# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

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## A PROJECT SYNOPSIS

**ON**

# "Image dehazing using CNN and DLA"

***Submitted in partial fulfillment of the requirement for the award of the degree of***

**BACHELOR OF ENGINEERING**

**in**

**COMPUTER SCIENCE AND ENGINEERING**

**by**


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# ABSTRACT

Degraded visibility and lack of luminance in foggy weather are major threats to the safety of drivers. One of the problems faced by drivers is the faded scene visibility and lower contrast while driving in foggy conditions. These conditions increase the danger of vehicle collision which leads to a major number of cases of injuries and fatalities on roads that are covered with fog. Accumulation of fine droplets in the fog blocks and scatters the light. This leads to reduced visibility since there is less light reaching the driver's eye, and also because of the lower contrast. The color and contrast of images under such weather conditions are considered to be degraded due to the airlight and attenuation of the radiance introduced by a scene visualized by the driver. At this point, a significant fog removal approach contributes to visibility improvement, reducing road accidents in such foggy weather. The physical properties which are present in the underwater environment affects the images captured by the visual sensors. As a consequence of these properties, the captured image includes non-uniform illumination. This non-uniform illumination cause color distortion, low contrast, white regions, and color casts. An underwater image enhancement method is proposed by combining a color constancy framework and dehazing. A chromatic adaptation technique (CAT) is adapted to correct the color cast caused by the non-uniform illumination. The color transferred image is then transformed into HSI with gamma correction in the Intensity (I)-component. This gamma correction enhances the intensity of the color transferred image. The gamma-corrected HSI image is converted to an RGB image. The dehazing is based on the estimation of artificial background light and transmission map depth. The depth is estimated from the difference of channel intensity prior (DCIP), which is the difference between the maximum and minimum intensity priors. A saturation correction factor is proposed for color correction. This correction factor, estimates the artificial background light, and solves the non-uniform illumination limitations in the turbid image. A guided and rolling guidance filter is adapted to refine the estimated transmission map depth. Finally, the recovered image is transformed into HSI image with gamma correction on the I-component. The gamma-corrected HSI image is transformed to an RGB image. Here in our approach, we assume that the image can be mathematically modeled by an unknown complex function. Using this function and utilizing the deep neural network to approximate the corresponding mathematical model for the image and subject it to guided filter method.. By doing it this way we input a hazy image and arrive at an approach to dehaze the image that can be used in real-time.

# DRIVING FORCE BEHIND THE IDEA:

Fog is a major factor in weather that affects most daily life activities. One of the major threats of fog is vehicle crashes. On average, 23% of crashes and 18% of all fatal crashes are weather-related, whereas crashes in foggy conditions are prone to be more severe and can involve multiple vehicles compared with clear conditions. The foggy weather makes it very difficult for drivers to view the road while driving. In a recent report from the Ministry of Road Transport, in 2018, 1,51,417 road crashes were recorded due to unfavorable weather conditions, especially fog, killing 28,533 people. Hence, our motivation to take up this project is to make driving safer for drivers.

Underwater images captured by cameras are plagued with poor contrast and distortion, which results in scattering and absorptive properties of water. Underwater robots play an important role in oceanic geological exploration, resource exploitation, ecological research, and other fields. The other major use of underwater images is to understand marine life, but due to the distorted images, we may encounter a lot of errors in it. The recent advancements in underwater exploration have led people to develop an interest in marine life and underwater photography. This demand has created a huge demand for producing quality underwater images without any distortions but due to the very less availability of methods and platforms to achieve such quality and methods it has people concerned. Hence we take this opportunity to take up this project to develop a platform where people can get their distorted or hazy images dehazed.

# LITERATURE REVIEW

## PROS

1. Hybrid methods have proven to provide much more accuracy and detailing.
2. Implementations is faster in higher GPU devices.
3. Tested models can be used in real-time.
4. These systems need minimal input.
5. Dark prior systems have been proved best for faster processing.
6. Object detection over the dehazed images has be proven very efficient.

