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Inspiring Excellence

An Emergency Based Image Filtering System

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We dedicate our thesis work to our family. A special feelings of gratitude to our loving parents.

We also dedicate this thesis to our many friends who have supported us throughout the process.

We will always appreciate all they have done.

Declaration

It is hereby declared that this thesis /project report or any part of it has not been submitted elsewhere for the award of any Degree or Diploma.

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Abstract

With the invention of new technology day by day the rate of inhuman works is also getting increased as well which ,making our life easier but at the same time unsafe. The new advanced technologies are permitting us to realize real time smart system that helps to provide advanced services to the users by giving real time image processing and currently, this smart system is also being imbibed to build the model according to the users' demand and interest. In this proposed model, an emergency image filtration system has introduced. Through our proposed model we tried to emphasis to implement it for security system. In low light or some other reasons image capturing devices failed to capture perfect or clear image. Insecurity system sometimes it is a must to get the clear image to identify the real fact. For that reason we proposed to filter noisy images in real time to check the fact on exact time. For noisy image we have taken 'salt and pepper noise' as a type of noise to check whether the received image is noisy or not. In addition, after assuring the presence of noise, an image filtering system is inaugurated which is suitable filtration for the specific noise category that can enhance the visualization of any degraded images in emergency basis in the server. After the filtration process is held, the denoised image is saved in the server again to share with other connecting devices through that server. As a result, the percentage of noise level for particular images can be identified. In particular, the proposed system relies on a smart device that assembles image filtration to deliberately provide the users with strained output image in an observed network. The final transmission of the refining data has done by the devices which are connected with virtual server. Finally, through running definite image filtering process, running in the system, that controls the smart environment security system and will help us to prevent various unwanted inhuman works. The system has been designed that can be easily extensible to other smart technologies and its effectiveness has been evaluated in various security as well as safety platform.

Keywords: Image processing, Filtration, Cloud storage, Smart Security.

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Chapter 1

Introduction

1.1 Introduction

In this high technological world,the real motive or idea is to ensuring security to minimize the security related issues we face now a days and failing to come to a fast solution[2].There are so many of its example that over the world in spite of having that much strong technological gadgets we are failing to ensure security due to some distorted data[3].As an example suppose in any given busy road of Dhaka city at night there happening any sort of crime activities and CCTV camera failed to capture clear image for lack of depth sensor .In that case to identify the criminal would be thought or even sometimes they won't be able to see before it happened due to low light failure of capturing the incident clearly In that case we proposed our system on emergency basis it won't wait for manual instruction rather it would detect the noisy image in real time and filtered it and send the denoised image to the server[22].In this way CCTV controller can get the news before can send the image to the police through that server at once. From these type of idea's we proposed our system model to ensure security on an emergency based .The virtual wireless connection, which is concerned with building a network of Internet-enabled devices to promote a smart environment, is another promising area of research numerous emerging computing paradigms related to those areas of research and their intersections have come into play.The smart technology has obtained great development over the last few years and is increasingly influencing various industrial development . It refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. It is already around us. On the other it is also used to find out omnipresent object. Capturing moments and emergency image filtering and saving while memory shortage in devices can be done in a smart environment. The quality of the images taken by the smart devices can be enriched through automating filtering process in virtual server that enables a coherent relation between receiving image from one place and from

other final filtered output image through cloud server. Initially, devices are conducted to capture image and check if there is any noise, and then the further filtering process is done by server by running Median Filter Algorithm. Generally, the noise is occurred in image because of random variation of brightness[21].It also can be generated by sensor and he circuitry of smart cameras. Also, it is kind of undesirable occurrences of captured image that inaudible the necessary information. There are various types of noises but for this paper 'salt and pepper noise' is used as an impulsive noise. An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions. This type of noise can be caused by analog-to-digital converter errors, bit errors in transmission. In order to manage the physical devices properly involved in smart system and the server that is used to collect and transmit data, filter the defected image, store in cloud storage, several steps are executed through the whole system[17].The ubiquitous sensors, and other devices involved in this proposed system can generate data rapidly so that the data must be processed with a high throughput[16].Furthermore, because the volume of the captured image is large and can consume the memory space rapidly, a data storage features for the data is added in cloud service which can be able to store massive data efficiently but also support horizontal scaling. Moreover, these data can be collected from many different sources and consisted of various structured and unstructured data; data storage components are expected to have the ability to deal with large data resources. For the challenges mentioned above, a data storage platform with the ability of efficiently storing and managing structured and unstructured data is required[9].Therefore, we propose a system where collected data is diagnosed to detect noise and transfer the data for filtration process and after filtrating the fine image is stored in cloud server as data storage platform for data. In our proposed model, Google storage API is used for accessing the data in the drive which is used as the cloud server on the framework.

1.2 Objective

1. To build smart security system using noise filtration.
2. To develop a system for getting more accurate information as well as the assistance of future research work.
3. To get the clear image in spite of lacking depth sensor ability of security in smart security devices.
4. The system must ensure more precise security system in official environment.

1.3 Motivation

Smart environment is created through taking advantage of new smart technologies that helps to predict users' intention which is trending both in academically and industrialized field. However, these technologies are now widely used for taking images right in camera at the moment. Not only that, the smart devices likewise cameras are using to capture every moment that can be in any situation to illustrate, unwanted or emergency situation. There are several types of model that have worked with unwanted situation that covers in secured zone like institutional, home or industrialized. From the necessity of getting a clear image for instant saving instant real time filtered image, authors have got the motivation to propose such model that helps to store the image in cloud and also filtering the noise if any degraded image is found. Innovation process is growing at a faster space. This situation propagates the dependency on technology among various categories of users, which are actually developed the interest to invent new features among all young people. This new era also demands for an innovative technological improvement in extremely small-scale electronic devices with identification and communication capabilities, which can be embedded in the environment or in common objects. Since progress in technology field, more and more processing power, storage and battery capacity become available at relatively low cost and with limited space requirements. Advanced technology has also the system of installation of hardware infrastructures which can able to provide new services to the users. Moreover, to improve the user experience as much as possible, this virtual connection and filtration should be done without any interruption and also without any evident action of the user. Moreover, the model needs to be achieved in every sensible way which seems convenient in a real scenario. The integration of image filtration capabilities with data storage infrastructure in real time allows accomplishment of the desired goals. As well as, the final refining data storage in cloud services can also be a multiplier to future approach.

