Camera Surveillance Using Raspberry Pi

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Abstract -*Protection is a situation in which objects, animals or individuals are granted unique identifiers and the ability to transmit data over a network without needing human-to-human or human-to-computer interaction. The webcam evolved from the integration of wireless and Internet technologies. The protection system is the communication of something to something else, the communication primarily transmitting accessible data, such as a sensor in a room to track and control the temperature. Describe a security alarm device that uses low-processing power chips using the Internet of Things to track and warn when motion is detected and send photos and videos to the owner. In addition, application based on the Internet of Things can be used remotely to monitor the operation and get updates when motion is detected. Benefits like these also make this program suitable for tracking homes in absence.*

Our total project ideology is based on alerting the owner of the house or authorized persons beforehand in order to protect their homes from the risk of burglary. This project's methodology depends on three modules using hardware and software tools of raspberry pi and few of its sensors and a pi camera to build an inexpensive system to monitor homes.

Module1: Motion detection using PIR sensor

Module2: Image processing using PI camera

Module 3: Sending image alerts to mail, phone (via text local), and buzzer ringing

If the person is unfamiliar then system will alert the user and registered members via e-mail notification by sending that person's captured image, video and audio clip. If the person is familiar then machine captures the person's image and is stored in the machine. In the second mode, if any suspicious person's movement is detected by device in front of the house, it will send email warning alert and also trigger security alarm device mounted at the house. The built framework, using Iot platform, provides protection against intruder.

***Key Words*: Raspberry pi, Pi camera, PIR sensor, Buzzer**

1. INTRODUCTION

In insurance parlance, burglary is a typical term. In basic terms this is not a burglary. It requires violent entry into the premises by way of breaking the door, breaking the lock, and using any weapon or robbery flowing from the premises. Every person, business, business, organization or corporate society engaged in commercial activity or individuals whose property is exposed to the risk of burglary, housebreaking, theft, robbery and hold-up necessarily needs protection at home. One might argue that a Burglary insurance would make it up but they might soon change their decision after they have been through at the " At your own risk" T&C which according to me appeals that it's better to not rely on insurance policies and better rely on Home security more. There might be several risks of lack or home securities which not only requires you to lose your monetary and materialistic goods but also mental peace. Here is the news cited by caba.org which vividly shows the reporting's as https://www.caba.org.uk/help-and-guides/information/coping-emotional-impact-burglarY.
According to the new Crime Report figures for England and Wales, from October 2015 to September 2016 some 686,000 domestic burglaries were carried out in England and Wales. The positive news is that the number is 8 per cent smaller than it was in the 12 months before. The bad news is that many too many people still have to live with the burgled trauma. If the house has been burgled, the stress it creates will stir up a wide range of thoughts and emotions. You can experience pain, rage and fear at first, as well as helplessness, remorse and panic. Such feelings may turn to sorrow, disappointment, desperation, distrust and vulnerability. In time, you may develop more serious emotional problems such as depression, anxiety attacks, post-traumatic stress disorder and sleeping difficulties. The first thing to remember is that you feel upset about a burglary in your house, which is natural. For a few days, a few weeks or longer, you can feel the emotional after-effects-or they can come in waves. Try to note that anything like robbery takes time to get over, so you should try to stop focusing on it as much as possible. What you feel is natural and you'll feel better if you look after yourself. My point is why compromise a pretty life?

Prevention is still safer than cure. So protecting our homes from burglary is the safest way to keep them safe in the house. Theft is the fifth most popular home-owners insurance allegation, accounting for 6 percent of them, according to Travelers, from 2009 to 2015. The average loss according to ISO runs at $3,786. Now if we prevail to talk about the developed nations I'm sure there wouldn't be any less endorsement. In a developing country such as India, if that is the case, the rates would be even strengthened unsurprisingly. Particularly during the period of quarantine due to the covid-19 pandemic-as cited by India's economic times:

https:/economictimes.indiatimes.com/topic/burglary?
From = mdr as Butter & booze new burglar gold during

