IOT-BASED SMART VIDEO SURVEILLANCE SYSTEM

Ms.Meghala Murgesh *[1], Mr.A.Gopalakishnan [2], R. Umamaheswari [3], M.S.Sabari [4]

[1]PG Scholar, Department of Computer Science and Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India
[2]Assistant Professor, Department of Computer Science and Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India
[3] Professor and Head, Department of Computer Science and Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India

[4]Assistant Professor, Department of Computer Science and Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India

*Corresponding Author: meghalasudha07@gmail.com

ABSTRACT

Smart video surveillance is an IOT-based application as it uses Internet for various purposes. The proposed system intimates about the presence of any person in the premises, also providing more security by recording the activity of that person. While leaving the premises, user activates the system by entering password. System working starts with detection of motion refining to human detection followed by counting human in the room and human presence also gets notified to neighbor by turning on alarm. We design and implement a distributed Internet of Things (IoT) framework called IoT-guard, for an intelligent, resource-efficient, and real-time security management system. The system, consisting of edge-fog computational layers, will aid in crime prevention and predict crime events in a smart home environment (SHE). The IoT-guard will detect and confirm crime events in real-time, using Artificial Intelligence (AI) and an event-driven approach to send crime data to protective services and police units enabling immediate action while conserving resources, such as energy, bandwidth (BW), and memory and Central Processing Unit (CPU) usage. The major use of the 'Motion Detection' is at homes, buildings and also for surveillance for security for example of server rooms.

Keywords: *IOT (Internet of Things), edge, fog, video surveillance, Artificial Intelligence (AI).*

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1. INTRODUCTION

In the present world, situation security assumes a vital part. Numerous individuals utilize distinctive sorts of security system to keep their property from unapproved person's entry. Security system helps individuals to feel somewhat safe while they have to travel or avoid their home for work. A large number of the security system works just inside a specific territory limit, for instance, CCTV, as a person need to see camera footage from control room. The current security systems against robbery are entirely costly as a certain measure of cash must be paid to administration supplier to store the recorded video despite the fact that there is no human movement is recognized.

The solution for this problem is an intelligent surveillance system that can start recording video only after a human motion is detected. This eventually minimizes the required storage space and makes system cost-effective. The proposed framework gives more security with the assistance of Web at less expensive cost and requires less storage space. In literature, researchers have proposed various methods for people counting. In literature, researchers have proposed many image processing methods/algorithms for human counting which are prone to problems such as occlusion or shadow and overlapping. To address these problems at some extent, Rossi and Bozzoli and Sexton et al.

Proposed a technique in which the position of camera is vertical as for the plane of the floor. In literature, researchers proposed an improved adaptive background mixture model for real-time tracking with shadow detection.

The proposed framework gives a smart security system which gives home security with SMS and e-mail notice about the unapproved people nearness, programmed human checking and switching off all the appliances which consumes more power by customizing coding with particular appliances. Proposed system performs various tasks such as motion detection, human detection and counting, alarm activation, SMS notification through GSM and Internet Twilio account, and e-mail notification.

To improve the system performance, two boards are used Raspberry Pi and Arduino. Raspberry Pi works in surveillance mode and Arduino works in normal mode. Arduino verifies the password and allows Raspberry Pi to start the surveillance mode. Once the password is verified, Arduino turns off all the electrical appliances by customizing coding with specific appliances. Raspberry Pi performs various tasks in surveillance mode such as motion and human detection, human counting, sending SMS, and e-mail notification to user after human detection. After human detection, Raspberry Pi sends command to Arduino for sending SMS to user by communicating with GSM module. By default, system remains in normal mode. As the user enters correct password, system starts working in surveillance mode.

In surveillance mode, Raspberry Pi detects human motion and counts number of people in a room. The location of a camera is at the entrance of a room. The human count is implemented by background subtraction method in OpenCV. If any human is detected in surveillance mode, then using the GSM module and Twilio account message is sent to the owner of the house.