1.4 Thesis Outline

Chapter One: introduces the treatise of virtual smart living and the need of noise reduction system and motivation behind this work.
Chapter Two: discusses a brief history of implanting the idea and related works to our systems.
Chapter Three: explains the methodology, algorithm and implementation of the prototype.
Chapter Four: provides the proposed model along with the implementation panning and process.

Chapter Five: contains the results we got and the analysis of noise reduction through our system.
Chapter six: concludes with the limitations of our system as well as the future plan with this system.

Chapter 2

LITERATURE REVIEW

Literature Review

Recent advances in image classification methods, along with the availability of associated tools, have seen their use become widespread in many domains[15].The adoption of using social media in our society is an opportunity and as well as helpline in case of emergency situation and to utilize the media such as CCTV, mobile phones, cameras as a source of situational awareness during crises events[15].The focus in this chapter lies in target based and explicit digital data collections in emergency cases which is transmitted by various image capturing media and filtering unwanted noises from image through detection of distorted image in the domain security basis. There is a possibility which entails that the image data that can't be saved locally instead only when the participant is able to access the internet. By then, important details of data can be lost[11].Recent advances in image filtration methods, along with the availability of associated algorithms, have been using become widespread in many domains[20].One of the major trends that is shaping the improvement of technologies in the ICT sector at a large space is the Internet-of-Things. The shift from an Internet used for interconnecting end-user devices to an Internet used for inter connecting physical objects that communicate with each other and with humans in order to offer a given service encompasses the need to rethink anew some of the conventional approaches customarily used in networking, computing and service provisioning[16].In this literature, there are several works are done that are addressed towards particular issues, but only some of them provide a flexible and scalable solution that can solve the problems in emergency basis . As per the proposal, the key features of these model is illustrated by the emergency image filtering system. It is an important and challenging research topic where authors have focused on the generalization form of data handling and image filtering process. The authors present a personalized noise straining system where the details processes are given about how the real-time image can

be filtered in emergency cases, handling through virtual server. Also it describes about the type of abnormality of an image which is captured in real-time. Further, after collecting the image and propagating the information about category of image, if experimented image is diagnosed with any kind of automated noise then that distorted image will be handled through virtual server[9]. In this paper, in terms image handling, authors have worked with gray scale images for which digital image processing has been used for filtering the image. The camera is used to collect the image of any situation or any person to detect that whether the image is clear or not. Then smart devices are used to transfer the data to the server in order to identify the nature of the image and the percentage of noises that image carries. The camera output is given to the virtual server for the processing and filtration are controlled by the server[17]. Automated noise detection is applied in order to detect if the image is noisy or not. In particular, for this model authors use 'salt and pepper' noise for noisy environment. For refining defected image, a non-linear digital filtering technique is used to remove noise from images named Median Filter.In particular, the increased level of heterogeneity, due to the inclusion of devices with only very basic communication capabilities, challenges the assumption that any device presents a full protocol stack, as well as the application of the end-to-end principle in network operations. From the conceptual standpoint, indeed, the smart devices is about entities acting as providers and consumers of data related transmission. The focus is on data and information rather than on point-to-point communications. This fact can push towards the adoption of this proposed model in the future work. The increasing use of devices in this physical world that comes with various features sometimes produce noise in image which is usually an aspect of electric noise[16]. In emergency cases, these kind of noise in image can create confusion and make the consumers worried about the hustle in that specific situation that can go beyond control. Therefore, in order to filter the defected images from refraining any unwanted situation, median filter is executed in server. As a result, filtered image is generated and is stored in cloud storage. Consequently, final refining data is transferred to the devices (client) that are connected to the server. Here, two machines are configured as server and client and data transfer is enabled.
Moreover, different steps have been carried out for getting the noise free image. In addition, the transfer of data in emergency cases is done by the server[22]. In the proposed system data transfer is performed by using mqtt protocol and rest API. Once the data is transferred to the client, the announcement regarding the arrival of the data is done. Regarding to the interaction with smart environments, in the literature focus on specific technologies and in order to achieve the goal, the system simplifies customized and manifested version of user application.

Chapter 3

DATA AND FILTERING PROCESS

Preparing a well structured an emergency based image filtering system we used real time picture from client's laptop as noisy image. But in bigger plan we proposed to take data from CCTV camera to the server as an input data. Then we filtered the noisy image using median filter for getting the filtered data.

3.1 Data Collection

Data is the term we use for a set of some existing information or knowledge we present in some suitable form for use. For implementing our system here the real time noisy image are the data we used as input through web-cam of client's PC.
Here when we take image from web-cam there are some noise in the picture due to various reason. Image noise is lack of balance in brightness or color information in images as a result of electronic noise. It produced by usually for sensor or digital camera . It's basically an unwanted by-product information that affects the desired information. In our system those noisy images will be considered as our data.

3.2 Data Filtering

Data Filtering is a process that helps to deduct irrelevant information and getting the desired information .Where as all signal generating devices; both analog and digital have the tendency to create noise with the information. So data filtering becomes a most needed work for getting the near to exact required information.

3.2.1 Degradation Model

For noise filtering of an image the most fit concept is degradation model. Degradation model is an analysis model through which we can restore the degraded picture. While taking picture there we can have so many issues for this the picture might get different type of degradation like blur, motion blur, haziness, focusing problem etc. For all these issues we end up having an approximate close to the original picture. This type of picture is known as degraded picture. Then there we can also have some additional noise due to sensor or camera as we know no machine is as perfect.[11] So this noise is called additional noise. There is another type of noise that is called multiplication noise. Here in multiplication noise the amount of noise is same as original one. multiplicational noise the amount of noise is same as original one.

