Design of Night Vision Camera

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ABSTRACT

From last few years, there have been notable capability improvements in Night Vision camera including resolution and sensitivity. Despite these improvements, modern Night Vision camera still has some limitations such as capturing the dark light image of high dynamic range as well as the image in low light. However, the longer we keep the camera explore on any object it results in blur image. Many approaches are developed for improving low light video, but most of those cameras are only good with dark light. In this project, we propose to develop an effective framework that will improve image quality in low light as well as in various environmental conditions using an appropriate technique.

Keyword— **Night Vision, Camera, Image Processing, Low light.**

1. INTRODUCTION

Night vision signifies the ability to see in the dark (night). This capability is normally possessed by owls and cats, but with the development of science and technology devices has been developed which enables a human being to see in the dark as well an in adverse atmospheric conditions such as fog, rain, dust etc.

The muscles present in the human eye have the ability to stretch or contract automatically, depending upon the intensity of light falling on the eye. When you go out in bright sunlight, the pupil gets contracted. Alternatively, when we enter into a shaded or dark room at that time the muscles of eye relax and make the aperture of the eye lens big enough to allow sufficient amount of light to pass through it, therefore the objects in the room appear blurred. Because of this human eye have limitations. The muscles of the eye cannot increase the aperture indefinitely.

Therefore, in low light, we are unable to see the objects because the image cannot be formed on the retina clearly. The capability to identify targets at night and under poor visibility conditions has been an essential military requirement. In the modern era, the army's need to operate at night and under conditions of extremely poor visibility, Since the soldiers have to often fight in the dark at night, they have to face severe stress as far as the location of the target is concerned. Also, various wildlife observers have to face problems of low light because many wild animals are more active during night time that day and it helps in providing household security, therefore to observe their lifestyle and study it night vision camera is important. Therefore to make a human being unable to see in the dark by technological means, night vision camera has been developed.

2. LITERATURE SURVEY

In [1], they have used Active Illumination, Thermal Imaging &Image intensification algorithm. In their project, they have also provided with the Excellent low-light level sensitivity, Enhanced visible imaging yields the best possible recognition and identification performance & ability to identify people. [2] In this they have developed an intelligent night vision System for automobiles for this they applied various algorithms such as detection and stabilization algorithm, road sign detection and recognition, spotlight projection, Scene zooming, road sign feature extraction. It is a review of low light video enhancement using image processing technique, in this, they have provided with features like auto recognition, detection & Segmentation [3]. It focuses on Improvement of the brightness of the image using the contrast enhancement algorithm [4]. It highlights about the adaptive enhancement and noise reduction in the low light video, for this they have used Histogram equalization algorithm (use the histogram to improve image contrast) & Adaptive histogram equalization algorithm(histogram equalization which adapts to local changes in contrast) and because of this motion blur can be prevented [5]. It provides advantages like image enhancement, noise suppression & in this computational time is very less for this they used algorithms like spatial noise reduction, temporal noise reduction, tone mapping, and gamma correction technique [6].

3. REQUIREMENTS

Following are the requirements that should be met for the efficient working of the system:
1) New software version must be possible in the application without any human intervention.
2) Human eyes can't identify the proper image captured by night vision camera so image processing needs to be done for good resolution.
3) The up gradation of the camera should be possible in any resolution which is compatible with the IR led.
4) An image enhancement algorithm should be available in the application for removing image distortion and noise.
5) Image obtained by removing the noise and unwanted distortion should be of high resolution that should be visible to human naked eyes.
6) The nature of the surroundings must be dark and the object identified by the camera should have an infrared image of the object.

4. PROPOSED METHODOLOGY

Our aim is to design a night vision camera and desktop application for improving the quality of the image means enhancement of image.
Components used:
1. Web camera
2. An array of IR led
3. IR filter

A webcam is a video camera that feeds or streams its image in real time which provides us with an image. we will make an array of IR led which will be in circular shape, night vision cameras are used for security purposes and so it would be pointless if the cameras cannot see anything at night. It would also be pointless to have large lamps shining the light in all possible corners, It could make sense to use lamps on a public road but not on private property.

However, if one wants to even arrange for lamps, if some miscreant wanted to create some mischief, he could easily knock out the lamps using stones or just kill the power in a particular area. Humans can see visible light which is in the wavelength from 380nm (violet) to 750 nm (red). Human eyes cannot see the wavelength beyond this range. Thus cameras use the Infrared wavelength as a source of light. In this way, they capture the infrared light bouncing off various objects and are able to get a black and white picture of the surroundings. Since the wavelength of the Infrared light is not visible by humans, it can't be seen by them and darkness prevails.

