Wireless Home Security Surveillance System Using Android Application

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Abstract

Surveillance system for home security is becomingan inevitable essentiality as the influence of modern technology on the security systems has reached its peak. This paper aims to describe an android based application for home security surveillance systemusing Raspberry Pi Single Board Computer and an IoTmodule. This system helps us to monitor and get alerts when any motion or fire is detected at the place of one's residence. It sends frames of images to the cloud server in the event of any intrusions or fire sightings and simultaneously sends a notification to user alerting him/her about the unsupervised activities. Internet of things-based application can be used to remotely view the activities and control the functions of Raspberry Pi. Remote user alerts, portability and live streaming of frames of images are the prime aspects of this system. This is a cost effective, user friendly, portable system which enables the user to easily monitor the unusual activities from anywhere in the world and respond consequently.

Index Terms- Internet of Things, Single Board Computer, Surveillance, Wireless sensor networks

1 INTRODUCTION

Nowadays, ensuring safety and security of one's home has become an unavoidable necessity. Since the influence of modern technology on the present day's security system has increased progressively, the need for an effective security system is also raising in demand. In the present days theft is on rise. So, there is an endeavor to build a security system which will effectively manage this issue. This system is also expected to demand minimum human efforts and offer considerable protection against break-ins and home invasions. Automated system can be made more intelligent by adding wireless and digital technologies. This way facility owner can remotely monitor his home through surveillance camera and sensor networks. Faster data transmission can be enabled by adding Wi-Fi to the security system. An IOT module can be added to provide global monitoring and controlling facility to the user. At the edge of IoT are the devices and objects that remotely controlled. These things are interconnected across an infrastructure or backbone using combinations of Raspberry Pi, sub- GHz and Wi-Fi

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connectivity to provide a robust bi- directional communications link, with relatively long range, low latency for fast responsiveness, low power and a sufficient data rate to accumulate data from many connected devices. This infrastructure also serves as a gateway to the internet and enables remote monitoring and control.

CCTV is one of the most commonly used surveillance techniques among the existing security systems. Despite its popularity it is restricted by some of its limitations. It requires constant human involvement for monitoring and thereby is a non- active monitoring device. The procedure of investigation is quite tedious as all the previously recorded CCTV footages need to be manually watched. In addition to this the files are always susceptible for corruption. An active surveillance system is needed to overcome the drawbacks of this conventional system. Remote Home Surveillance can be described as an introduction of technology within the home environment to provide safety and security to its residents. Adding intelligence to home environment can provide improved quality of life. The proposed system is targeted to serve the people of all kinds by being cost effective and user friendly, as the security of every common person should not be left behind.

2 LITERATURE SURVEY

This section provides a descriptive summary of some methods that have been implemented for an wireless home security surveillance system. A few of them are mentioned below:

2.1 An improved real time home security system using Beagle Board and Zigbee:

Remote alert on fire and intruder detection are the main features of the system. This system implements an embedded system for monitoring wireless sensor node and camera installed inside a building for security surveillance. When smoke or intruder movement is detected, the system sends warning message through Short Message Service (SMS) to cell phones and makes the alarm go on. [1]

2.2 Internet of Things approach for motion detection using Raspberry Pi:

This system aims at developing a security alarm system using low processing power chips using Internet of Things which helps to monitor and get alarms when motion is detected and sends photos and videos to cloud serve. It utilizes FTP server for camera feeds and it alerts user through email. When the cloud is not available, the data is stored locally on the Raspberry Pi and sent when the connection resumes. [2]

2.3 An Internet of Things (IOT) Based Security Alert System using Raspberry pi

Here a security alert system which records a video when a motion is detected and uploads it to the external server and notifies the user via text message is reported. This application can be used to view the remote activities and notifications can be received whenever the motion is detected. Internet of things basically deals with transferring of useable data without involving human interferences. [3]

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2.4 Smart surveillance and Monitoring System using Raspberry pi and Android