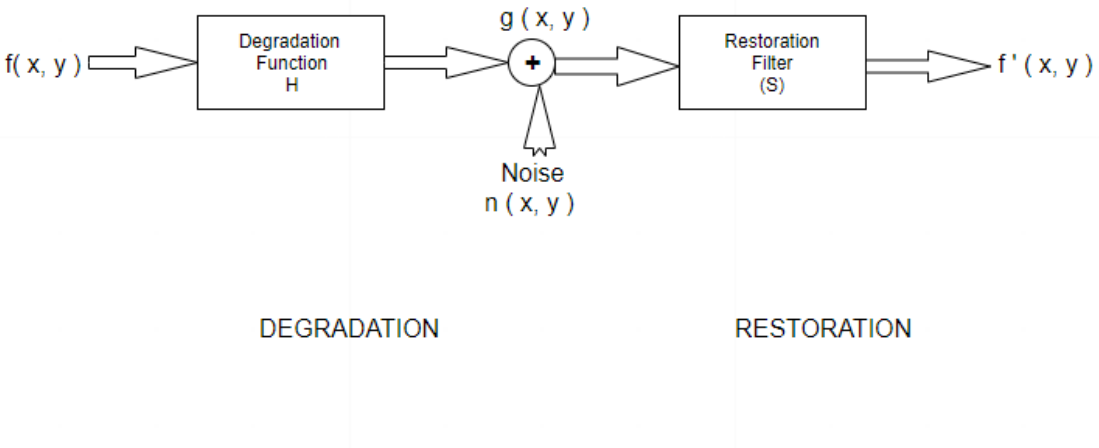

Fig. 3.1 Degradation model

here,

f(x,y) = the function of original required image

h(x,y) = the function of degradation image that being created for different reasons of the smart device then n(x,y) = the set for noise that is added (if we add some additional manual noise)

g(x,y) = the degraded image and at the last after filtration

f'(x,y) = the Image that is being restored through filtering.

There are two equations for getting the combination of all noise (both for sensor or additional)[15].One is additional degraded noise set another is multiplication degraded

noise set.
The equation of additional noise , g(x,y) = f(x,y)*h(x,y)+n(x,y)
And the equation for multiplication noise g(x,y) =f(x,y)*h(x,y) *n(x,y).

3.2.2 Median And Average Filter

The median filter is a noise filtering algorithm for non linear digital images uses for removing noise from an image or signal. It is a widely used algorithm for digital image processing purpose with some conditions in spite of preserving edges of the image while noise cancellation . This type of noise filtration is much helpful for getting the filtered image[25]. Image filtration is used for many purpose like removing noise, sharpen contrast, highlight contours, edge detention and so on. As we know there are lots of noise types , median filter can use for all types of noise but usually it performs better for speckle noise (which means the inherently degradation of the quality of the image for synthetic aperture (SAR) , ultrasound or optical coherence tomography images) and for salt-and-pepper noise(which means impulsive noise as in will have dark pixels in bright regions and bright pixels in dark regions as a result of analog to digital conversion) rather than Gaussian blur or blur images[1].

Fig. 3.2 LINA image before and after filtration

It is particularly most effective for ‘Salt and pepper’ type noises. It actually works by

moving through pixel by pixel value by replacing the neighboring (slides or pixel by pixel in the entire image) pixels with the median value[6]. It first sort out all the pixel values from the neighboring numerical order and then replaces the median pixel value.

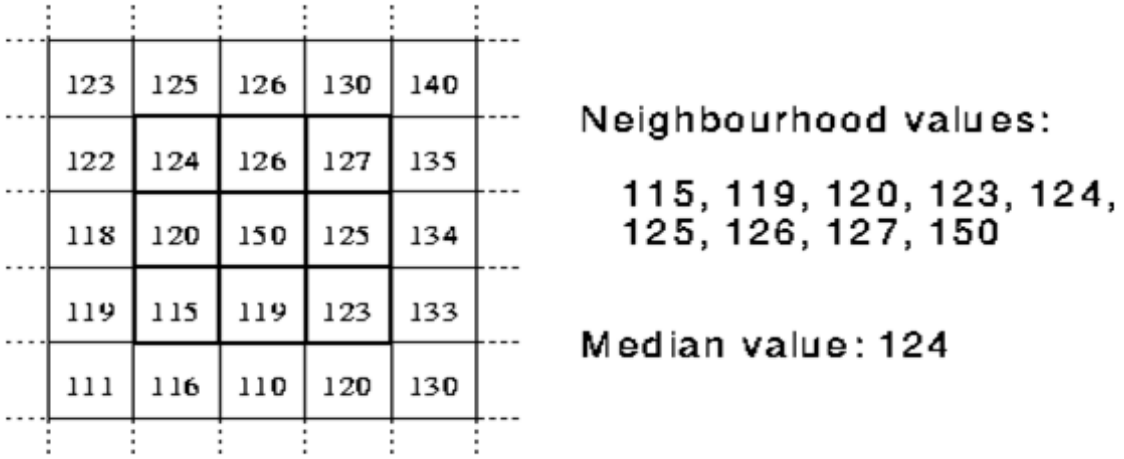

Fig. 3.3 Median value from neighborhood values[18]

Now we saw for using median filter we need median value. It is a commonly used statistical and probabilistic theory of mathematics for measuring the properties of data set. Sometimes we describe it as average while comparing mean values. Wile trying to median value in a sets of data odd or even number we try to separate the data in upper part and the lower part[8].For example if there is data set 1,2,3,4,5,6,7 . Here there are 7 elements in the set and 7 is an odd number[14]. So if we divide it into lower and upper parts there will the a middle value as a fourth value which is considered as a median value .So for that set the median value will be 4 .

