

## Department of Computer Science and Engineering

**IT23A31-IOT**

# ***FOG CLEAR: IOT-BASED IMAGE ENHANCEMENT SYSTEM***

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**MUSA HAJI**  
**230701391**

**PRIYANS RAJ BHANDARA**  
**230701403**

**LOHITH KRISHNA**  
**230701506**

# ABSTRACT

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Fog and low-visibility conditions pose significant challenges for imaging systems in applications such as transportation, surveillance, and environmental monitoring. *FogClear* is an IoT-based image enhancement system designed to address these challenges by improving image clarity in real time. Our system uses an Arduino Uno R3 integrated with an OV7670 camera module to capture images and a VL53L0X sensor to measure environmental visibility conditions. Captured images are processed using lightweight enhancement algorithms optimized for edge devices, improving contrast and reducing haze effects. Data is transmitted through an IoT network for remote monitoring and further processing if needed. *FogClear* aims to provide a low-cost, energy-efficient, and portable solution for enhancing visual information under adverse atmospheric conditions. This system is ideal for applications in smart vehicles, outdoor security, and autonomous monitoring stations, contributing to safer and more reliable.

# INTRODUCTION

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In many real-world environments, fog and low-visibility conditions significantly degrade image quality, affecting critical operations like transportation, security surveillance, and environmental observation. Traditional imaging systems struggle to maintain clarity in such situations, leading to safety risks and reduced system performance. To address this problem, we present *FogClear*, an IoT-based image enhancement system. By combining real-time image capture with environmental sensing, FogClear enhances visual information even under challenging conditions. Our system uses the Arduino Uno R3, OV7670 camera module, and VL53L0X distance sensor to collect image and visibility data. Through lightweight processing and IoT integration, FogClear not only improves image clarity at the source but also enables remote access and monitoring. This project demonstrates how IoT technology can be leveraged to create smarter, more adaptive imaging solutions for safer and more efficient operations in low-visibility environments.

# PROBLEM STATEMENT

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*The goal is to create a low-cost, portable, IoT-based device that captures and enhances images in real time under foggy or low-visibility conditions, improving visual clarity for applications in transportation, surveillance, and environmental monitoring.*

# PROPOSED WORK

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- > The **FogClear** system consists of an image-capturing module integrated with an environmental sensing unit, aimed at enhancing images captured in foggy or low-visibility conditions through real-time lightweight processing, empowering users to obtain clearer visuals for applications like transportation, surveillance, and environmental monitoring.
- > By leveraging IoT connectivity and advanced technologies, such as embedded image processors and visibility sensors, the system enables users to access enhanced visual data remotely, improving decision-making, operational safety, and reliability in adverse atmospheric environments.

