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The Effective Use of Images in Traffic Management

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***Abstract*: To investigate about a traffic related incident proof should be present to support the case. There are two teams in this process, one is CCTV team and the other is the Investigation team. The CCTV team will do the technical part of the investigation. The process includes analyzing the video proof that is acquired from the CCTV cameras. From that image, the information that will help in breaking the case is taken. To get a proper evidence from the video, snapshots are taken every second i.e. there will be a 10-second window in which it has 5 seconds before and 5 seconds after the accident has happened. With the help of computer vision toolbox the images are processed to locate and then extract the features. There are two teams in the process, and for communication purpose SFTP is used. The acronym of SFTP is Secured File Transfer Protocol. With this method, the transfer the proofs can be done securely as there is an extra encryption used here.**

***Key Words:* SFTP, CCTV, Local feature retrieval.**

1. SOME DATA ON INDIAN ROAD SAFETY REPORT

From an article [5] the statistics state that there are nearly 1.4 million road accidents occurring every year. And from that 1.4 million only about 40 lakh cases are recorded. The main reason due to which the cases are still not resolved was due to no proper proof to support the case. Some of the reasons behind that were due to the carelessness of the insider in maintaining the proofs or intentional damaging of the proofs.
This paper concentrates on supporting the activities that could help in analyzing the pictorial details for getting more solid data that could assist in breaking the case. With everything available on the internet about the hacking of the network. This can prove to be dangerous when something more important is sent across a network.
Therefore SFTP is used in this for transfer of data from location to the other with the help of VPN tunneling mechanism.

2. PROPOSED RESEARCH

In the proposed research we have the following:

2.1 What are local features?

The local features and descriptors are the building blocks of the computer vision algorithms. It contains some specific applications like image registration, object detection, and classification and also tracking and estimating the motion. The above-mentioned algorithms use these local features to handle the scale changes better. The computer vision algorithm includes FAST, Harris, Shi and Tomasi corner detectors and the SURF, KAZE and MSER blob detectors. The toolbox includes SURF, FREAK, BRISK, LBP and HOG descriptors. The detectors and the descriptors can be mixed and matched according to the needs. The feature extraction can also be performed by the pre-trained convolution neural networks which are applied from the field of deep learning.
The local feature can be anything from the picture, it can be an edge, corner or anything from the image. This is usually associated with the patch from the surrounding in the picture such as a change in the intensity of the color of the patch. It doesn't matter what the feature represents but that will be distinct from the surrounding.

2.2 Local feature extraction

The local feature will let us in finding the similarities, with or without the changes in the viewable conditions or also with the clutter. In addition due to the properties of the local feature, the images can also be classified
A local feature can be used in two fundamental ways:
By localizing the anchor points for the use of image stitching or 3-D reconstruction. By representing the image contents compactly, for detection or classification without the use of image segmentation.

2.3 What Makes a Good Local Feature?

There are detectors that rely on the gradient-based intensity variation approaches. It will detect better local features. These features include edges, blobs, and regions. A good local feature will have the following properties:

2.3.1 Repeatable detections: When a picture is compared the feature detector will get the same features from both

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the images. The features are stronger and do not change even when the viewing condition changes.

2.3.2 Distinctive: The surrounding around the feature center will have enough variation that will enable a better comparison of the features.

2.3.4 Localizable: Every feature has a distinct location around it and the viewing condition does not alter the location.

2.3.5 Feature detection: The feature detection selects the region in the image that has a specific content like a corner or a blob. The feature detection is used to find the points on the picture that can be used for some more processing activities. The points that are indicated does not correspond to the edges on the sides of the table. The key use of this is to find the features that are present locally so that it can be detected even after there is a change in the scale or rotation of the picture.

