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SMART SURVEILLANCE MONITORING SYSTEM USING MACHINE LEARNING AND RASPBERRY PI

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ABSTRACT

It is important to build reliable security systems for security and safety. The adoption model is an integral part of any surveillance system. With the recent development of hardware and embedded devices, it is possible to build a real-time system that identifies people with low-cost. The participation of embedded systems and computer vision is increasing daily in a few segments of the consumer market such as industrial automation, traffic monitoring, medical imaging, augmented reality systems, etc. This technology is free to make new improvements in the field of commercial and home security surveillance. Our project focuses on making contributions to the video surveillance environment through embedded computer recognition systems. For the implementation of our project, it uses the Raspberry Pi 4 which aims to use computer vision techniques such as motion detection, object detection, face detection, etc. to separate the region of interest from the recorded video. This process is amazing compared to traditional surveillance systems as it requires less human interaction and intervention in the control room of those security systems. The proposed system has the ability to detect suspicious events such as the detection of an unknown face in a captured video or detection of an object / detection of an object in a closed building block. Also, with the help of a turret machine built using servo motors, the cameras integrated into the system are able to have 360 degree rotation and can track the detected person within their range.

Keywords: Computer Vision, Raspberry Pi, PIR Sensor.

I. INTRODUCTION

One of the biggest concerns in today's world, be it home or business is security. Conventional surveillance systems use wireless or closed-circuit television networks (CCTV) where they require a person or persons to monitor live camera feeds. The latest developments in surveillance systems are made up of Internet of Things (IoT) devices that are smarter and more responsive to home surveillance systems, which can grow by integrating locally distributed sensors to analyze global data collected for firm decisions. Computer recognition is the most widely used way to analyze images or videos of automated programs. For example, an embedded computer-assisted system can detect attackers using recorded images from surveillance cameras and alert owners. Our project aims to address home and business safety concerns by providing a motion detection solution using the Raspberry Pi and PIR Motion detection sensors. The Raspberry Pi is a credit card-sized computer capable of connecting to a computer monitor or any other display and can be connected to a keyboard and mouse for operation. Raspberry Pi has a operating system called Raspbian OS and can be a very useful program for running applications in programming languages such as Scratch and Python. Although small, the Raspberry Pi is almost identical to a desktop or portable desktop computer in terms of functionality. The Raspberry Pi can also be connected to the internet. Basic tasks performed on a desktop / laptop computer such as Internet browsing, spreadsheet, word processing and playback can all be done on the Raspberry Pi. Passive Infrared Sensors, commonly referred to as PIR Sensors are small devices that help detect movement. PIR sensors are inexpensive, require low power, durable devices and high performance. For that reason, they can be embedded in larger devices such as cameras and other video-enabled devices. These portable devices have the ability to detect infrared radiation levels, which is an important factor in detection of movement.

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II. LITERATURE SURVEY

i. Motion Activated Security Camera using Raspberry Pi

K.N Karthick kumar, et al. [2017] [1]. In this paper, the home security framework is named after the Raspberry pi (RPI) with openCV and Harr cascade. This gadget can detect any progress and send alerts to the customer dashboard advising the focus of the test. Sensors are initiated between invisibility or when someone informs us of our absence program at home. It is possible to set up a security framework to record activity with a surveillance camera when improvements are identified. Raspberry Pi, measuring pc with built-in camera board can be converted into a security framework when the camera board is used. This framework makes use of Open CV. Sensory sensors may respond in a variety of ways. For example, moving in the family room, opening and closing doors, breaking a window.

ii. Ambient Intelligence and IoT Based Decision Support System for Intruder Detection

Lakshmi.K, et al. [2019] [2] .In modern society, crime has become a major factor in influencing many aspects of normal human life. Therefore, the people themselves began to take action against crime. This paper outlines an intellectual-based decision-making system that provides home-based security. The proposed plan focuses on two strategies, one of which is face recognition for homeowners and the other is anonymous access to individual activities. It can therefore be used to send alerts to the required authorities and family members if necessary and to enable real-time monitoring of the Internet scanned anomaly (IoT). The proposed framework produces an effective face recognition and a anomaly detecting system with the highest level of performance.

iii. Home Surveillance System using Computer Vision and Convolutional Neural Network