COVID times! Lockdowns have made everyone, including the thieves, change direction. Unable to get their hands on gold and electronics with people staying in their homes, this month it's the liquor sales and grocery stores that have become the latest destinations around the world recorded at 04:58AM IST 19 Apr, 2020. Recorded theft rate in India-selected states and union territories 2016 Published by Madhumitha Jaganmohan, Sep 23, 2019 at statista.com the statistics show the theft rate registered in selected states and union territories in India in 2016. In that year there were more than 600 theft cases registered in Delhi's union territory per 100,000 inhabitants.
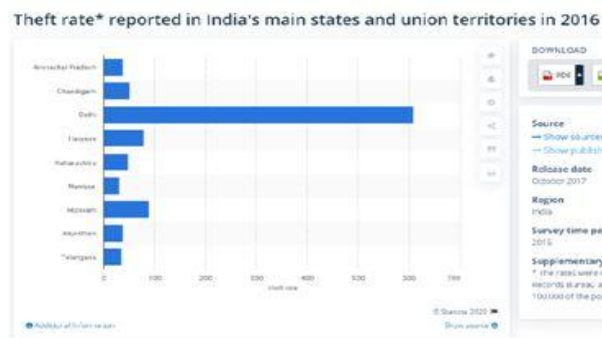

Figure.1. Theft rate reported in India 2016

Now according to Countryliving.com there are 8 clever gadgets that can keep your home safe from burglary:

1. Timed lights
2. Outdoor camera
3. Outdoor light
4. Alarm
5. Indoor deterrent
6. Indoor camera
7. Hidden key
8. Outdoor lock

So, on the above basis padlocks everybody have as a regular commodity at house and otherwise everything else is about home security is about cameras, lights and alarms which if branded or least branded could cost so much which is not reasonable at all when you know you can engineer a cost efficient genius system. Thus, Our project "Camera surveillance using raspberry pi" In this IOT based project, we will build a **House safety System using PIRSensor and PI Camera**. This system will detect the presence of Intruder andquickly alert the user by sending him an alert mail and also real time SMS via third party apps along with ringing the buzzer. This mail will also contain the Picture of the Intruder, captured by Pi camera. Raspberry Pi is used to control the whole system. This system can be installed at the main door of your home or office and you can monitor it from anywhere in the world using your Email over internet.

Figure.2. Pie Camera

2. LITERATURE REVIEW

In the paper [1] "Motion Activated Security Camera" the authors initially used the PIR sensor which will enables to sense the motion. The principle of PIR is based on the small amount of infrared radiation. The PIR sensor can also detect the change in the infrared radiations. The PIR-OUT is also enables to detect the motion. With the help of the camera the image will be captured and by using Open CV the face detection takes place. The captured image can be viewed in the Parse Database. Finally the image is stored in local hard drives. This particular system is also having remote monitoring facility.

 [2] In this paper which was titled as "Low cost real time system monitoring using raspberry pie", the authors mainly focused on how to decrease the storage usage based on raspberry pie.

With the effective use of Motion Detection and automatic video stream does not require an individual to start or to stop the camera detection process.

[3] The surveillance and monitoring system in which the steps used were, initially the surveillance will be done by the camera using raspberry pie and secondly the images will be captured and compared for finding the motion using Simple CV. Later the lights will be switched on and the images which were captured will be transferred by using the internet and finally the motion presence will be alerted to the user.

[4] By installing the surveillance robot, it can monitor the area where it was fixed. The users have to just login to the raspberry pie webcam and can view the live feed. Cost effectiveness and remote controlling features of the robot made it an easy usage.

[5] The author in this paper taken an architecture based on the smart surveillance camera using raspberry pie in which initially the raspberry pie is connected to the web camera to detect and capture the images and RJ45 LAN cable which was connected to the internet to send and receive data.

[6] The proposed work in this paper was closely related to our proposed project. The author in this paper proposed a real time security surveillance system using IoT. In this system raspberry pie and camera were used to detect the motion detection, in this system camera captures the images and sends to the user through email server and it also sends SMS alerts to the user mobile automatically through GSM modem. The recorded video through surveillance camera will be automatically uploaded to cloud server through email server and it also sends SMS alerts to the user mobile automatically through GSM modem. The recorded video through surveillance camera will be automatically uploaded to cloud server. When cloud server is not available then the data will be locally stored in raspberry pie and when the server is available then the data gets automatically uploaded into cloud server. Since the model is based on the IoT platform, the author used the IoT platform for the movement of the surveillance camera for better coverage of that particular area where the camera was placed for surveillance.

[7] In this paper the author designed and developed the WIFI enabled Home security surveillance system using the raspberry pie and IoT module. The main aim of this proposed model is that it is an active surveillance system which will help in alerting the user when any event happens wrongly. Intruder detection and fire detection are the main features of this system. Web servers have been created which helps the user to view the sensor status and can surveillance the live video. The intruder image and the video will be sent to the user email. The authors have used Node MCU which makes the system cost efficient, portable and compact.

