SIKSHA 'O' ANUSANDHAN
(Deemed to be University)
Faculty of Engineering & Technology (ITER)

Department of Computer Science and Engineering
Project Proposal Form

SENIOR DESIGN PROJECT-2025

SECTION: CSE- F **GROUP NO: F12**

PROJECT TITLE: Lightweight Hybrid CNN for Real-Time Image Dehazing with Perceptual Loss Optimization

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PROJECT ABSTRACT:

Aim/ Objectives: This project aims to design and implement a lightweight hybrid convolutional neural network (CNN) model for real-time image dehazing. The primary objective is to optimize perceptual loss functions to enhance the clarity and natural appearance of dehazed images. The model will focus on achieving computational efficiency and robust performance across various environmental conditions.

Problems to be addressed: Hazy images, caused by atmospheric particles such as dust and water droplets, degrade the visibility and quality of captured scenes. This issue significantly affects applications such as autonomous driving, surveillance systems, and photography. Existing methods for image dehazing either suffer from high computational costs or inadequate perceptual quality. Therefore, developing a lightweight and efficient image dehazing algorithm with perceptual optimization is crucial for real-time applications.

Functionalities/ Technicalities:

1. **Data Collection:** Collection of a diverse dataset containing hazy and clear image pairs from public datasets and real-world environments.
2. **Preprocessing:** Image normalization, resizing, and augmentation techniques to improve model robustness.
3. **Model Architecture:** Design of a lightweight hybrid CNN architecture combining residual and attention-based components to capture multi-scale features efficiently.
4. **Training Strategy:** Implementation of perceptual loss functions that consider structural and content similarities between dehazed and ground truth images.
5. **Performance Metrics:** Evaluation using PSNR (Peak Signal-to-Noise Ratio), SSIM (Structural Similarity Index), and computational speed benchmarks.
6. **Deployment:** Optimization for real-time deployment on edge devices and cloud-based applications.

Benefits/ Social Contributions:

- Improved visual clarity in images for surveillance, autonomous driving, and navigation systems.

- Enhanced user experience in photography and media applications.
- Reduction in computational costs for real-time applications through an efficient lightweight model.
- Contribution to environmental monitoring by enhancing visibility in weather-compromised images.

(1) SOFTWARE, HARDWARE OR METHODS/ALGORITHMS SPECIFICATIONS:

Algorithms/Methods:

- Lightweight Hybrid Convolutional Neural Networks (CNNs)
- Perceptual Loss Functions
- Optimization Techniques for Edge Devices

Software Requirements:

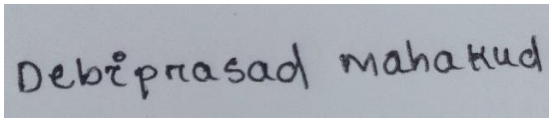
- Python Programming Language
- TensorFlow or PyTorch for deep learning model development
- OpenCV for image processing
- Jupyter Notebook, Visual Studio Code for development

Hardware Requirements:

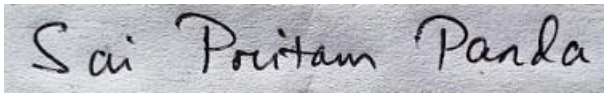
- GPU-accelerated computing device (NVIDIA GPUs recommended)
- Standard edge devices (Jetson Nano, Raspberry Pi, etc.) for deployment

(2) NAME, REG. NO AND SIGNATURE OF GROUP MEMBERS:

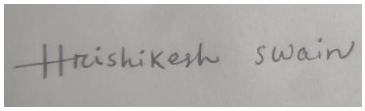
1. Debiprasad Mahakud, 2141013002



2. Sai Pritam Panda, 2141016050

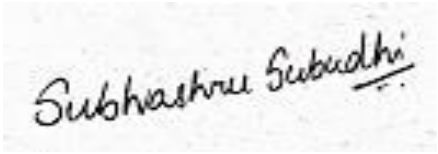


3. Hrishikesh Swain, 2141019406



4. Prabhat Kumar Sharma, 2141019275

(3) APPROVAL STATUS (To be filled in by the Section Coordinator of SDP):



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Project Supervisor **Section Coordinator, SDP** **SDP Coordinator**