2.3.6 Feature extraction: The feature extraction comprises of performing the calculation of descriptor that is done on regions that are centered on the detected features. The descriptors will depend on the image processing to convert the local pixel neighborhood into the compact vector representation. This helps in comparison among neighbors with or without changes in scale or orientation. Some of the descriptors like SIFT and SURF rely on gradient-based computations. The binary descriptors like BRISK or FREAK will depend on the pairs of intensity differences, these can be encoded as a binary vector. Depending on the needs the best descriptor and detectors can be selected.

Table 1: Considerations for Selecting a Detector and Descriptor

Criteria	Suggestion
Type of features in your image	Use a detector appropriate for your data. For example, if your image contains an image of bacteria cells, use the blob detector rather than the corner detector. If your image is an aerial view of a city, you can use the corner detector to find man-made structures.
Context in which you are using the features: Matching key points Classification	The HOG, SURF, and KAZE descriptors are suitable for classification tasks. In contrast, binary descriptors, such as BRISK and FREAK, are typically used for finding point correspondences between images, which are used for registration.
Type of distortion present in your image	Choose a detector and descriptor that addresses the distortion in your data. For example, if there is no scale change present, consider a corner detector that does not handle scale. If your data contains a higher level of distortion, such as scale and rotation, then use the more computationally intensive SURF or KAZE feature detector and descriptor.
Performance requirements: Real-time performance required Accuracy versus speed	Binary descriptors are generally faster but less accurate than gradient-based descriptors. For greater accuracy, use several detectors and descriptors at the same time.

Table 2: Choose a Detection Function Based on Feature Type

Detector	Feature Type	Function	Scale Independent
FAST	Corner	detectFASTFeatures	No
Minimum eigenvalue algorithm	Corner	detectMinEigenFeatures	No
Corner detector	Corner	detectHarrisFeatures	No
SURF	Blob	detectSURFFeatures	Yes
KAZE	Blob	detectKAZEFeatures	Yes
BRISK	Corner	detectBRISKFeatures	Yes
MSER	Region with uniform intensity	detectMSERFeatures	Yes

Table 3: Feature extraction methods

Application	MATLAB Examples
Image registration and stitching	Feature Based Panoramic Image Stitching

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Application	MATLAB Examples
Object detection	Object Detection in a Cluttered Scene Using Point feature
Object recognition	Digit Classification Using HOG Features
Object tracking	Face Detection and Tracking Using the KLT Algorithm
Image category recognition	Image Category Classification Using Bag of Features
Finding geometry of a stereo system	Un calibrated Stereo Image Rectification
3-D reconstruction	Structure From Motion From Two Views Structure From Motion From Multiple Views
Image retrieval	Image Retrieval Using Customized Bag of Features

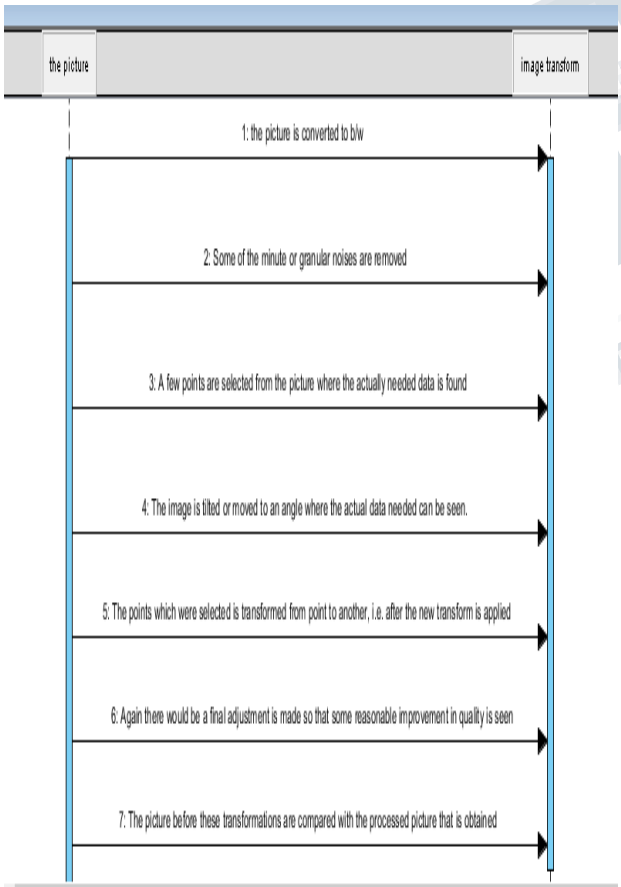

Fig 1: Full interaction diagram of the project.