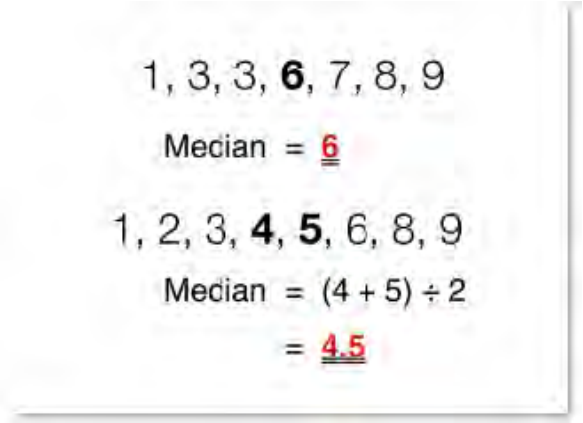

Fig. 3.4 Calculation of median value[24]

But if the data set be like 1,2,3,4,5,6 that means there are 6 elements in the set which shows that the set is of even numbers then the divination will be an equal of lower part and the upper part[23] . For that we need to take the last number of the lower part and the first number of the upper part and take the average of these two numbers for getting median value of the set. So for that set the median value would be

$$\frac{3+4}{2} = 3.5$$

.For calculating probability distribution the median value is considered as likely equal to fall above or below of the whole set.

```
Program median filter
for every pixel in the image do
        sort values in the mask
        pick the middle one in the sorted list
        replace the pixel value with median one
end
```

Fig. 3.5 Sample pseudo code of median filter[12]

Median filter is popular widely for it's excellent noise reduction capabilities for random noise considering less blur than any linear smoothing filters of same size[13]. Here, Sxy is representing set of coordinates a as rectangular types image m * n centering at point (x,y).Then we consider corrupted image as a function of g(x ,y) which is defined by Sxy.The value of the filtered image set as f(x,y) at any point which is simply the arithmetic mean being computed by the region Sxy . If we represent this as an equation this will be something like , $f(x,y) = (1/mn)\sum g(s,t) where (s,t) \varepsilon Sxy$

This filtration represents a set of techniques whose objective is to obtain a result with a specific application from a source image which improves characteristics that allow to extract information from the image.

```
for i = 1:m
    for j = 1:n  %intesity of pixel in the noisy image is given as noisy(i,j)
        % here we define max and minimum values x and y coordinates of any
        % pixel can take
        xmin = max(1,i-1); % minimum x coordinate has to be greater than or equal to 1
        xmax = min(m,i+1);
        ymin = max(1,j-1);
        ymax = min(n,j+1);
        % the neighbourhood matrix will then be
        %temp = noisy(xmin:xmax, ymin:ymax);
        temp = I(xmin:xmax, ymin:ymax);
        %now the new intensity of pixel at (i,j) will be median of this
        %matrix
        output(i,j) = median(temp(:));
    end
end
```

Fig. 3.6 System's code for median filter

Average Filter is also almost same as median filter but it just take the value of an output pixel determined by the mean value of the neighborhood pixels rather than the median value[7] .In our system we did both so that we can also show an addition comparison between both of the filter also.

Fig. 3.7 Noisy Image filtration for average filter

Chapter 4

METHODOLOGY AND SYSTEM PROCESS

The proposed model shows the planned working process of emergency based noise filtering system which is implemented with the help of Math lab, Python and other software[19]. This system process illustrates how the Emergency Noise Filtering system takes noisy image from the virtual server as a input and after filtration how it gives noise filtered image in the virtual server again.

4.1 Software(Programming Language)

We have used some software(programming languages) to implement Emergency Noise Filtering system. They are Math lab, Python, Git bash etc. With the help of these interpreted high-level programming languages we implemented our system[10]. The proposed model of our system is the summary of the ideas that we tried to implement in our system.

4.1.1 Math Lab

MATLAB is a high-level algebraic computer programming language and interactive environment that helps us to solve computationally functional tasks faster than with other programming languages which is designed for fast numerical calculations . The main data type for math lab is matrix. As example, A=[1 2 3; 4 5 6; 7 8 9]; here A is a matrix of size 3 x 3. There is a image processing toolbox separately in MATH LAB .It is a collection of functions that extend the functionalities of the MATLAB's numeric computing environment. It supports a wide range of image processing operations, like linear filtering and filter design, image analysis , transformations , geometric operations and so on. We can interactively

segment image data, compare image registration techniques, and batch-process large datasets. Visualization functions let us explore images, 3D volumes, and videos, adjust contrast, create histograms and manipulate regions of interest (ROIs).

4.1.2 Python

Python is an object-oriented , functional ,reflective high-level programming language for general purpose programming . It supports multiple programming paradigms. It is an open source software that has community based development model. It uses dynamic typing which is a combination of reference counting and a cycle detecting garbage collector for memory management. It offers some functional programming for list comprehensions, generating expressions and so on. It is a very good choice for memory insensitive work as a large number of resources are available in python. It is easy to learn and it supports multiple systems and platforms. As for image denoising we need to keep track of the previous values so we need some programming language based on best performance in memory management. So we choose python for implementing our system.

4.1.3 OTHERS

Apart from Math Lab and python we used wireless local area network for taking the input image to the server and again sending the output image to the server back so that the device connected with it can get the denoised image[4]. And for server we used Cloud virtual server so that through Wi-Fi we can take the image to the server for denoising.

4.2 Proposed Model

The proposed system model of emergency noise filtration works based on algorithmic implementation through Math Lab, Python , Git bash etc. Math Lab is used for getting the denoised image and it's detail pixel values and python is used for implementing the "Median Filter' algorithm. The method uses smart devices, virtual server and in addition some devices connected to that server.