## CONS

1. Sometimes the loss function extracts high level functions resulting in increased computing time.
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3. Models often return garbage values in real time as they are only subjected to synthetic images and not real images.
4. Dark prior method has incorrect estimation from transmission map when there are bright objects.
5. Multiple models with same approach are available but due to lack of proper interface, they are not implemented in real time easily.
6. Object detection is efficient but due to loss of actual data from the image, the accuracy gets

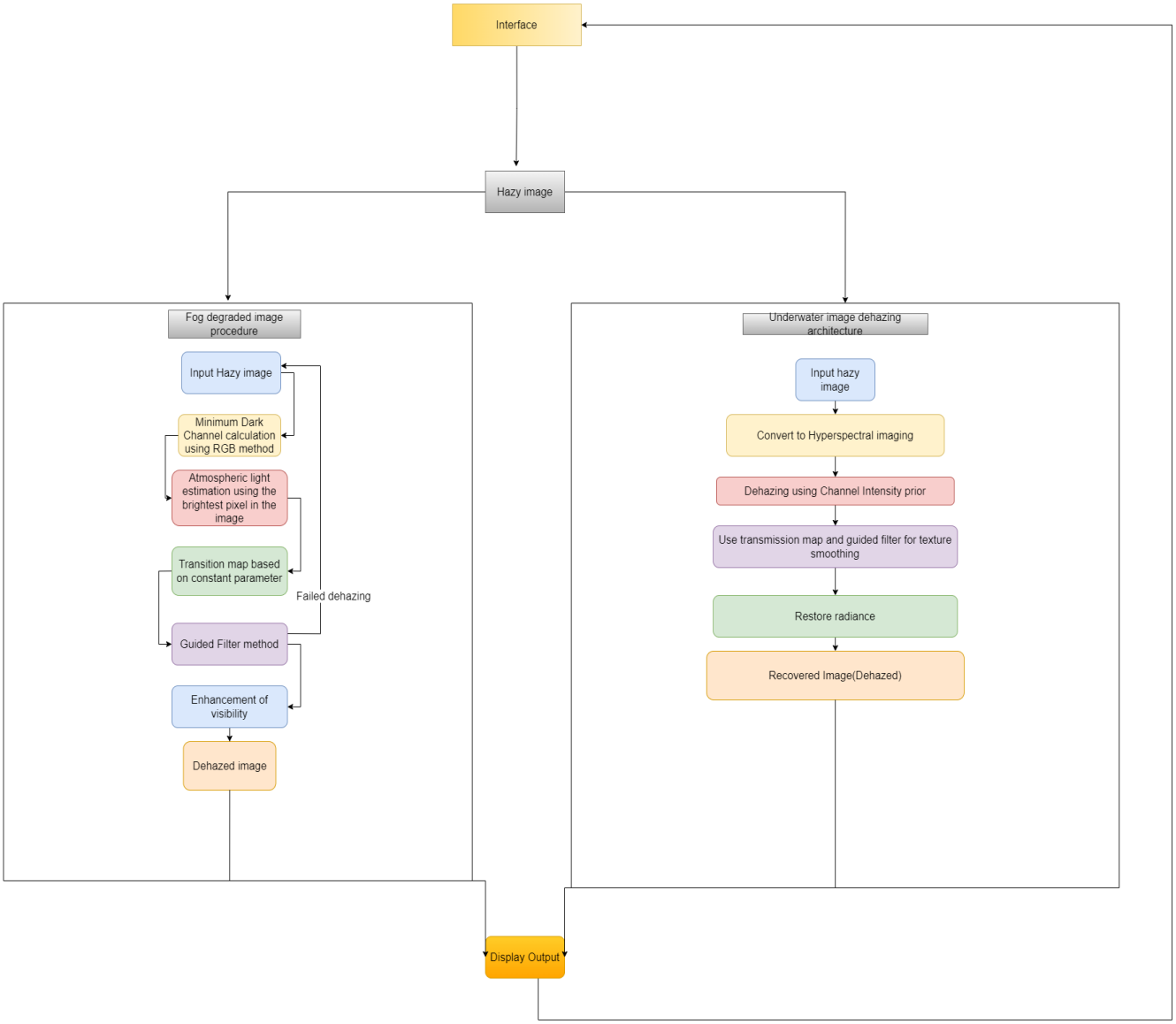
# PROBLEM STATEMENT/ OBJECTIVE

Fog is a natural phenomenon that blurs the scene, reduces visibility, and changes color. It is an annoying problem for photographers because it can reduce image quality but it is a major problem for drivers as it makes the road invisible. The foggy weather makes it very difficult for drivers to view the road while driving. In a recent report from the Ministry of Road Transport, in 2018, 1,51,417 road crashes were recorded due to unfavorable weather conditions, especially fog, killing 28,533 people. Dense fog was also recorded in Bihar, Uttar Pradesh, and West Bengal. Sometimes due to high concentrations of smoke and fog, there is a mixture formed called smog. This results in poor air quality and also in poor road visibility. This has led to a dramatic increase in accidents in Delhi. Hence, it is necessary for us to develop a system that can produce images that are clear and free from fog disturbance. This could help in reducing the number of accidents and also provide better support for traveling.

Even though science has led to major advancements in various fields, oceanic exploration is one field that still hasn't had much progress. The major reason for that is the fact that with the increase in depth, the conditions change drastically. One of the major conditions here is light. Due to the lack of light, it is difficult to capture images deep underwater. Recent advancements have helped in developing methods to capture images underwater but the issue they are facing is that the images underwater are often hazy and distorted. Due to this, the efficiency of research has decreased. In order to improve the quality of such research, it is necessary to develop a system that can dehaze the image and help in the effective exploration of the oceans.

# SYSTEM DESIGN

## 1. ARCHITECTURE:



## 2. HARDWARE AND SOFTWARE REQUIREMENTS:

**Hardware Requirements:**

1. **CPU:** Intel core i5-7267U @ 3.50 GHz
2. **Memory:** 8 GB
3. **GPU:** NVIDIA A100 and upwards
4. **Network:** minimum 1 Mbps

**Software Requirements:**

1. **Operating system:** Windows 7 and above( 64bit)