Here smart surveillance system operated via android device by owner remotely as well as locally. This system increases the usage of mobile technology to our homes and for other control applications. IOT application for remote controlling is used, system will send the push notification to android device when an intrusion is detected inside the room. The Android application will open a web page, which has images of surveillance. Android Smartphone and Raspberry Pi board is connected to wifi. [4]

2.5 Wireless Real Time Video Monitoring System Using Raspberry Pi:

The embedded Real time video monitoring system based on ARM is designed, in which the embedded chip and the programming techniques are used. The central monitor, which adopts Raspberry pi, is the core of the whole system. Real time video transmission is widely used in surveillance, conferencing, media broadcasting and applications that include remote assistance. First, USB camera video data are collected by the embedded Linux system. All data are processed, compressed and transferred by the processing chip. Then, video data are sent to the monitor client by wireless network. [5]

3 IOT BASED SYSTEM ARCHITECTURE

The Internet of Things (IoT) can be described as connecting physical devices such as smart phones, Internet TV's, sensors and actuators to the internet where the devices are intelligently linked together enabling new forms of communication between things and people. The proposed system consists of Surveillance controller system (Master node) set up at entry restricted areas, a desktop based application, and a mobile application.

3.1 Surveillance control system (Master Node)

There are two types of sensors used in this system. Passive Infrared(PIR) Motion sensor and Fire detection sensor. PIR sensor will detect the presence of an intruder and it can be set up in entry restricted areas or other prohibited areas. Fire sensor will detect the presence of fire and trigger the buzzer. Surveillance controller system is built upon Raspberry Pi Single board computer with a Linux based operating system Debian installed into it. RPi is a low cost, low power, credit card sized computer that plugs into a computer monitor or TV. Master node has webcam connected to it for taking frames of images; it also has GSM connected to it for sending notifications, in addition to these there is a buzzer attached to it. This node is responsible for handling various functions such as managing the sensor feeds, camera feeds, sending SMS alerts via GSM, and sending push notifications. Raspberry Pi is programmed to work as a Wi-Fi server. The system is connected to router with an Ethernet cable to get updates and configure Wi-Fi. The master node takes actions according to the status updates from both the sensors. Once it receives signal high status from either of the sensors, webcam will be activated and events will be recorded as frames of images. User can watch these feeds from

anywhere using the IP address of cloud server enclosed with the notification provided the user has enabled "off desk" feature in the desktop application. GSM Modem will send notification to authorized users such as the facility owner. This system also notifies the occurrence an event to the user through Push notification.

3.2 Desktop based application

In case the user is at his place of residence and is willing to carry on the surveillance via desktop computer, he need not get any notification to his mobile phone as he is already monitoring the activities through the desktop computer. To ease the monitoring of home activities we have designed a desktop based application, wherein the user can receive notifications and view frames of images in the event of forcible entry or fire detection. This desktop application has a feature called "off desk" that allows the user to receive notifications on the registered mobile number in case he is away from home and wants to keep track of unusual activities at home.

3.3 Mobile Application

In case the user wants to ensure the home, security while being away from home, he can still do this using a mobile application that will help him keep track of the events occurring in his absence at his house, and take suitable actions in case of break-ins and fire breakouts. The frames of images captured in the events of intrusions or fire detection are uploaded to the cloud and consequently a notification is sent to the user alerting him about the unusual events. The user receives an alert notification through an SMS and a Push notification on his registered mobile number. This way the user can secure his home even while being away from his place of occupancy.

4 SYSTEM DESIGN AND ANALYSIS

4.1 Hardware Design:

This system consists of control section. The control section mainly consists of Raspberry Pi, PIR motion sensor, Fire detection sensor, webcam and buzzer as shown in Fig 4.1

4.1.1 Raspberry Pi

Raspberry Pi is a credit card sized computer. It is a low cost, single board computerwhich can handle multiple functions like a normal computer. It requires less power of 5 volts. By using Raspberry Pi images can be captured when motion and fire sightings is detected by PIR motion sensors and fire detection sensor and send alert to the user through Email and SMS.