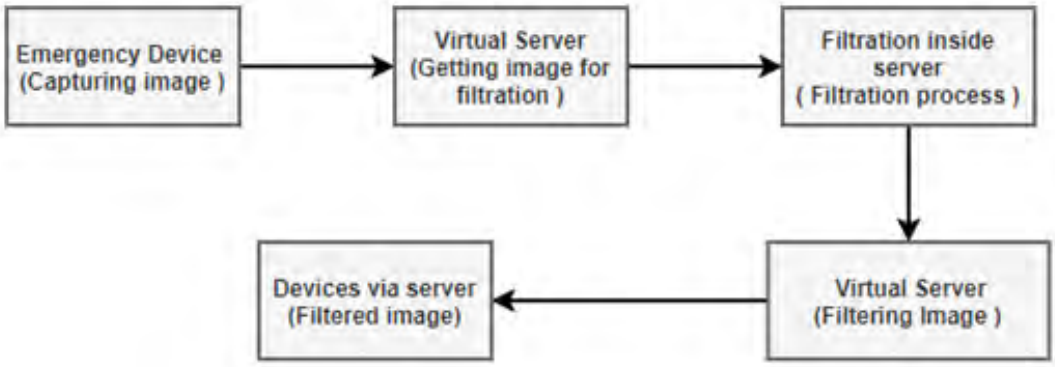

Fig. 4.1 Flowchart of An Emergency Based Image Filtering System

4.3 System Process

For our proposed model the given flowchart we followed to implement the filtering system. Step by step the filtering system working to have the denoised data and showing that as output. All the steps are described below

Emergency Device

At first we capture the image from the emergency devices as example web camera , digital camera etc. Digital camera is used for capturing video footage to transmit data from one signal to another. Same goes for Web camera which also streams images in real time to computer to a computer network. Usually both are being used for security purpose and some other purposes also. Here in our system we considered web camera as our smart device to capture the image. As these cameras are not used manually for it is focusing, aperture and on various issues there is always a huge chance of getting noisy image. More additionally those cameras don't have depth sensors ability so it might fail to capture the real image of all time. So the image we will take from the device will be sent to the next step in the server.

Fig. 4.2 Emergency Device (Web Camera)

Virtual Server

After getting the image from the smart device the image is sent to the virtual server.Here we used cloud server as virtual server[5]. It is a virtual server being run in a cloud computing environment via internet and it can run various functions as an independent unit. It is fast, secure and stable one for running different functionalities. There are various cloud server already existing but for our working purpose we used google storage as the server. So after capturing the image from the web camera the image will be virtually uploaded in the google storage.

Filtration Inside Server(Filtration Process)

After getting the image in the server we run the median filter or average filter algorithm for filtration. Inside the server we set the algorithm to perform the noise filtration to cancel out the noise from the image. Usually median filter works best to cancel out the salt and pepper noise mainly but in addition we can run other noise reduction algorithms too for different types of noise. So in this step the filtration will be done in the server.

Fig. 4.3 Virtual server (Google Drive)

Output In Virtual Server

After the filtration done in the step 3 the filtered image will be again sent in the server as output . As an instance virtually we will get the filtered image again in the server to have the clear version of the image.

Sharing via Server

In this step after getting the filtered image from the server we can have access of the image from different devices that are being connected with that server. By this we can get the filtered image from different places by connecting with the server.

This is how our proposed systems will work accordingly on an emergency basis by noise cancellation.The pictures for individual steps are given below