Xin Zhang, et al. [2019] [3]. In this paper, they have introduced a home surveillance system that uses computer-assisted detection techniques to detect intrusion and alarming information including the identification of offenders and specific weapons used. Interference detection process is achieved through the Smart Intruder Detection and Monitoring System (SIDSS) which includes 3 phases of computerized visual detection algorithms. The three-phase SIDSS includes a developed convolutional neural network (CNN) for advanced detection and intervention detection, classification filters to detect any potential attackers in the form of corrective action to overcome unseen threats of the previous phase, and key component analysis (PCA) for optimal facial recognition. accurately distinguish passers-by from potential entrants. The system is capable of measuring various surveillance events and can be expanded with additional processed databases added to the SIDSS model to manage larger surveillance areas. With this advanced configuration, the system can achieve improved accuracy in identifying multiple weapons used by attackers.

iv. A Survey on Human Detection Surveillance Systems for Raspberry Pi

Ali Farouk Khalifaa, et al. [2019] [4]. In this paper, several types of human detecting programs have been explored. All systems have a different location and settings. Different features and separators have been used in the adoption problem. However, HOG was used for the most part and SVM in the segregation phase. Many different methods of acquiring movement are available but Frame Differences and Background Extensions are the most widely used. Due to the limited features of the Raspberry Pi, some complex methods have not been used. Also, other SVM characters such as: Polynomial and RBF other than Linear kernel can be used. Currently, there are attempts to create a lightweight version of CNN that can be used in a limited area of the app such as: embedded devices, or mobile phones such as SqueezeNets, and Lightweight CNN (L-CNN), MobileNets.

v. Implementation of Low Cost IoT Based Intruder Detection System by Face Recognition using Machine Learning

G.Mallikharjuna Rao. et al. [2021] [5]. The burglar can enter the premises without the owner's knowledge, so identifying the movements of the person trying to enter the house will get the sensor to detect the movement. The PIR sensor is mounted on the door frame, activating the USB Camera to take a picture of a person. The captured image is processed for face detection and face recognition using machine learning algorithms and OpenCV. During face recognition, the Raspberry pi was designed to compare the acquired faces with authorized images stored on a website. Raspberry pi captures 28 images processed per second and sends an email to the owner whether it is authorized or not. Verification can be verified by the owner via Internet of Things (IoT).

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III. METHODOLOGY

The flow chart below represents the flow of system activity as shown in Fig. It follows a step-by-step approach to building a system, from detecting PIR sensor movement to owner receiving email alerts. The decision boxes used in the flowchart help to understand the flow of different processes and system operations. There are three such decisions to be made by the system and to behave based on the results.

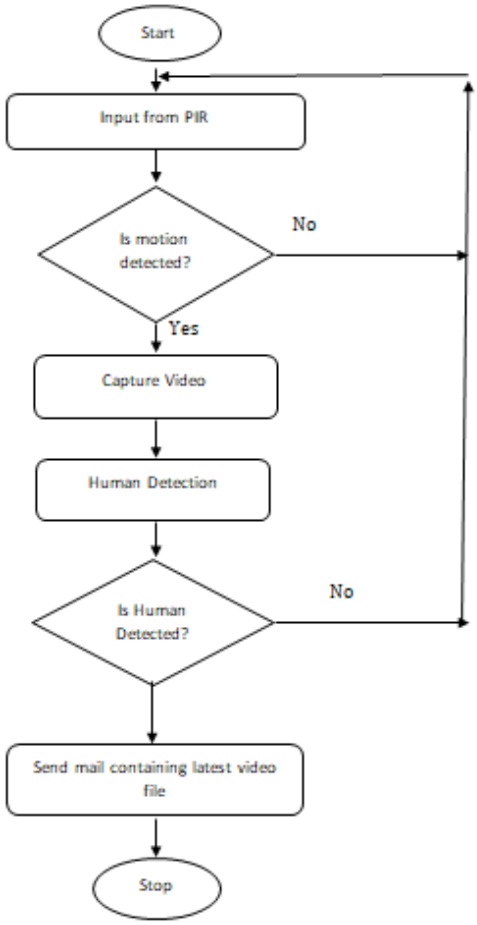

Fig: Flow Chart for complete hardware and software procedure

i. Raspberry Pi

The Raspberry Pi is the latest small computer with an affordable price range. This credit card sized processing computer with high resolution and low power consumption is a Python-based program. Our proposed system is designed to detect faces accurately, in real time, as well as in photography.

The following steps will allow you to set up your Raspberry Pi-based system for face recognition.

