IoT Based Smart Surveillance Security System using Raspberry PI

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Abstract
Communication is nothing but transfer or exchange of data. Exchanging the data can be done using Internet of things (IOT). The internet authorized devices are used by nearly about billions. Main motive of this paper is to describe an alerting device handled by internet of things (IOT). This makes it easier in observing and also alert as soon as motion is detected. Internet of things can also be used to detect motion, gestures, and actions to indicate warnings when any kind of motion is detected. Images are captured when motion is detected and it is sent to cloud server and there will be a notification sent to the specified email as the motion is detected. Raspberry Pi is used with open source computer vision software for image processing. Control algorithms are also used for watchfulness so that as soon as motion is detected the monitoring and images are captured properly.

1. Introduction

In our society from many years there is a huge problem that is theft and burglary. From small private houses to big industries this is creates a big problem. This also creates a huge financial loss to our society. Internet of things [IOT] is a transmission of network that is constructed as "always on" on internet. Raspberry-pi is an inexpensive microcontroller. Raspberry-pi platform is extensively used over few years. Surveillance is nothing but observing a certain area through the means of electronic devices for instance web camera or CCTV camera. Internet of things is connecting routine set-up to internet to let the communication between things and also to let the communication among people .The device can be various physical things identical mobiles, sensors, internet.TV.

The quick fix is to make an image recording device which would be able to record such image when it is required. The web camera will record image when the thief is breaking into a room. The web camera recognizes and captures the image and sends it to the owner .The owner will be warned by sending a notification to owner by Gmail. Then the email is finalized with addition to the text that specifies that the thief has entered inside the property.

2. Literature Survey

Paper [1] focuses on minimizing energy consumption by automating everyday tasks such as turning on/off lights, thermostats, etc by detecting their presence. Raspberry Pi, Amazon Cloud Services, Simple Email Service (SES) and Simple Notification Service (SNS) are used for notifying the owner. In paper [2] it is proposed that in this the system provides wireless remote control solution to control the lights and fans through Wi-Fi capable devices like smart phones, which makes it easy and also reduces electricity consumption through the concepts of IOT. In paper [3] it is proposed that Reconfigurable Virtual Instrument (RVI) system which can be considered as a general purpose measurement instrument designed with reconfigurable hardware like FPGA connected to PC through a standard port. By this technique, one can emulate multiple instrument functionalities like function generator and oscilloscope, multimeter, logic analyzer in a single hardware platform. In paper [4] the proposed work of these authors was to decrease the cost production and improve the efficiency, productivity and intelligence. The goal was to run home appliance through smart phone using Wi-Fi as transmission protocol and raspberry-pi as server. In paper [5] it is proposed that implementation for internet of things (IOT) used to monitor regular domestic conditions in a low cost

ubiquitous sensing system. In paper [6] it is proposed that work home appliances is interfaced along Arduio UNO with Wi-Fi module called ESP8266 by using this the status of the system security can be accessed and their following data can be logged in the cloud server. So that data can be accessed anywhere and can be controlled using android app from anywhere.

3. Proposed Work

Starting from ordinary source to big business internet of things has numerous advantages and benefits in the world. A person who has knowledge in the existing system can add flexibility to the existing system. In this paper the main aim is to erase the disadvantages present in the previous module where it provides more flexibility, protection, capacity .In the system raspberry-pi is connected to CCTV or web camera to detect and capture snapshots .When videos that contain motion is detected and the RJ45 cable is connected to internet to send and receive the data. The data can be uploaded to external server such as cloud.
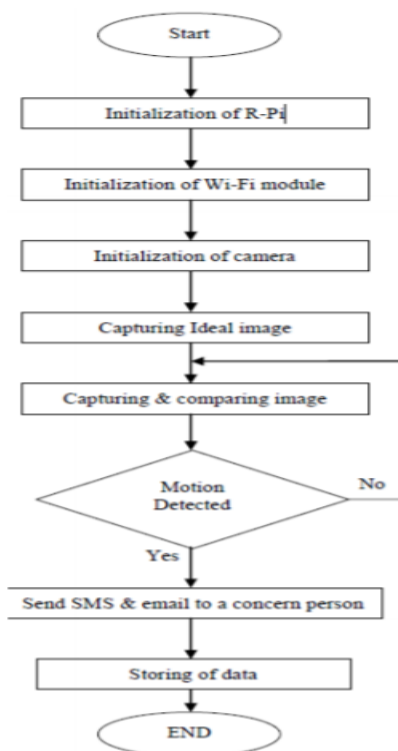

Figure 1: Flow chart for motion detection

Figure.1 describes the flowchart for motion detection. The first step would be the initialization process of the Raspberry-pi. Raspberry-pi is the low cost micro processor and it has huge processing power in a compact board.