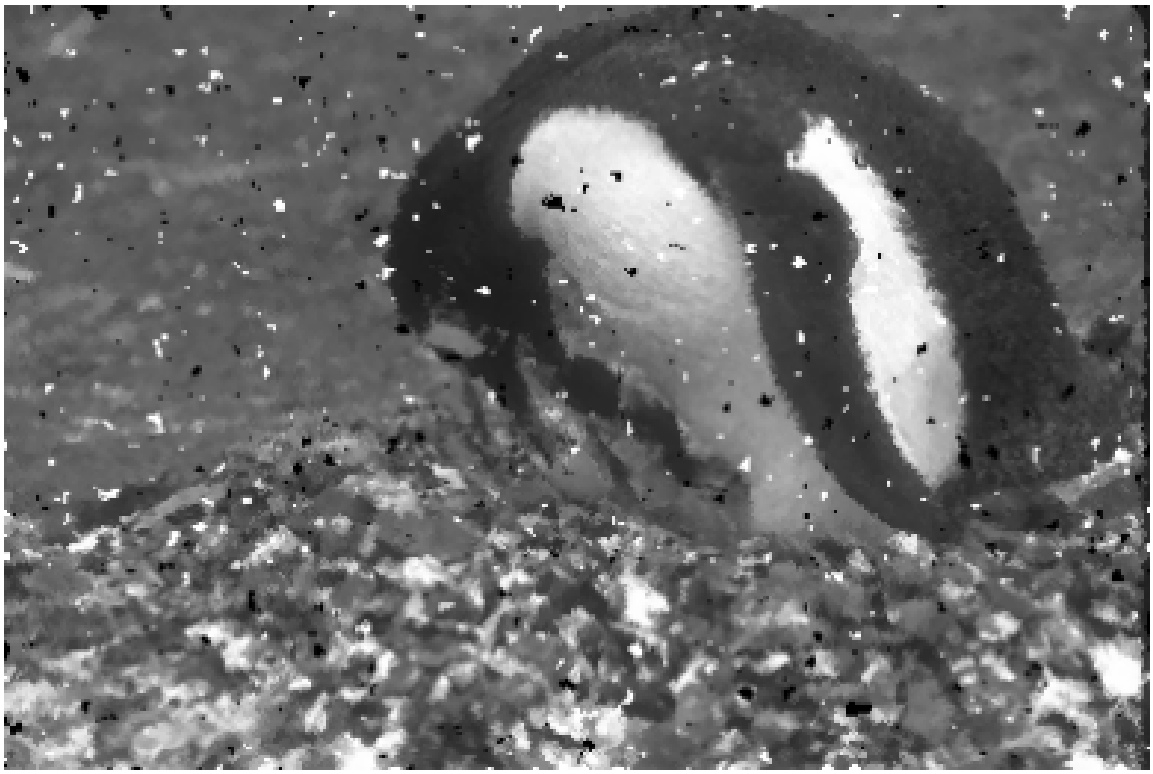

Fig. 4.4 Noisy Image for Filtration

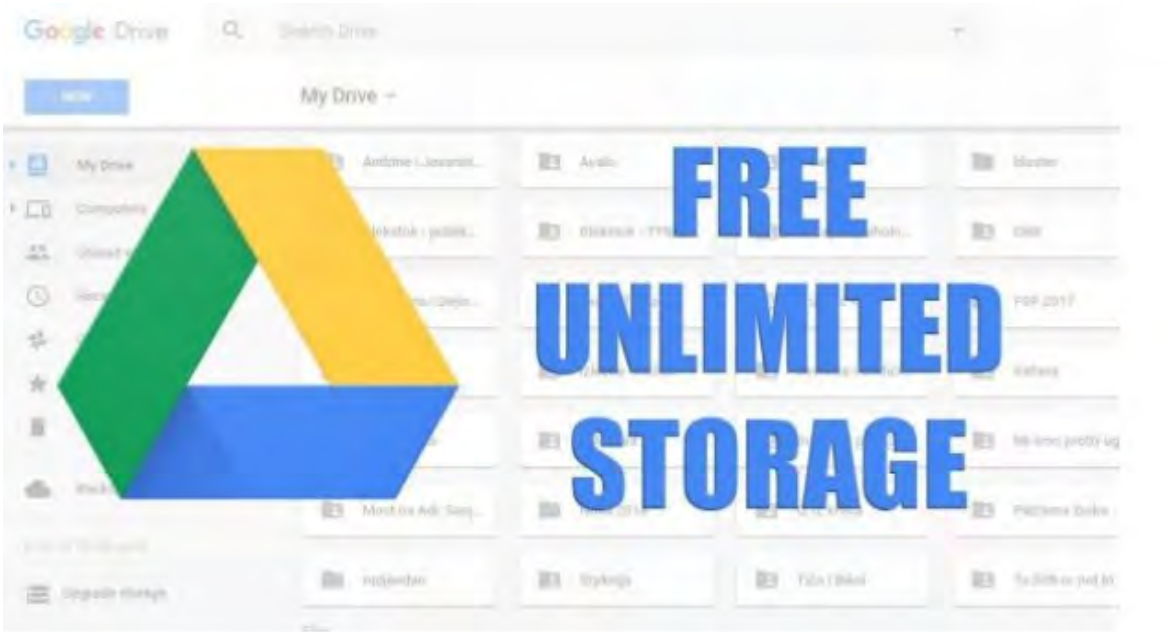

Fig. 4.5 Output in server again

Fig. 4.6 Shared Devices

Chapter 5

RESULTS AND ANALYSIS

5.1 Results

After implementing our system , it is responding by giving denoised image an output by taking the noisy image by device . After implementing the system we used some data set of “salt and pepper” from kaggle as sample data set for analyse it’s performance . We used various percentage of noise additionally added in the images to test it’s noise reduction efficiency also. In total we run the system over near about 2000 images from kaggle and more than 100 real time images. Almost near to we been able to denoised the images with the filtration through our system. Here is some sample of noise filtered images we got after filtration .

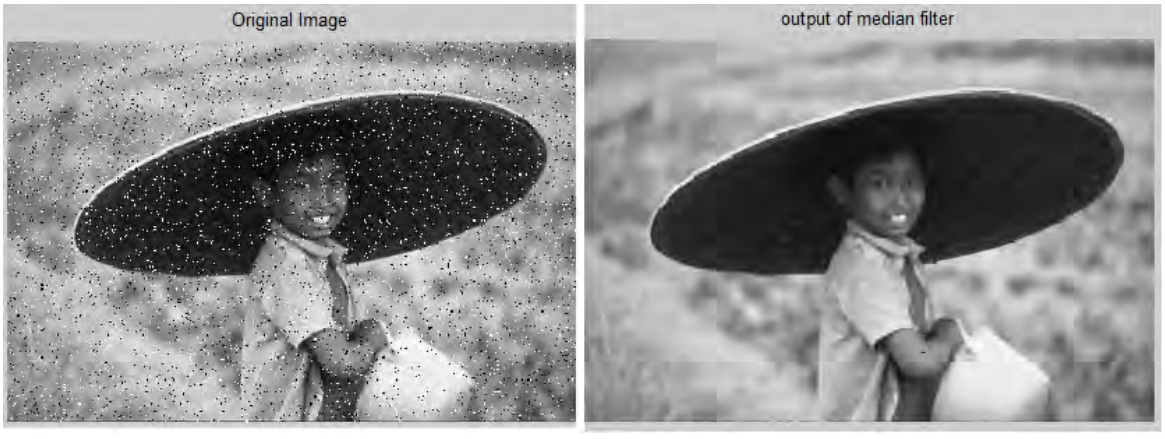

Fig. 5.1 Before and after filtration(Noise 20%)

The above figure shows the both image of before and after filtration process where the left sided picture represents as a noisy image having 20% noise added itself and right sided image illustrates the denoised version of noisy image.

5.2 Performance

First of all we will get the denoised image as output after removing “salt and pepper “ noise in the image. Usually in the low light “salt and pepper” noise is mostly found . So after using median filter we will get the denoised image . “Salt and pepper “ noise is consists of Salt means white colour (0 RGB) and pepper means black colour (255 RGB) values. It is also called an impulse noise and it actually defined as probability function of X and Y . In median filter it take the median value of white colour and black colour and replace that with that median value of grey colour . That’s why for having a close comparison we decide to compare it’s performances in respect to three parameters . They are SNR(Signal to noise ratio) , MSE (Mean Square error) and PSNR (Peak Signal to noise ratio) values .