The highlights of proposed system are as follows:

(1) The proposed framework includes people counting, and two notices are sent to client by SMS: One SMS is sent through GSM and one SMS is sent through Twilio trial account with the assistance of Web. The recorded video is sent as a e-mail to client. At the point when there is no individual in the premises, the framework works in ordinary mode.

(2) Raspberry Pi detects motion and human presence and it counts number of humans in a room. As the system detects human presence, immediately a SMS notification is sent to the user. The system also sends the recorded video to users mail id. As a human is detected, GSM module gets instruction from Arduino regarding SMS notification. Another SMS notification is sent through Internet Twilio trial account. The alarm is turned on as human presence is detected.

(3) The proposed system also provides a facility to control electrical appliances by turning them off. The proposed system offers few advantages such as- (i) Less memory storage space is used for recording video as system start recording the video only after motion is detected. (ii) Recorded video is e-mail to user so that the user can inspect it later. (iii) User gets noticed (SMS and Email) just after human detection, so that he can take necessary actions immediately.

2. RELATED BACKGROUND SURVEY

This section surveys previous works on smart surveillance and analyzes techniques leveraging security and safety services in a smart-city environment, including transportation, healthcare, industry, and residences.

Shih [18] developed an occupancy detection and tracking system for automatic monitoring and commissioning of a building with the help of an image-based depth sensor and a programmable pan–tilt–zoom camera. A device free occupant-activity sensing system using Wi-Fi-(IEEE 802.11x)-enabled IoT devices for smart homes is proposed by Yang et al. [19]. Lee et al. studied an on-road pedestrian tracking system across multiple moving cameras [20] and in another article, developed a technique for vehicle tracking and localization based on 3-D constrained multiple-kernel tracking [21]. In [22], Chen et al.

Proposed a quality-ofcontent- based joint source and channel coding system for detecting humans in a mobile surveillance cloud. Ajiboye et al. [23] proposed Fused Video Surveillance Architecture (FVSA) that enhances the public safety by utilizing data from privately-owned cameras. Cloud-based IoT architectures are used for processing and storing essential surveillance data where each camera/node sends the data directly to a cloud for all sorts of decision making. The authors of [24] discussed the contribution of cloud technology and its secured integration into IoT architectures. Hossain [9] proposed a framework for a cloud-based multimedia surveillance system that supports the processing overload, storage requirements, access, security, and privacy in large-scale surveillance settings. These studies reveal the capability of cloud computing to satisfy many IoT requirements (e.g., monitoring, sensor stream processing, and visualization tasks).

However, the large amount of real-time media data sent by the end devices using high-speed fiber networks leads to a high network deployment cost [25]. Although the situation has changed in recent years with the internetworking ability of IoT, still IoTcloud architecture has issues regarding bandwidth, energy, and latency in real-time video surveillance applications[11], [25].

Consequently, fog computing paradigm emerged and fog –based solutions can now facilitate real-time processing and fast response time, and reduce latency issues, thus extending cloud computing and services closer to the end of the network [11], [25]. Fog, however, can be distinguished from the cloud by its proximity to the end users, the geographical distribution, and its mobility support [26]. Ni et al. [10] explained the architecture, features, and role of fog computing. Distributed and efficient object-detection architecture in edge computing for real-time surveillance application is also proposed in [25]. The authors in [27] explained an edge-computing framework to enable cooperative video processing on resource-abundant mobile devices for delay-sensitive multimedia IoT tasks.

To provide intelligent applications, researchers combined IoT with AI. An AI and software-defined network-(SDN)- based system for detecting and correcting multimedia transmission errors in a surveillance IoT environment is described by [28]. A DL-based pedestrian detection and face recognition technique for surveillance application in a fogenabled IoT environment is proposed by [5]. Li et al. [29] showed the design of a novel offloading strategy to optimize IoT DL applications with an edge-computing environment. Cao et al. [30] described the design of a self-optimizing, context-driven, and energy-aware IoT wireless video sensor node for surveillance applications.