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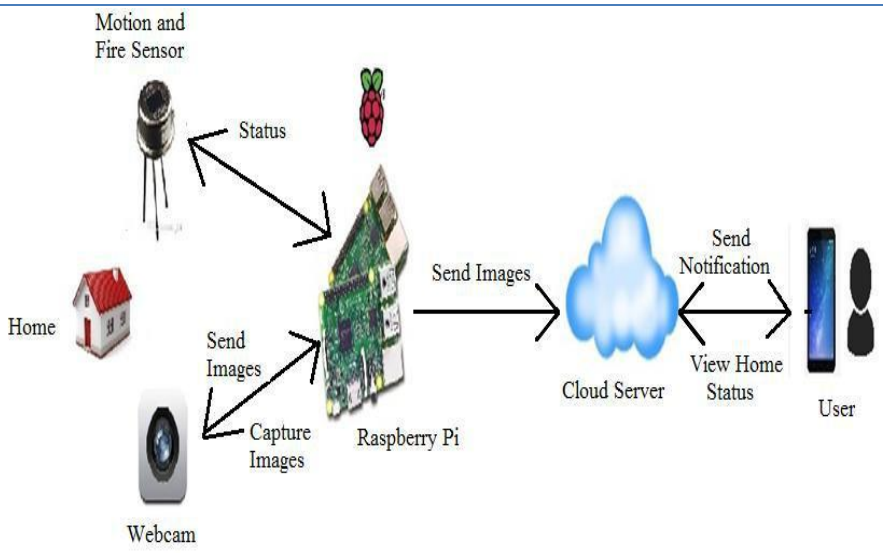

Fig 4.1: System Architecture of home security surveillance system

4.1.2 Web Camera

This is used to capture high definition pictures. The camera consists of small circuit board, which connects to Raspberry Pi's Camera Serial Interface bus connector via flexible cable. The Pi camera receives signal from the Raspberry Pi when PIR and fire sensors have detected motion of the intruder and fire sightings. After receiving the signal, it captures frames and sends it to the cloud from where user can view the images with the help of enclosed link.

4.1.3 PIR motion sensor

A passive infrared sensor is an electronic sensor that measures infrared radiation that is being emitted from objects in its field of view. They are most often used in PIR-based motion detectors. The term passive in this instance refers to the fact that PIR vices do not generate or radiate energy for detection purposes. They work entirely by detecting infrared radiation emitted by the objects. They do not measure or detect heat. A PIR-based motion detector is used to sense the movement of people, objects, or other objects. They are used in burglar alarms.

4.1.4 Fire detection sensor

Fire detectors sense detects and responds to the presence of fire allowing fire detection. A fire detector can respond faster more accurately. When the fire sightings have been captured, the buzzer must be triggered.

4.2 Software Design

In the user section, the user is given with a username and password through which user can login to the application(Mobile Application).The cloud is responsible for the authentication

process. Once user logs in to the application successfully, he/she can view home status. The user can monitor and control the activities of Raspberry Pi from remote locations.

A Linux based operating system DebianOS is installed into memory card and inserted into Raspberry Pi. An open source integrated development environment, Eclipse is used for writing application programs in Java. In order to send Push notification using Java we make use of a simple FCP object. FCP object accesses the FCP server and routes the notification to an authorized user. Raspberry Pi communicates with GSM modem through serial Port.On the occurrence of an event, the sensor will regularly update its status to Raspberry Pi. In case of logic high status the master node will trigger a java script which will execute a sequence of functions such as taking frame of pictures, sending alerts via Push notification and SMS, and activating buzzer when fire is detected. In order to view home status from anywhere the RPi's IP address and port are mapped to router's IP address and port. Frame of images can be saved in RPi for future reference and can be deleted when necessary.