First we looked into SNR values of on different percentage of noise . SNR is a physical measurement of the sensitivity of a digital image . It is defined by the ratio of the average signal value by using the standard deviation . Generally, an image with a SNR value of 20 dB or more is recommended for clear image .The results of SNR values using MATHLAB are listed below in the table along with the graphical presentation of the values:

Table 5.1 Before and after filtration SNR (in dB) values at different noise densities.

Before and after filtration SNR (in dB)							
Percentage	5%	10%	20%	30%	40%	50%	60%
For input Images	14.85	16.88	13.66	14.56	13.39	18.88	17.85
For output Images(Median Filter)	42.35	45.79	55.66	46.45	34.25	57.24	48.95
For output Images(Average Filter)	20.32	25.79	26.67	24.75	27.54	30.25	28.79

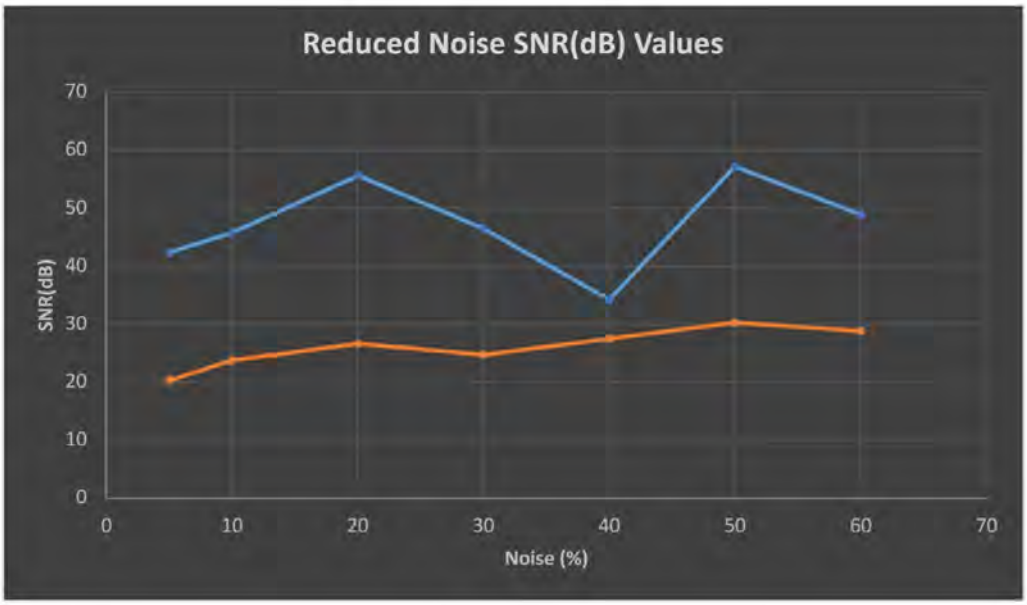

Fig. 5.2 SNR graph for the image using salt & pepper noise where x-axis contains noise densities and y-axis contains SNR values for the Median Filter and Average Filter

Then we looked into MSE values for the same dataset . It measures the average of the squares of the errors. I accesses the quality of the estimators(mapping a sample data to an estimated parameter from which the data is estimated) or predictor (arbitrary inputs of some random values). It differs according to the estimators and the predictors . The lower the MSE value is the lower the error will be .The result of MSE values using MATHLAB are given in the table along with the graphical presentation of the values

Table 5.2 Before and after filtration MSE values at different noise densities

Before and after filtration MSE values							
percentage	5%	10%	20%	30%	40%	50%	60%
For input Images	2950.5	3305.7	5525.6	6712.3	7978.4	8832.6	11575.0
For output Images(Median Filter)	625.53	875.33	1095.1	1750.4	2333.6	3871.7	5150.0
For output Images(Average Filter)	1052.5	1390.8	1840.2	2190.2	2579.8	2982.5	3469.8

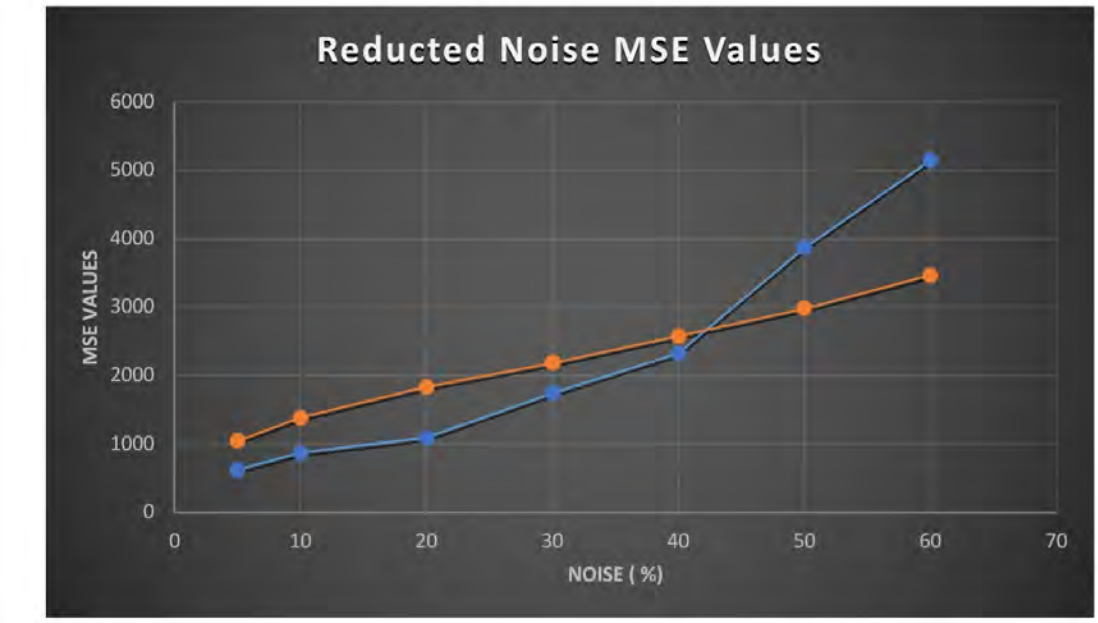

Fig. 5.3 MSE graph for the image using salt & pepper noise where x-axis contains noise densities and y-axis contains MSE values for the Median Filter and Average Filter

Lastly we looked into the PSNR value of those datasets .This ratio is oftenly used for a quality measurement between the original image and a filtered image . The higher the PSNR value will be the image will be more clear. It is most commonly used for testing image quality , in cases of degradation image. It indicated the almost human perception of quality of an image. Here, PNSR is calculated as in,

$$PSNR = 10log10\frac{R^2}{MSE} \tag{5.1}$$

Where, R = maximum number of the pixels present in the image And MSE = Mean Square Error .