A fog framework for intelligent video surveillance to enhance crime assistance and safety in public transportation is presented by [8]. Fan et al. [31] described a novel visualization mechanism which fuses multimodal information for large-scale intelligent video surveillance, utilizing an event-driven approach. Some architectures and frameworks for event-driven video surveillance approaches are also described in [32], [33], and [34], along with energy-aware, event-driven video surveillance solutions, such as [35] and [36]. The authors of [8] described the critical application requirements of an efficient smart-surveillance system, such as real-time and accurate detection of an event, reliable and agile prediction of crime events, and high-performance service deployment.

Resource-efficient approaches add benefits in the IoT-based video surveillance architectures because of the ever-increasing number of surveillance nodes [11]. A BW-and energy-aware video compression algorithm for IoT-based video surveillance applications is proposed by [37]. However, to deploy a resource-efficient and proactive surveillance system, the previously discussed proposals may be insufficient. Therefore, this paper proposes IoT-guard, which successfully addresses all requirements. It also achieves significant efficiency compared to SoA or traditional surveillance architectures.

3 ADVANTAGES OF VIDEO SURVEILLANCE

Availability-

There was a time when the surveillance techniques were utilized only in shopping centers and malls. Now-a-days, you can notice closed-circuit televisions almost at any place you visit, from a small store to homes and holy places. As a result, they guarantee greater public security at a fraction of the cost.

Real-time monitoring-

Traditionally big organizations have always had the benefits of video surveillance manned by security professionals. In the past times, the events captured on video were used to expose important information and work as proof after the event happened. But, modern technologies let users to check and reply to alarms immediately.

4 PURPOSE OF THE SYSTEM

The main aim of this project is the utilization of Raspberry Pi to depict a security alert framework utilizing low processing power chips utilizing Internet of things which screens and get alerts when movement is identified and sends photographs and recordings to a cloud server. Moreover, Internet of things (IoT) based application can be utilized remotely to see the movement and get warnings when movement is identified. The photographs and recordings are sent straight forward to a cloud server, sent as Gmail Notifications with snapshots and SMS alerts and when the cloud is not accessible then the information is put away locally on the Raspberry Pi and sent when the association resumes. Accordingly, points of interest such as these make this applications perfect for smart security surveillance monitoring where ever the security is a big concern and required security alert system with instant notifications such as in Industries, Banks, IT Offices and in Homes, this system can be best utilized. The whole report is centered on the field of embedded system, Internet of Things and the use of Linux based OS to run applications on them.

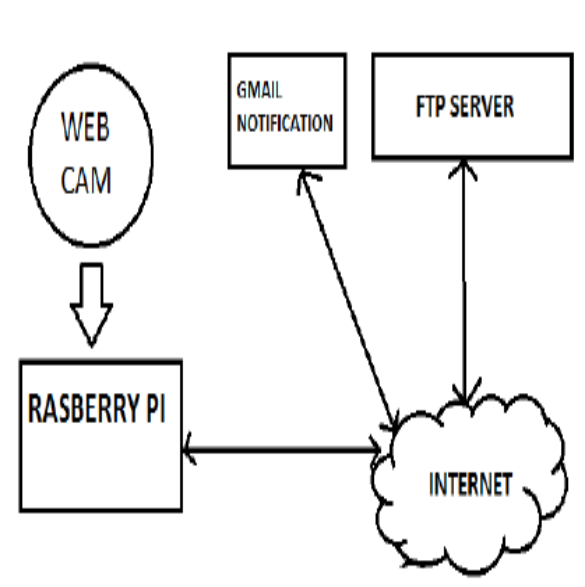

Fig.1. Internet based motion detection.

4.1 AN INTERNET OF THINGS APPROACH FOR CLOUD SERVER:

This paper presents about monitoring and controlling of home appliances from outside and also monitoring the motion detection in home for unauthorized person detection, office, industry for monitoring the machineries etc. Here we are going to avoid the use of external cloud server for which we have to pay some amount monthly to get space there. Now a day's cost is a important factor. So this project will be useful to mainly reduce the cost for monitoring the motion from outside. So to implement this method we are going to use ARM11 processor and Raspberry pi which is going to act as a server in home side and ARM11 is going to capture the pictures and finally these pictures converted into video then this video will be sent to web Page that we created or sent to one URL, or one IP address. So that we can see what is happening in our house or office by just entering the URL or IP address.