3. SECURITY ASPECT OF THE PROJECT

3.1. HOW THE SECURITY ASPECT OF THE PROJECT WORKS

For the security of the data transferred between the teams SFTP is used. There are chances that when the data in transit would get tampered. The data when transferred from one location to another in an encrypted manner there is lesser chance in getting the data. Now even when an intruder drops in, without knowing the private key the encryption cannot be broken. The name of the key is called as the SFTP key.

During the login process the server will pose a challenge to the user to guess the username and the password. The password should not contain predictive contents like name, date of birth etc.

For the authentication process to be robust the password should be long and complex. The complexity can be raised by means of using upper case and lower case alphabets, then numerical values and then special characters can be used. This makes the password stronger. Also, this can make brute forcing tough.

The password authentication is used and also in addition to that a private key is also used. So in this method two things a user should enter, first something he knows i.e. the password and then something he has i.e. the private key. And this is called as a two factor authentication.

Now this also helps in preserving the confidentiality of the message. This method will be automatically enabled and this is done on the server side. The public key and the private key used here is also used in authenticating the user details also.

To start this process there should a public and private key pair assigned to the users. Different public-private key pairs can be assigned to different users. This should be kept safe by the respective users.

Each time when the user enters details to login into the SFTP server the user should enter the respective SFTP user name and then the password and finally load his SFTP private key. The SFTP private key is used in generating the digital signature. In this mechanism the private key and the saved public key should match and

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after that the user will validated and then user is allowed to access the server.

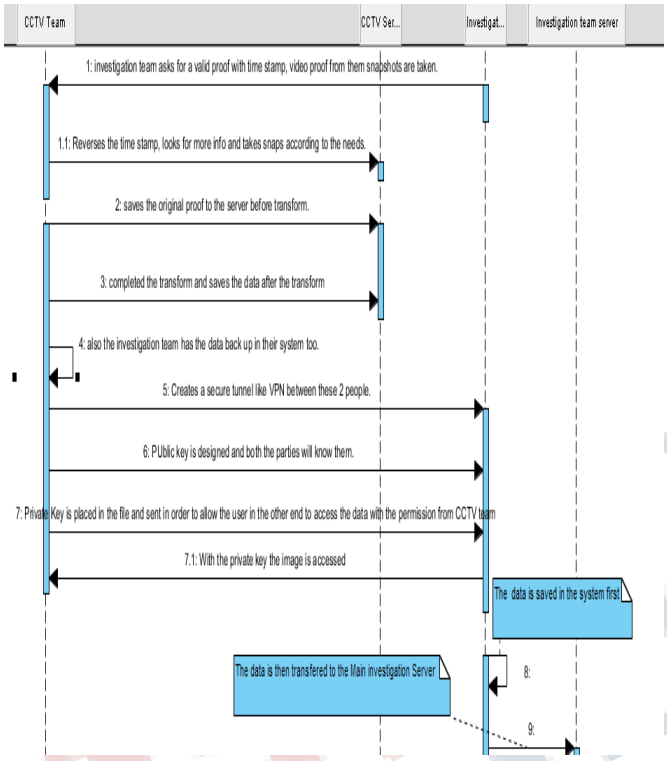

Fig 2: Security aspect of the project.