The result of PSNR values that we got are given below in the table table along with the graphical presentation of the values

Table 5.3 Before and after filtration PSNR (in dB) values at different noise densities

Before and after filtration PSNR (in dB)							
Percentage	5%	10%	20%	30%	40%	50%	60%
For input Images	10.56	11.89	10.75	9.77	7.95	7.25	6.79
For output Images(Median Filter)	19.93	19.07	18.25	16.67	14.52	13.92	11.40
For output Images(Average Filter)	16.79	16.29	15.52	14.89	14.12	13.45	12.76

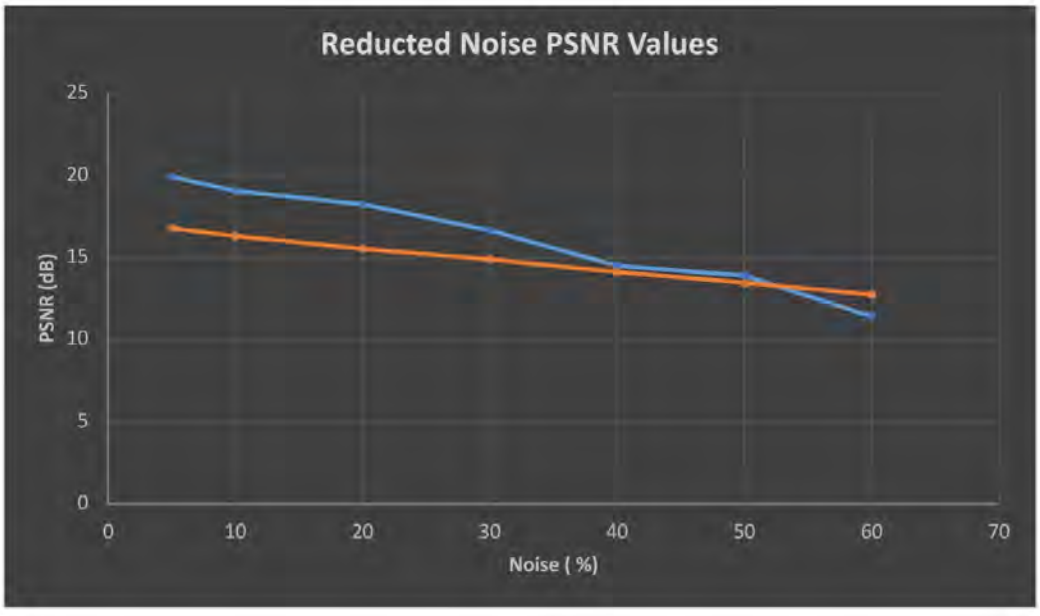

Fig. 5.4 PSNR graph for the image using salt & pepper noise where x-axis contains noise densities and y-axis contains PSNR values for the Median Filter and Average Filter

Chapter 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

In this paper, using the presence of smart devices, an emergency noise filtering system was designed and assimilated for storing data through giving access in the cloud platform where input data was filtered and after filtration the output data was sent to the connected devices in the server. Refers to the last few years the the development of smart technology has been increasing at a faster rate that creates huge impacts on the society. People are now prone to use digital devices to capture each and every moments. Our proposed model has focused on emergency situation specifically when there is a shortage of memory in the devices. In more detail, the proposed system depends on a wireless device occupied with image capturing features and automated filtering of given defected image then the capabilities of storing that images. The whole process was executed in a smart environment. The architecture model consists of a filtering center (in cloud server), where the actual Median filter algorithm is run to reduce the salt and pepper noise of the input data. Then retrieving data from the noisy data it was saved into the cloud environment under a observed network. Also manage the status of the data storage according to the file size. As a result, the smart system can get access to the Cloud also to store multimedia contents which is produced by the user. In the field of data storing and accessing in this model an unified accessing API is used for maintenance purpose. Broadly speaking, for allowing intense level of use, if there happens any hardware damage which could be the reason of bearing from internal maintained, it does not require any expensive infrastructures. Client also are not compelled to use their own devices.

6.2 Limitations

Though the smart emergency based noise filtering system gives clear image for capturing image data using smart devices but it as some sort comings. This proposed model will not work properly for CCTV cameras and motion based field. The authors have a further plan to improvise the current model and to increase the features of this application.

6.3 Future Work

In future we have plan to merge our system with emergency based image classification or image identification system. So that our life becomes more simpler by ensuring strong security system. By this no crime work can be done under this strong smart security system. Another thing in this paper we worked on noisy images only but in future we want to expand our work in video also. Then we can ensure security of the roads at night also. Day by day the crimes are getting increase We have plan for having a large number of different types of peoples image and their movements to classify them and to indent them by their faces. Here we worked on one type of noise but in future we want to collaborate with more noise filtering algorithms for different types of noise such as motion blur , Gaussian blur etc. Additionally we want to develop the system in this way so that we can implement our system in various industrial level for ensuring smart security and making our life more secure and smooth. In this way the crime rate will also decrease that' what we believe. If we can implement it in the streets in night then the people of city will have more safer life then previous.

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