5 SYSTEM ARCHITECTURE

In this System, we have a tendency to develop a brand new approach for motion detection. The Block diagram of the proposed system consists of Raspberry Pi board (Model B+) ,Wi-Fi Module, GSM Module, USB Camera and PIR sensor. Raspberry Pi model B+ is connected to the USB camera (2 Megapixels) with the help of USB port .The operating system installed in Raspberry pi is Raspbian operating system. The diagram of the planning is as shown in Fig.2. It consists of Raspberry pi processor, USB camera, GSM module etc. The temporary description of every unit is explained as follows.

The project aims to simplify motion detection and the interface to be user friendly, which would send prompt notifications when motion is detected using Raspberry Pi which depict a security alert framework utilizing low preparing power chips utilizing Internet of things which screens and get alerts when movement is recognized and sends photographs and recordings to a cloud server. The photographs and recordings are sent to cloud managed service Drobox, Gmail Notifications with snapshots and SMS alerts to the user. When the cloud is not accessible then the information is stored locally on the Raspberry Pi and sent when the association resumes. The primary functions of the project are

Detect Movement:

Python script would analyze the video of the USB WEB Camera, if there is a difference from the last frame to current frame it would be flagged and video recording and snapshots generation will begin.

On Movement Detected:

When movement is detected, then python script will execute on the Raspberry Pi to send an email to the registered Email with attached snapshots and SMS notifications to registered mobile number.

On Snapshot Save:

When a snapshot is saved, by default it is saved locally on the SD card of the Raspberry Pi. Shell script will upload the snapshots to cloud managed service Dropbox, which supports command line Linux based commands. The snapshots are saved instantly if there is a breach in the surroundings/house and the person tries to remove the setup still the snapshots already been stored to external cloud service Dropbox as configured.

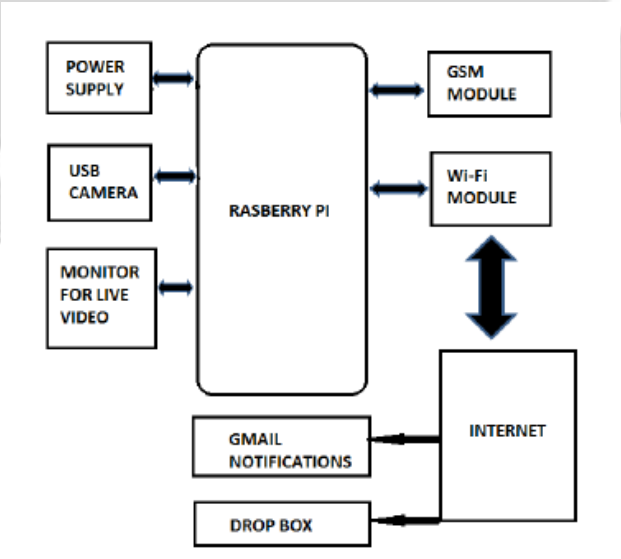

Fig.2. Block diagram of proposed system.

6 CONCLUSIONS

IoT based smart security surveillance system using Raspberry pi have been successfully designed and implemented which is capable of recording the videos and capturing the images and the same has been uploading to cloud service Dropbox if it is not available then stores locally on Raspberry Pi storage. At the same time SMS notifications and Gmail notifications with captured snapshots will send to user. Live video streaming also provided to monitor continuously. It is advantageous as it offers reliability and privacy on both sides. It is authenticated and encrypted on the receiver side; hence it offers only the person concerned to view the details. Necessary action can be taken in short span of time in the case of emergency conditions such as industries, offices, military areas, smart homes, elderly person falling sick etc., The proposed framework is cheaper in cost as it requires less storage space and no individual to monitor persistently from control room. In the proposed framework, two hardware boards are utilized to enhance the execution of the framework. The proposed system also provides facility of instantaneous alert to user so action can be taken immediately. The proposed system can be implemented at high-alert places such as banks, industry, or any other places where this type of security is required.

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