5 RESULTS AND IMPLEMENTATION

Fig.5.1 shows the surveillance controller system implemented using Raspberry Pi. It has PIR motion sensor, Fire detection sensor, buzzer, GSM Modem and Webcam connected to it. Raspberry Pi is powered by 5V adapter and GSM is powered by 12V adapter. The desktop of Raspberry Pi isaccessed from Debian software which is burnt on a memory card and inserted into Raspberry Pi.

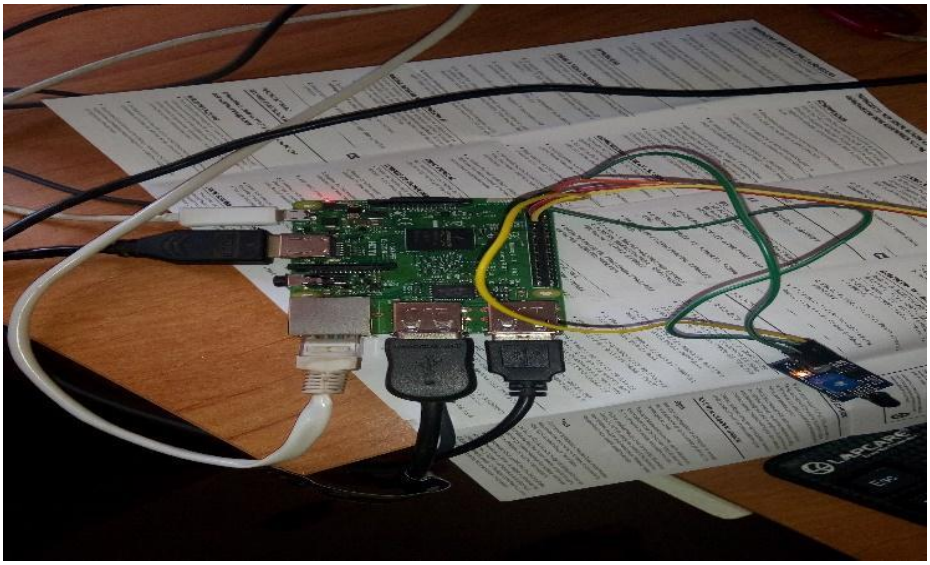

Fig 5.1: Raspberry Pi containing wireless PIR and firedetection sensor.

The output obtained from the PIR sensor and Fire detection sensor is displayed on the terminal of Debian operating system installed on Raspberry Pi. If the PIR sensor data shows a logic high value, then the webcam is activated, image is captured and sent to the cloud. If the user has opted for off desk option on the desktop based application, a notification is sent to user through SMS via GSM modem and a push notification is sent via FSM modem.

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Otherwise no notification will be sent to the user on his registered mobile number rather the monitoring process will be done on desktop based application manually by the user. If the fire sensor data gives a logic high value, the buzzer is activated and then GSM is activated, and SMS and Push notification is sent to user provided the "off desk" feature is enabled on the desktop based application. Authorized user can seek surveillance on the mobile application using cloud's IP address. This system allows the facility owner to get a view of his home from any part of the world

6 FUTURE ENHANCEMENT

This proposed system provides intrusion notification, so user is immediately aware of the intrusion. But, if in case the intruder wears mask, then it is difficult to identify the intruder in these cases. In such case, we can use automatic door locks and releasing of gas to faint the unauthorized person. If the fire sighting is captured, then the fire safety device must be activated automatically, and Implementation of face recognition and detection technology can be included, which grants access to authorized persons to enter that area.

7 CONCLUSIONS

In this paper, we have developed an android application for a home security surveillance system using Raspberry Pi and Internet of Things. The main features of this system are to detect motion and fire sightings. It activates a pi camera to capture frames of images when motion and fire sighting is detected, and it alerts facility owner through SMS and push notification. The use of Wireless Sensor Nodes results in a cost-effective surveillance system. The android application provides the facility to the user through which he/she can control and monitor unusual activities from remote location. This system is user friendly and caters the needs of all kinds of people.