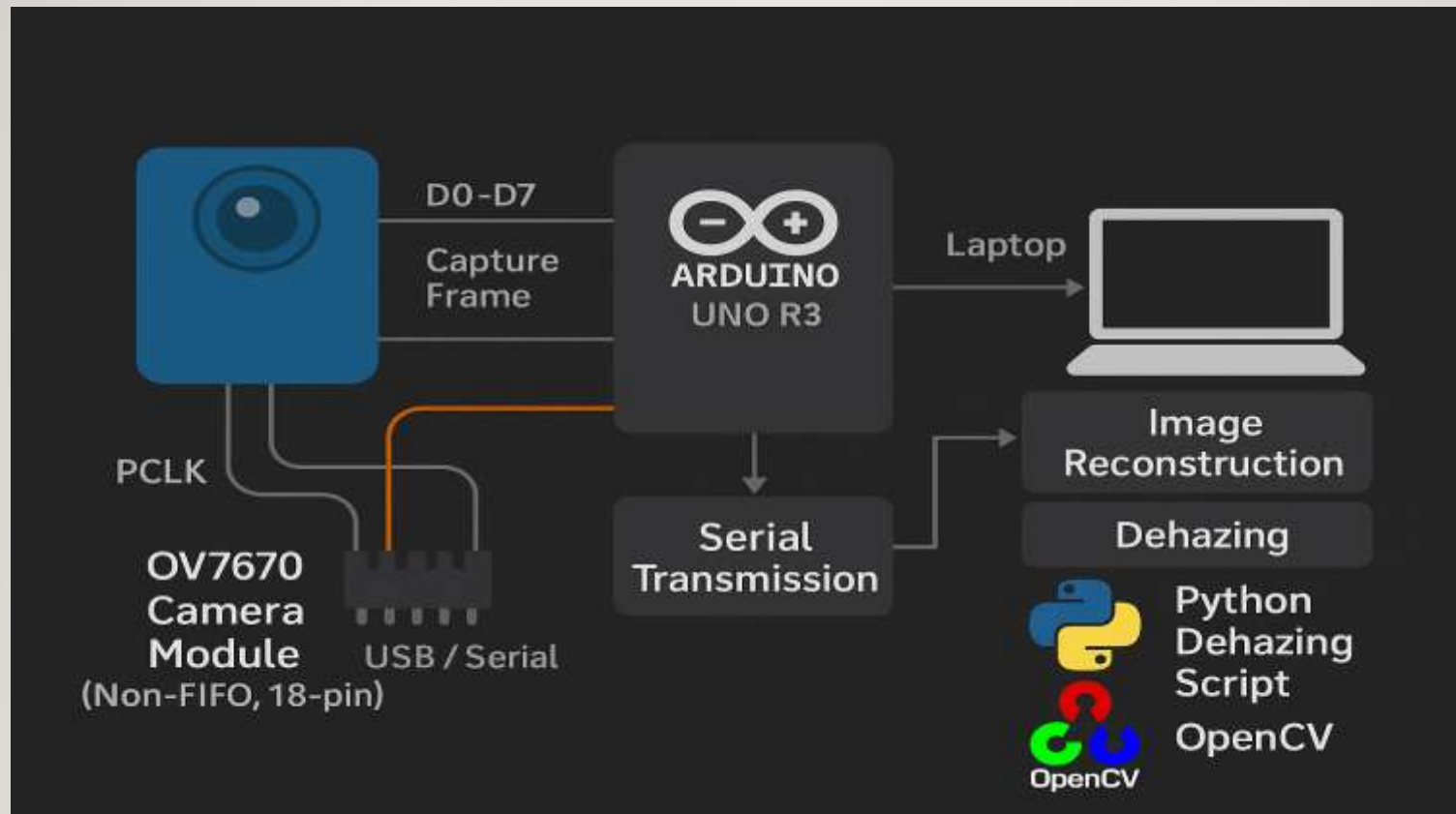


# IMPLEMENTATION

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- Capturing clear images during foggy or low-visibility conditions is essential for maintaining safety and effective monitoring in critical areas like transportation and surveillance.
- By enhancing images in real-time, *FogClear* allows users to overcome environmental challenges, ensuring that vital visual information remains accessible and reliable.
- This system boosts user confidence by delivering consistently clearer images, reducing risks, and supporting better decision-making in low-visibility environments.
- With a growing global demand for improved visibility solutions, *FogClear* provides an innovative and scalable approach to enhancing safety and operational efficiency across multiple sectors.

# ARCHITECTURE



## SYSTEM REQUIREMENTS

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### > Hardware:

- Camera Module (Raspberry Pi Camera, ESP32-CAM, or USB Camera)
- Microcontroller/Processor (ESP32, Raspberry Pi)
- IoT Module (WiFi – ESP32, GSM – SIM800L)
- Power Source (Rechargeable Li-ion Battery, Solar Panel)
- LCD Screen or Mobile App for output

### > Software:

- Python + OpenCV (for image processing)
- TensorFlow (AI-based enhancement, optional)