The Infrared light is also the reason why the LED's have a dim red glow at night. Calculation of the number of illuminators needed to cover the given distance:

No of illuminators	Distance Multiplier
1	1
2	1.4
3	1.7
4	2
5	2.2
6	2.4
7	2.6
8	2.8
9	3

Fig.1. No. of illuminators needed to cover given distance

Infra-Red light provides larger distance, a varying degree of invisibility (depending on the exact wavelength) and no light pollution. Infra-Red is light designed only to be used by night vision cameras. White-Light provides the opportunity to illuminate an area for pedestrians, staff or vehicles in addition to the night vision system.

We had developed a desktop application for enhancing the quality of the image. The image captured by the webcam will have some distortion. This distortion will be removed through the desktop application using image enhancement technique.
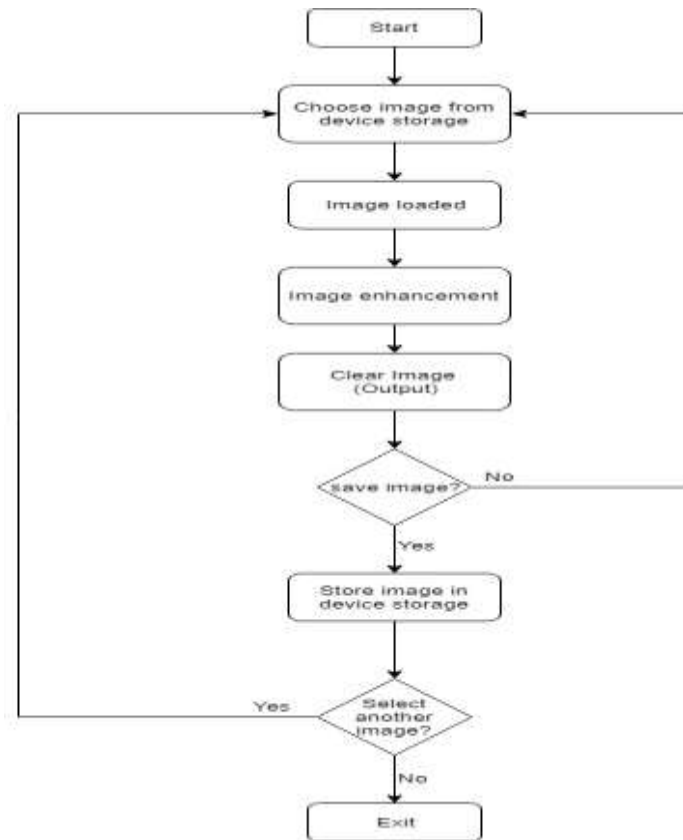
Fig.2. Userflow diagram

First, User will click on the desktop application then the user will get a dashboard then the user can choose an image from the database stored in the device. This database in the device will have images which are being captured by the web camera. Those images will have some distortions in it. The user will click on Image enhancement option to remove some distortion from the image and to clarify it. Desktop application will show an output image to the user which is clear and doesn't have any distortion in it. After getting an output image desktop application will ask the user whether he/she wants to save the output image in the device. If the user clicks yes then output image will be saved in the device storage. If the user clicks no then he will again get an option to choose an image. After saving the image user will get a pop-up saying whether he/she wants to continue or not? If the user selects yes then he will be directed to the dashboard and will again have the option to choose an image from the device else user can get exit from the desktop application.

5. RESULTS

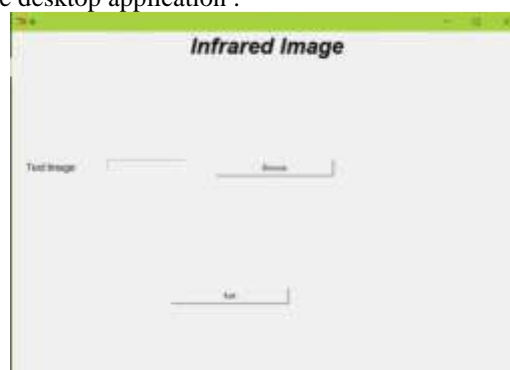1) When the user will open the desktop application :

Fig. 3. Desktop Application

2) The user will fetch the image which he is going to enhance through this desktop application:

Fig 4. Browse the image

3) The user will select the image to remove distortion:

Fig 5.Captured image displayed

4) The image will be enhanced and get stored in a device

Fig. 6. Enhanced image

6. CONCLUSION AND FUTURE SCOPE

With the work described in this paper, we will provide an ability to see in the dark through our desktop application. After IR filtering we will get an image with some distortion in it. This distortion can be removed through the desktop application and user will get an enhanced image which is more clear. Any image which is not clear due to dark or any environmental conditions like fog, mist etc can be clarified through IR filtering and our desktop application. For the time being our project prototype is restricted to only an image. In future, we can expand it to video so that we can get a clear recording in the dark light.

7. REFERENCES

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