References

[1]. Sundas Zafar. "Motion Detecting Camera Security System with Email Notification and live streaming using Raspberry Pi", 2015

[2]. A.N. Ansari, M. Sedky, N. Sharma, A. Tyagi,'An Internet of Things Approach for Motion Detection using Raspberry Pi', International Conference on Intelligent Computing and Internet of Things(ICIT), pp.131-134.

[3]. AdimulamPadmanabham and Venugopal "An Internet of Things Approach for Motion Detection using ARM-Based System On Chip" Int. J. Engg. Res. & Sci. & Tech. 2016.

[4]. A. Arun Raja, R.Naveedhab, G.Niranjanadevic and V.Roobini "An Internet of Things(IOT) Based Security Alert System using Raspberry PI" Asia Pacific International Journal of Engg Science,(2016).

[5]. Priya B Patel, Dr. K.R. Bhatt, Viraj M Choksi and Dr. M. B. Potdar "Smart Surveillance and Monitoring System using Raspberry PI and Android" International Journal of Enhanced Research in Science, Technology & Engineering ISSN: 2319-7463,Vol. 5 Issue 5, May-2016.

[6]. Sahil R. Arora, Prof. Amol Boke, Prof. PragatiKene and Suraj U. Patinge "Advanced Real Time Home Security System Based on Raspberry PI" International Journal of Pure and Applied Research In Engineering And Technology.

[7]. Parashiva Murthy B M and Inchara S and Yashaswini K K "Motion Detection using IOT Mechanism" International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 3, Issue 5, May 2016.

[8]. G. Anitha, S. Praveen Kumar "An IOT Approach for Motion Detection and Controlling Home Appliances Without Cloud Server" second national conference.

[9]. Wilson FeipengAbya, Jimmy Basa "Low Cost Smart Security Camera with Night Vision Capability Using Raspberry pi and OpenCV" IEEE conference.

[10]. VamsikrishnaPatchava, M. Surya Gupta, Virginia Menezes "Surveillance and Monitoring System Using Raspberry pi and SimpleCV" IEEE conference.

[11]. Raspberry Pi Org. Forum [Online]. Available: www.raspberrypi.org

[12]. Sunil Kanzariya, Vishal Vora "Real Time Video Monitoring System Using Raspberry Pi", National Conference on Emerging Trends in Computer, Electrical and electronics (ETCEE-2015).

[13]. Sundas Zafar "Motion Detecting Camera Security System with Email Notification and live streaming using Raspberry Pi", 2015.

[14]. Zhuankun Wu: Initial Study On IOT Security Architecture, 1) Strategy and Decision MakngReasearch(2010).

[15]. SerkanAkbas, Mehmet AkifEfe&SuatOzdemir "Performance Evaluation of PIR Sensor Deployment in Critical Area Surveillance Networks", 2014 IEEE International Conference on Distributed Computing in Sensor Systems (DCOSS). pp, 327 - 332, May 2014.

[16]. A. Sawant, D. Naik, V. Fernandes, V. Pereira, 'Low Cost Wireless Home Security System Using Raspberry Pi', International Journal of Pure and Applied Research in Engineering and Technology, Vol.3, No.9, pp.814-821.

[17]. Gantt, Charles. "Raspberry Pi Camera Module Review and Tutorial Guide. "TweakTown News. Tweak Town,22, July 2013. Web. Oct. 2013. http://www.tweaktown.com/guides/5617/raspberry¬-pi-¬camera-¬module-¬review-¬and¬tutorial-¬guide/index4.html.

[18]. Buenger, Christoph. "Raspberry Pi as Low Cost HD Surveillance Camera." CodeProject N.p., n.d. Web. Oct. 2013. http://www.codeproject.com/Articles/665518/Raspberry-¬Pi-¬as-¬low-¬cost-¬HD-¬surveillance¬-camera.

[19]. Andrew K Dennis. " Raspberry Pi Home automation system with Arduino". Feb. 2013.

[20]. Raspberry Pi Technical documentations[Online]. Available: www.elinux.org