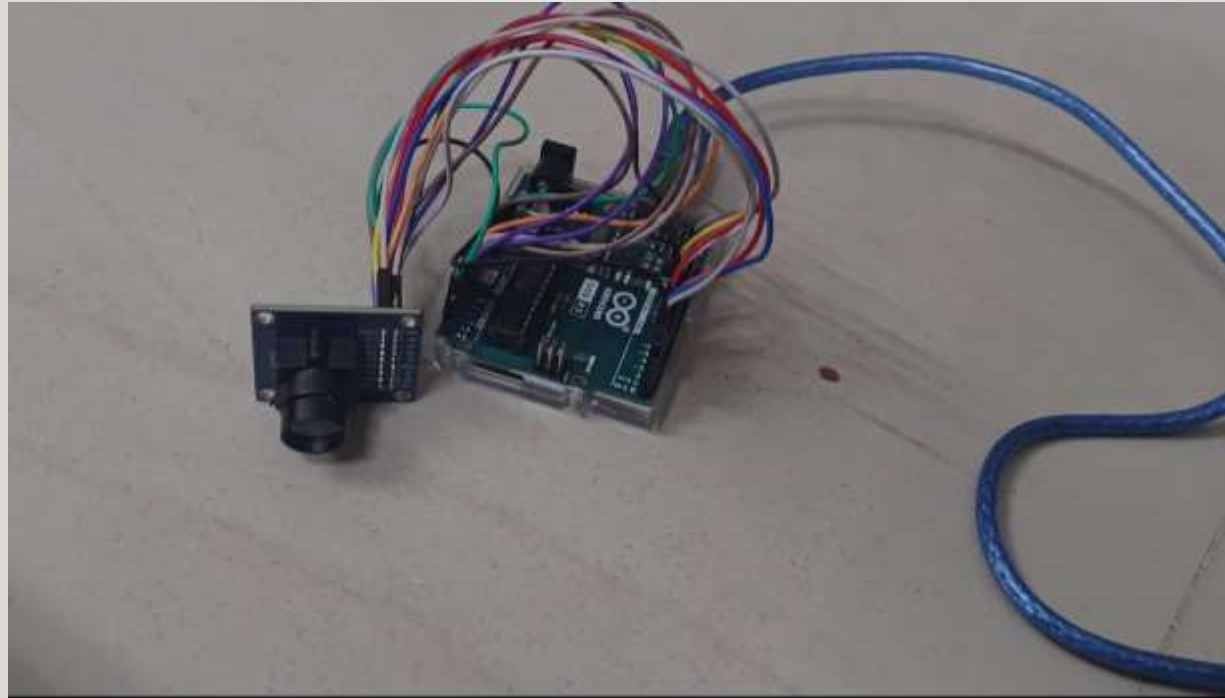


# ADVANTAGES OF THE PROPOSED SYSTEM

- Real-time image enhancement improves clarity in foggy conditions.
- Cost-effective solution using affordable IoT hardware.
- Enhances visibility for safety-critical applications like transportation.
- Scalable and adaptable for various environments and use cases.
- Enhances image clarity in real-time, even in foggy conditions.
- Cost-efficient solution using low-cost IoT components for broad accessibility.

# OV7670 CAMERA MODULE WITH ARDUINO R3

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# IMPLEMENTATION OF CAMERA MODULE WITH ARDUINO R3

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- The OV7670 camera module is connected to the Arduino R3 and captures real-time foggy images.
- The captured images are processed using an image enhancement algorithm to remove the fog effect.
- The Arduino R3 manages the image data and applies the enhancement technique to produce clearer images.
- The processed clear images are then transmitted or displayed for improved visibility.



# CONCLUSION

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*In conclusion, the FogClear Image Enhancement System leverages IoT technology to provide real-time image clarity in foggy or low-visibility conditions. By utilizing affordable components, the system offers a cost-effective solution that can be easily scaled and adapted to various applications, ensuring improved safety and visibility in critical environments such as transportation and surveillance. Its flexibility and scalability make it a valuable tool for enhancing operational efficiency and decision-making in challenging environments. The system represents a significant step toward more accessible and reliable image enhancement solutions in the IoT landscape.*

# REFERENCES

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# THANK YOU