the contour area is larger than the specified area, a bounding box is drawn around the foreground and motion areas. It also updates the text status string to indicate that the room is "occupied". You can then view the results of your work and visualize whether the video has detected any movement. Finally, I cleaned up and released the video stream pointer. Therefore, our motion detection system can track a person as he or she moves around in the room. Therefore, if an intruder is detected in the frame, the system only sends a notification to the owner via the GSM module.

VIII. CONCLUSION

The proposed system presents a low-cost ubiquitous monitoring system design approach for detecting intruders. Most camera-based surveillance systems are video streaming systems that rely on guards to constantly monitor the screen. Therefore, by human nature, the system can miss important surveillance issues such as intruders and anomalous activity due to tiredness and minor carelessness. The proposed system only notifies you when an intruder is detected, so the system can easily reduce the burden of continuous monitoring of the system. In addition, the proposed framework is cost-effective because it requires less storage space and does not require continuous monitoring from the control room. The proposed system also provides the user with the possibility of immediate warning, thereby taking immediate action. Apart from remotely isolated areas, the proposed system can also be implemented in vigilant high-alert locations such as banks, industries, or other locations where this type of security is required. The idea for the future enhancement is to try to add more elements to the framework, like legitimate entries only by using special RFID tags or face recognition for user for activation and deactivation of the system and mobile-based home automation framework which will permit client to control the proposed framework through mobile. Since the Internet plays an essential role in the proposed framework, the use of 3G / 4G networks is suggested for better execution.

IX. REFERENCES

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