3. THEORETICAL ANALYSIS

This frame work is composed of specifications both for hardware and software. The hardware requirement is raspberry pi model b, Pi camera, Pir sensor, power cable, keyboard and mouse, SD card, connecting wires, led's and buzzer. The software requirements Raspbian OS buster, Python, Windows, VNC viewer, Putty, Eject flasher, SD card formatter, programming language. Raspberry Pi is connected to the Pi camera with the help of camera port. In the PC, the Free SD card is inserted via card reader and is formatted with SD card formatter later Raspbian buster software is flashed into it using flasher software. Raspbian operating system is installed. Raspberry-pi works only on the Raspbian operating system, Linux, Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the collection of core programs and utilities that will power your Raspberry Pi. But Raspbian offers more than a mere OS: it comes with more than 35,000 packages, pre-compiled software Raspberry Pi 3 7 You can program the pins to communicate with the real world in incredible ways.1; pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. Putty configuration and VNC viewer are needed to install Raspbian OS. Putty configuration is SSH and Telnetclient. It is open source software that is available with source code. Now the step by step procedure is given below

Project Hardware Requirements:
1) Laptop
2) Raspberry pi
3) Pir sensor
4) Led Lights
5) Universal USB cable
6) Ethernet cable
7) Pi camera
8) Female to female connecting wires
9) Wi-Fi Router (Internet)
10) Buzzer
11) SD card

Project Software Requirements:

1)   Raspbian buster
2)   Putty
3)   VNC Viewer
4)   Windows or IOS
5)   Python IDLE
6)   Flasher
7)   SD Card Formatter

4. FUNCTIONAL ANALYSIS AND METHODOLOGY

Functional Analysis of Existing System:

A smart surveillance system has been developed that can record / capture video/ image and send it to any device. This is beneficial because it gives both sides' reliability and privacy. On the receiver side it is authenticated and encrypted; hence it only offers displaying the information to the person in question. Required action can be taken in a short span of time in the event of emergency situations such as surveillance of the aged, military areas, smart homes, schools, factories etc. Future research is to identify the number and location of individuals exactly in that area so that correct information can be collected on the receiver side. But the existing system is almost much branded with expensive prices. Thus, our proposed system uses the below given components and can build an easy home security system at a very low price.

Fig.3.CCTV existing technology

Methodology:

Our idea is to develop a system that works with easy home security and surveillance. Basically our Pi is equipped with motion detecting sensor and Pi camera as well. We have a notion to segment the work in #3 modules.

Module 1: Motion detection with PIR

Module 2: Image processing with Pi Camera

Module 3: Sending alerts to phone & mail; Buzzer ringing, Led blinking

Motion detection with PIR: In our first module the PIR sensor detects the heat waves emitted by the humans its job here is to detect motion so that it sends signal to capture picture.

Image Processing with Pi camera: In the second module, on receiving signal from the Pir sensor the camera captures the pictures as many times as times as it wants according to our python code and then it carries out the Image processing with including data sets it compares if the new image is already existent or not .It checks the accuracy of the newly formed image, if the accuracy is less than 70% it flags it as unauthorized entry.

The camera module plugs to the CSI connector on the Raspberry Pi. It's able to deliver clear

- 5MP resolution image
- 1080p HD video at 30fps.

The camera module attaches to Raspberry Pi by a 15 pin Ribbon Cable, to the dedicated 15 pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2835 processor.

After installing the OS to the board connect all the necessary hardware components and switch on the power supply. It starts booting up the Board and login the raspberry pi by username and password. It mainly works on the python software and checks the network settings to update the python software by commands in the terminal window.

Following packages are to be installed for implementing the proposed model.

Installation commands have been listed below.

1) sudo apt-get install python-matplotlib
2) sudo apt-get install python-numpy
3) sudo apt-get install python-scipy
4) sudo apt-get install python-imaging
5)   Enable the camera settings on the board to capture the image and save it on the folder. Run the python code to check the enhancement algorithms and remove the noise present in an image.

Sending Alerts & Consequences: As soon as the system comes to know that it's an un-authorized entry it sends the picture it captured to the provided mail and also rings the buzzer and led's blink set according to the python code. Apart from that an alert shall be sent to the provided

phone number via 3rd party portals like way2sms, text local etc.