Next is the initialization of the Wi-Fi module. It is a technology to provide network connectivity using radio waves.

Then the camera initialization takes place. Raspberry-pi is connected to the camera to detect and capture snapshots. Next the camera captures an ideal image and after waiting for few seconds it captures another image and starts the comparison with those two images. After the comparison if the motion is detected, the system intimates the concerned person by an SMS or Email and now it starts storing the data. If not, it continues to capture images and compare.

Motion Detection Algorithm
1: Motion detecting process
2. Calculation of mean of a particular shade in that first frame
3: waiting for X sec.
4: calculation of mean of a particular shade in that second frame
5: condition absolute $(avgFrame1 - avgFrame2) >$ threshold then
6: motion detected

Motion detecting algorithm comparably cannot consider a spinning thing - a thing that changes. Condition here remains not any intimation identified; the package won't be protecting information.
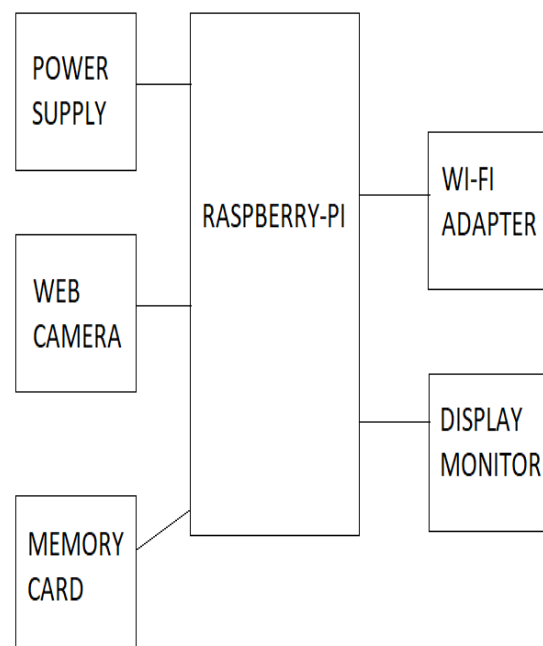
4. System Architecture

Figure 2: Systems Architecture

Figure 2 represents the System Architecture. It includes 6 components namely:
Power supply
Raspberry-pi
Wi-fi adapter
Display monitor
Web camera
Memory card.

Firstly, the Power supply has to be given to the Raspberry-pi through the Micro USB port on the side of the unit. Recommended is 5V input voltage and 2A input current.

Raspberry-pi is nothing but the microprocessor which has huge processing power in the compact board and it is the main component in our model.

Wi-Fi Adapter is used for achieving network connectivity and to communicate with the concerned person.

Display Monitor is used for displaying or viewing purpose.

Web Camera is used for taking pictures or recording videos and its main advantage is security surveillance

Memory card is used for storing the images or video footages that has been captured.

Raspberry-pi is a single board computer in which any HDMI and any input gadget is able to plug as well as operation a keyboard is needed for the procedure. The technical features of the latest raspberry-pi having numbers of features are:

1. To install OS/booting term storage SD card is used
2. HDMI OUT is used with HDTV as well as monitors
3. GPIO 40 in interface allows interconnecting with the real world

Raspberry-pi can be used as security system at a reasonable cost .It controls the concept of Internet of things .There are plenty of factors that make raspberry-pi very much required for security purpose and one of the best factor is that it is inexpensive.

Web camera and memory card is connected to raspberry-pi so that the image or video footage can be analysed through the algorithm and the required footage can be stored in the memory card. Wi-Fi adapter is connected to this system so that data transmission and notification could be sent to the user. Monitor will display the video or photo that has been recorded or the footage that has been captured.

Figure 3: Raspberry-Pi

5. Experiment Result

The method that concentrates on security observation arrangement with the approach of internet of things with the help of raspberry-pi has been successfully done. The monitoring system contains both of the operations i.e. it contains both hardware and software operations. The implementation process of hardware operations is done by Raspberry-Pi. The software implementation process is carried out on the software program that is present in the Raspberry-Pi. Screenshots or footage that the smart security surveillance system has captured will be presented by the display monitor as output.