1. Place the camera module on the board as shown on the Pi Camera website.

2. Now connect the PIR sensor. Three female-to-female jumper wires should be connected to each PIR sensor connector, as well as matching pins to the Raspberry Pi.

a. PIN-labeled VCC PIN label should be attached to the 5V PIN on the Raspberry Pi.

b. The middle PIN marked OUT should be connected to the GPIO 4 PIN

The PIN below with the GND label should be attached to the PN code labeled GND.

ii. PIR Sensors Work

PIR sensors are also called “IR Motion sensors” or “Passive Infrared” sensors. PIR sensors enable sensory mobility. The PIR sensor target is based on the fact that everything emits a small amount of infrared radiation. The amount of radiation emitted by a substance is directly related to the temperature generated by it. PIR sensors have the ability to detect changes in infrared radiation levels. PIR sensors and PIR motion sensor

cameras measure infrared radiation levels to detect changes in the environment and can detect movement. For example, the PIR sensor can detect when a person enters a room. Connect the PIR Camera Module
To set up the PIR camera module, follow the basic steps given below:

1. Connect the three pins to the jumper wires, labeled PIR-VCC (3-5VDC in), PIR-OUT (digital out), and PIR-GND (ground) to the three PIR sensor pins.
2. Connect the GPIO GND (PIN 6) to the Raspberry Pi on the ground jumper cable.
3. Connect the GPIO 5V (Pin 2) to the Raspberry Pi with a jumper cable connected to the VCC.
4. Connect the GPIO 7 (Pin 11) to the same railway as our PIR-OUT so it can see the movement.

iii. Human Detection Process Work

The camera captures an image or video and OpenCV uses a human detection algorithm. OpenCV is a C language program in the core with Python and PHP binding. The program helps to find the human in a photo and can automatically crop photos without cutting faces. The face recognition method is programmed internally using Python programming language. Open CV and Python binding is used as a script to find faces in a photo or video. The system requires training data from the XML file. Successful facial detection requires that you download the Haar Cascade Frontal Face package of OpenCV. When the captured image is accessible, you will be able to see it on your screen and your Analytical website will also add a new object to accompany the captured image. When the camera detects an individual's face, you can see an image in your web console. In the case of moving objects, the system has this ability to verify whether faces have been detected or not. When face detection is complete, the image is saved in the local database. The system is also released via a remote monitoring center. To enable remote monitoring, you must configure the Wi-Fi router.

IV. CONCLUSION

Our proposed system utilizes affordable computer software and open source software libraries to create a complete video surveillance solution. The system can be easily integrated and the individual components easily accessible. Libraries in which documents are built, receive regular updates that may provide improvements to algorithm performance. The solution described in this project is timely and cost effective. The use of the Raspberry Pi also has the advantages of high scaling and the availability of a wide range of built-in components that can be integrated to further enhance the project. In conclusion, the PIR motion sensor and camera module are an inexpensive monitoring method. Python and Open CV supported by Raspberry Pi can be used to develop flexible and flexible projects, expanding in the future. The current system is coded to send email to user / owner when movement is detected.

V. REFERENCES

[1] K.N Karthick kumar, H.Natraj and T.Prem Jacob, “Motion Activated Security Camera using Raspberry Pi”, International Conference on Communication and Signal Processing, April 6-8, 2017, India.Sachin D. Khirade,A. B. Patil, “Plant Disease Detection Using Image Processing” Pimpri Chinchwad College of Engg 2015.

[2] Lashmi.K and Anju.S.Pillai, “Ambient Intelligence and IoT Based Decision Support System for Intruder Detection”, 2019 IEEE International Conference on Electrical, Computer and Communication Technologies (ICECCT).

[3] Xin Zhang, Won-Jae Yi and Jafar Saniie, “Home Surveillance System using Computer Vision and Convolutional Neural Network”, Embedded Computing and Signal Processing (ECASP) Research Laboratory (http://ecasp.ece.iit.edu), Dept of Electrical and Computer Engineering Illinois Institute of Technology, Chicago, Illinois, U.S.A.

[4] Ali Farouk Khalifaa , Eman Badra, Hesham N. Elmahdya, “A Survey on Human Detection Surveillance Systems for Raspberry Pi”, https://doi.org/10.1016/j.imavis.2019.010.

[5] G.Mallikharjuna Rao, Haseena Palle, Pragna Dasari, Shivani Jannaikode, “Implementation of Low Cost IOT Based Intruder Detection System by Face Recognition using Machine Learning”, Turkish Journal of Computer and Mathematics Education. Vol.12 No.13(2021), 353-362.