2. **CUDA:** CUDA Toolkit 7.0
3. **OpenCV:** OpenCV 3.0
4. **cuDNN:** cuDNN 8.3
5. **Python:** 3.11.0
6. **Pytorch:** 1.13.0
7. **Frontend:** React native, Html, CSS

# CONCLUSION:

The present study is based on the removal of fog from natural images, which can be mainly applied to automation in self-driving vehicles. In case of underwater s image dehazing, the proposed method can be used in various fields such as in under water vehicles for deep sea explorations and photography.

This paper addresses two major issues caused by hazy images. This paper addresses the issue by taking the hazy images and transforming the images into maps. The results are presented for the transmission map and the filtering methods. The comparison of filters based on the contrast gain and the color index is tabulated. Then the foggy region gets converted to a white region after this transformation. The restoration after this transformation plays a key role in understanding the actual data without fog. The deep learning model also utilized the convolutional neural network system in it so that the quality of the defogged image does not decrease and also so that the accuracy obtained is very high. Here, the defogged image is generated. The proposed method provides much higher accuracy and faster processing. Using these methods in real-time, we can facilitate the drivers, outdoor surveillance, video-guided transportation, remote sensing images, and real-time image processing.

In the case of underwater, we combined a color constancy framework with dehazing for underwater image enhancement. Gamma correction, WPR, and CAT is adapted in color constancy method. The color constancy framework illuminates non—hardware-based balanced artificial illumination and corrects the color cast due to nonuniform illumination. The DCIP-based dehazing approach is proposed to estimate the artificial background light and transmission map depth. We also proposed a saturation correction factor for color correction and enhance the intensity in each color channel. This saturation correction factor approximates the wavelength of each color channel. The artificial background light depth is used to estimate the transmission map. The transmission map is refined using the guided and RGF filter. The guided and RGF filter preserves visual information such as texture, and edges, and produces artifacts-free results. The recovered RGB image results in enhanced contrast and brightness. The proposed method retrieves more visual information from the turbid image. According to the visual assessment, the proposed method results are pleasing, with better color restoration, edge-preserving, texture smoothing, and artifacts-free.