When any movement is detected by the sensor, camera starts to record the video which is stored and mailed using MQTT protocol with the help of Wi-Fi. The sent mail would appear as shown below:
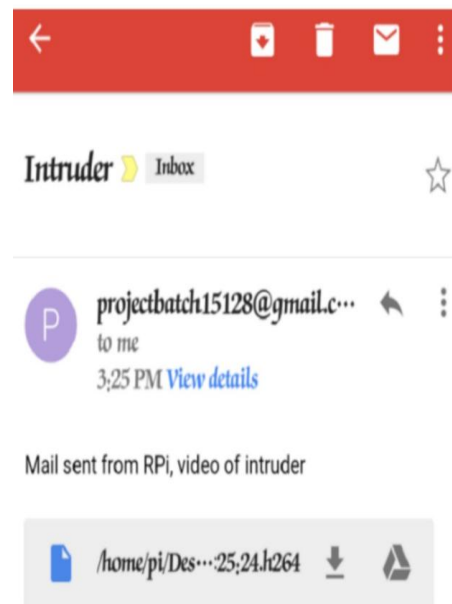

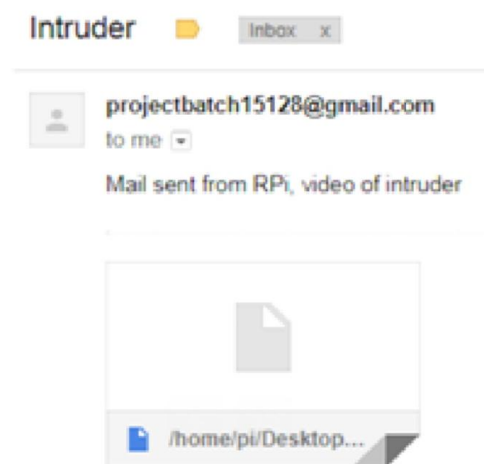Figure 4: Screenshot of Email Alert in User Smart Phone

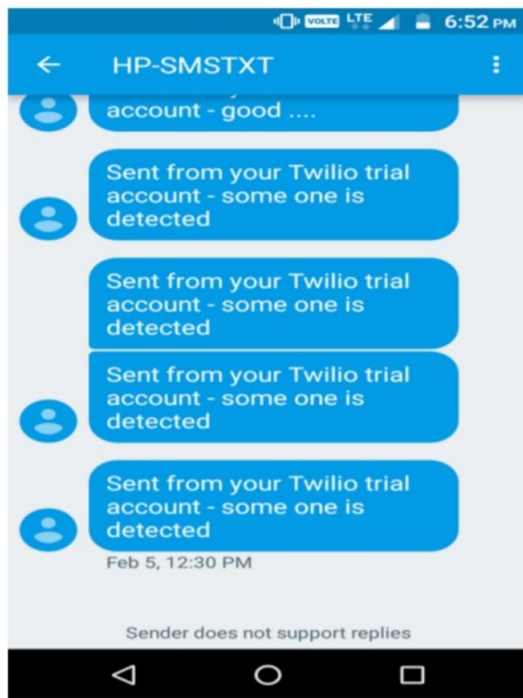Figure 5: Screenshot of Email Alert in Desktop

Figure 6: Screenshot of SMS Alert through Twilio

6. Comparison

In existing paper, maintaining the storage became a hectic task as the camera surveillance would be ON 24/7.

So it would store everything and maintaining the storage devices became difficult.

But in our model, it does not record all the things 24/7. During the surveillance only when the motion is detected, the camera starts recording and only that phase would be stored. So based on this idea unnecessary Storage of data is reduced.

Future extensions can be made like alerting the neighbours about the activity by previously storing numbers.

Storing some emergency contact information also can alert the nearest police station.

Even when the intruder wears mask, Face recognition could be done by using IR rays in future extension.

7. Conclusion

It ensures safe and secured environment. The monitoring of the required area using raspberry-pi is successfully done. Here web cam or CCTV is used as motion detector. In future as further extending this system we can add infrared emitting system so that even if a person wore mask he could be identified as we can further make some progression so that as soon as the person has been captured in the video the police could be immediately alerted. So, here MQTT protocol is been used. This is a light-weighted messaging protocol. This protocol usually runs over TCP/IP. This

captures and stores only the required data and avoids unnecessary storage of data when motion is not detected. Here storage space for unnecessary data will be saved.

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