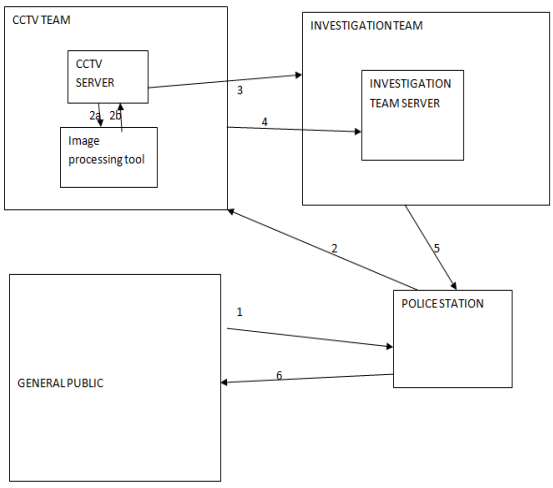

Fig 3: Architecture Diagram

The implications of the arrows are as follows:

1. The General public has been affected by an incident and lodges a complaint.
2. The police personnel get in touch with the CCTV team with the details provided by the person. The video feed gets reversed and with the time stamp and few moments before and after moments the snaps are taken. Then with the available details the data is processed using the image processing tool.
3. The saved data by the CCTV team gets recorded in the server of the CCTV team. Now the data transfer from CCTV team to Investigation team takes place with the help of SFTP protocol.
4. The data sent from the CCTV team reaches the server of the investigation team.
5. With the available data the investigation occurs. Then the investigation team gets in touch with the police
6. Then the general public is provided with the case results.

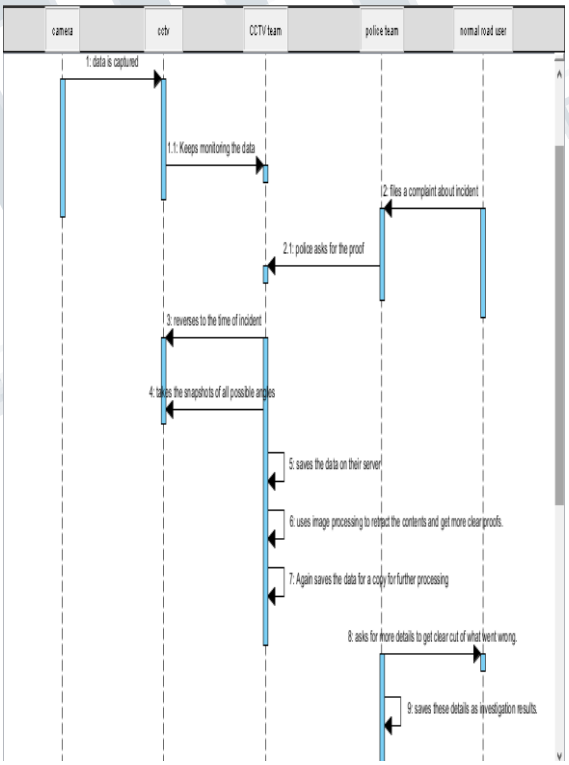

Fig 5: The interaction diagram of the project

4. IMPLEMENTATION WORK:

After the features are located, again the features extracted. Detectors that rely on gradient-based and intensity variation approaches detect good local features. These

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features include edges, blobs, and regions. Good local features exhibit the following properties:

- Repeatable detection
- Distinctive
- Localizable

To extract features again the following methods are used

- MSER
- BRISK
- KAZE
- SURF

For this we are using extract commands to make sure that the features are extracted.

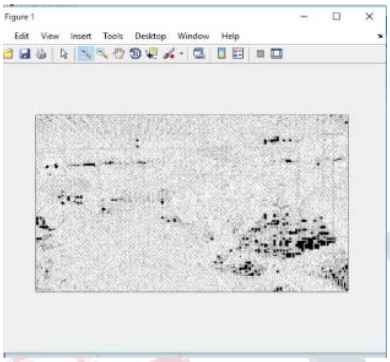

Fig 6: Feature extraction using HOG method.