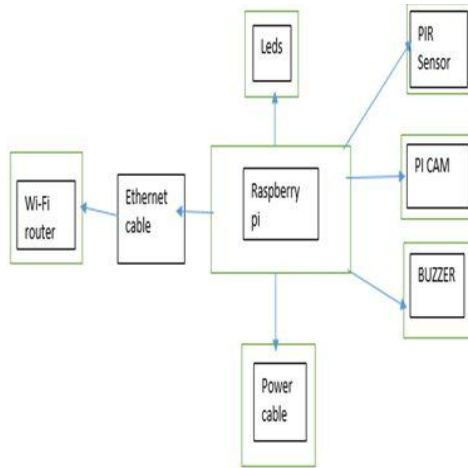## Block diagram & Flow charts

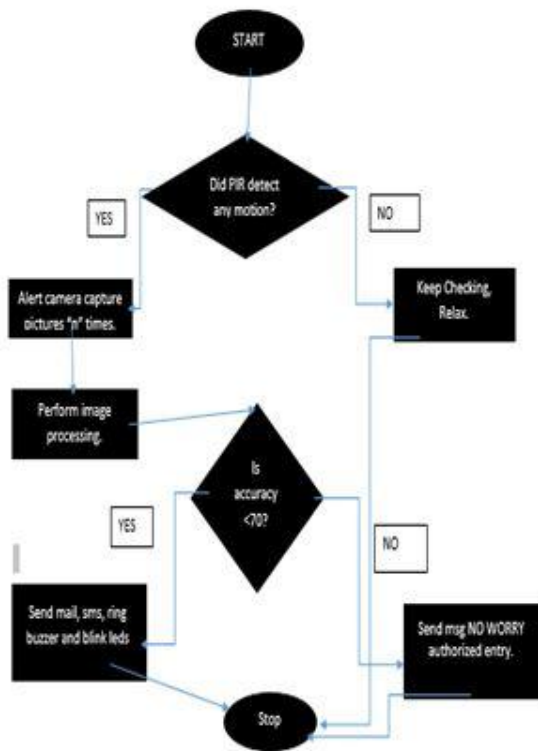Fig.4. Block diagram of work flow

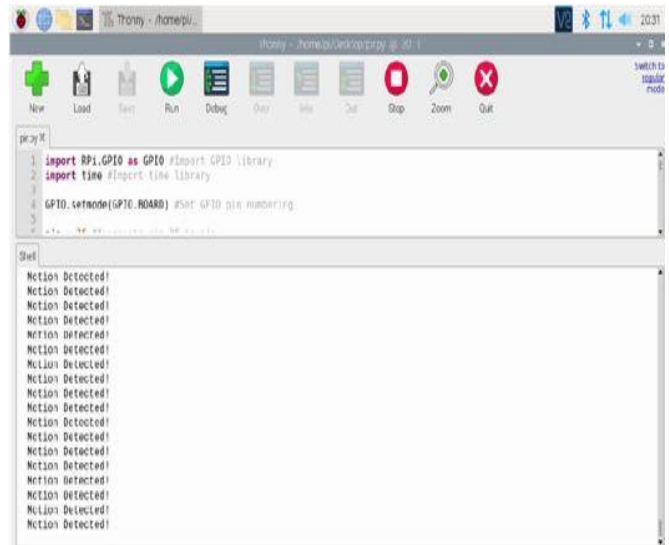
Figure.5. Methodology Flow chart

OUTPUTS:

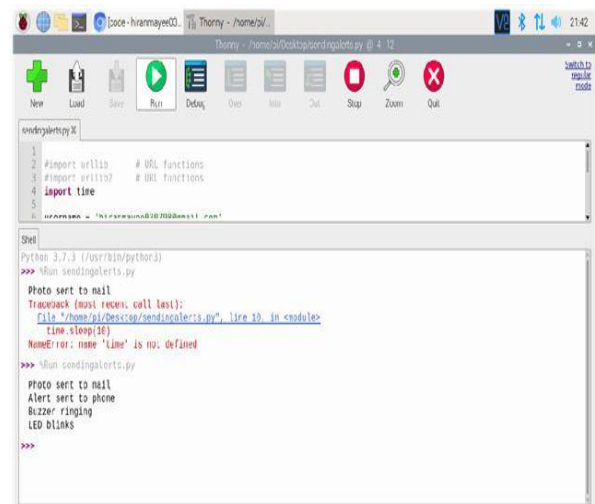Figure.6. Message displayed as motion detected
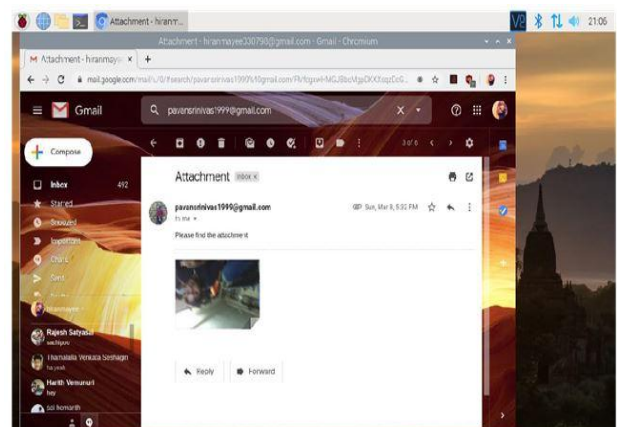