Fig 7: the actual picture used in this process.

The commands used here are:

```
img = imread('cameraman.tif');
[featureVector,hogVisualization]=
extractHOGFeatures(img);

figure;
imshow(img);
hold on;
plot(hogVisualization);
```

The output of the image obtained after the n-2 matrix is selected. This is done in order to make sure that only a particular area concerned is taken as a view point. In this process we will be able to understand the shadow part and the part in which the light is getting incident with.

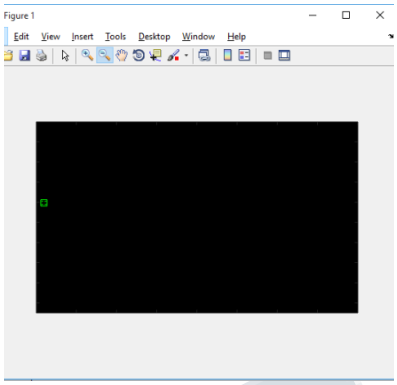

Fig 8: Corner detection algorithm.

The corner detection process is done based upon the impact of the light on the image. As we can see in the earlier image, when there is a change in the intensity of the light we can select an edge from that. In this image there is a point detected on Arizona flag.

The above study is done to understand the impact of the light on the image. This will enable us to choose the image from the snap shots that are received from the CCTV team for effective processing of the image. Now we will look into the security aspect of the project. In the security of the project we will be using the SFTP which is Secure File Transfer Protocol. This protocol requires a special interface from the base operating system so that we can communicate with the operating system in the VM ware. For that purpose we use the putty configuration.

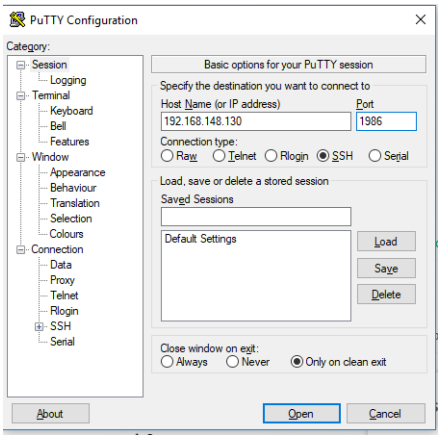

Fig 9: Putty configuration

This also helps us in selecting the port in which the session is getting established and the IP address in which this transfer can be done.

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On the basic connection establishment we will first understand the services that are run on our Kali repository. Then we will be importing the right services that are required for the process. After the services are imported from them we will be able to generate the key that is required to initiate the transfer.

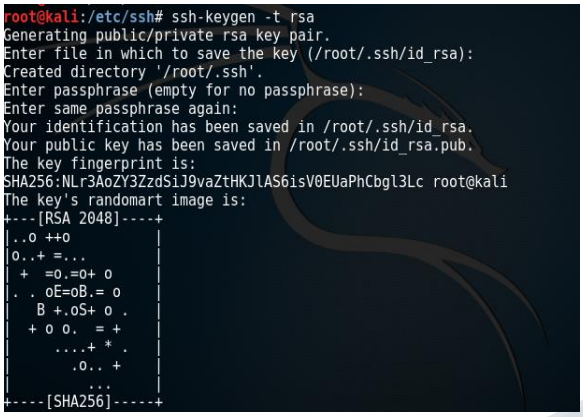

Fig 10: Key generation process

From the above we will be able to initiate the required transfer with the base operating system to the operating system where the investigation team is placed.

5. EXPECTED RESULTS:

The expected results will be as follows:
Using the computer vision tool box the image is processed. The processed result would provide the user the details with which the traffic related case can be resolved.
In the security aspect of the project there is a comparison in time taken for the data transfer between the OS like Win 7 and Win XP so that the process can be deployed effectively. Also how the data transfer occurs efficiently in this process.

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