Figure.7. output displayed after execution

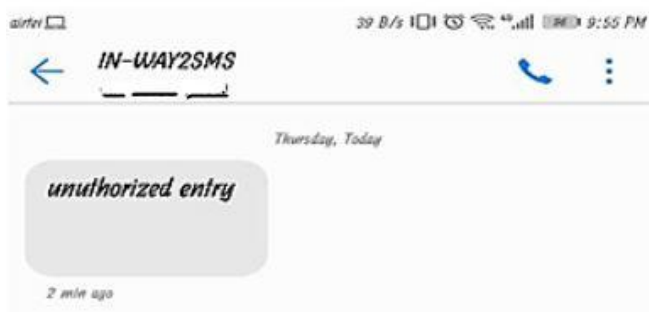Figure.8 output displayed through Gmail

Figure.9. output displayed through way to sms

5. DISCUSSION AND SUMMARY

The home security system based on IoT was designed and developed using RaspberryPi-3, Pi-camera, and PIR sensor. The user can receive notifications at anytime and anywhere via Smartphone or laptop email. It gives loud alarm if any unexpected or suspicious movement is detected. The engineered device thus effectively prevents any unknown person entering the home from accessing it. This idea is used to assist home protection to the next level, this approach is cost-effective and highly efficient compared to the existing system.

This system can reduce man power, and is an effective solution for the world's real-time problem. Protection can be given by automating the system using IOT without the human interference. Here one can detect any intrusion. This information can be used for system maintenance and also to provide some details about the intrusion to the registered user. In several fields such as home automation, office protection system, and so on, this system can find its applications.

Henceforth, this project intends to incorporate the 'Motion Detection' technology and to add to the existing protection framework by improving the functionality of these technologies and incorporating them.

This system would be an alternative to present-day costly security systems.

6. FUTURE SCOPE

The further extension of this report is Artificial Intelligence and Real Time surveillance. To capture and send direct videos to nearest police stations and also to send voice warning messages to approve persons. In addition, a device can be implemented in which LED lights flash at the watchman's house so that they can chase and catch the red handed burglars.

We have therefore developed a smart, lightweight, cost-effective monitoring device capable of capturing video / image and transmitting it over the internet. Reliability in privacy and protection at both ends, which is achieved in this project, is most significant. Authentication is given on the receiver side, so it can only be accessed by the individual concerned. Also some options such as camera angle control, to be viewed in 360 degrees. Changes can be made in the future if appropriate, so that it can also be used in drone, international boarder surveillance or some other military applications. In this we may build this same framework for different applications using digital image processing.

By using the same hardware & software implementations can also be done Like in the following applications.

CONCLUSIONS

IoT refers to the connected physical interface network that is increasing at a rapid pace because a large number of devices and items are being linked to the Internet. Home protection is a very useful IoT technology and we use it to build an affordable security device for both homes and industrial uses. The device can warn the owner of any unwanted access, or when the door is opened by giving the user a note. He will take the appropriate actions once the user receives the notification. Such a system's key benefits include ease of deployment, lower costs and low maintenance. In short, we want a holy project and we are so excited to move forward.

This study is performed with various aspects on the analysis surveillance system for motion detection. The issues identified in the previous system will attempt to solve the current system using raspberry pi. This study carefully reviewed and summarized various literature contained in this survey. This analysis assesses the strengths and limitations of movement detection algorithms, Contact through push eta and emails will be introduced so that we can upload the picture or videos to emails, live tracking will also be carried out where necessary so that it can be viewed from anywhere on the internet and movement detection is also necessary.

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