

THE COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART
ALBERT NERKEN SCHOOL OF ENGINEERING

Computer Vision for Vehicle Emission Estimation

By

Aidan Cusa

A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Engineering

Advisor

Carl Sable

THE COOPER UNION FOR THE ADVANCEMENT OF SCIENCE AND ART

ALBERT NERKEN SCHOOL OF ENGINEERING

This thesis was prepared under the direction of Carl Sable and has received approval. It was submitted to the Dean of the School of Engineering and the full Faculty, and was approved as partial fulfillment of the requirements for the degree of Master of Engineering.

Barry L. Shoop, Ph.D, P.E. - Date
Dean, Albert Nerken School of Engineering

Carl Sable, Ph.D - Date
Candidate's Thesis Advisor

Acknowledgement

I would like to express my sincere gratitude to my mentor Professor Carl Sable for his guidance, patience, and encouragement throughout this project. I would also like to thank my teammates, Sun Kongsonthana, and Minahil Bakhtawar for their collaboration, creativity, and teamwork during the development of the Remote Micro-Robot middleware.

I am grateful to the College of Design and Engineering at the National University of Singapore for providing the resources and support that made this work possible. Finally, I would like to thank The Cooper Union for providing me with this incredible opportunity to represent the school abroad.

Abstract

Hello

Contents

1	Introduction	1
2	Background Research	1
3	Dataset	1
4	Methodology	1
5	Experimentation and Results	1
6	Discussion	1
7	Limitations	1
8	Future Work	1
9	Bibliography	1

1 Introduction

Urban air pollution remains a major public-health and environmental challenge. The World Health Organization (WHO) estimates that around 99% of the world's population breathes air containing pollutant concentrations that exceed WHO guideline limits, and that air pollution is responsible for more than 7.9 million premature deaths annually. [cite arabian peninsula and WHO. New State of Global Air 2025 Report] Additionally, it is linked to a broad range of chronic and acute outcomes, including cardiopulmonary disease and asthma, and it also contributes to environmental harms such as global warming and weather variability [cite arabian peninsula, New State of Global Air 2025 Report, Transport impacts on atmosphere and climate]. Road vehicles are central to both the climate and health aspects of the problem. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report Working Group III notes that, in 2019, direct greenhouse gas (GHG) emissions from the transport sector accounted for 23% of global energy-related CO2 emissions. Of these, 70% came from road vehicles [cite IPCC]. In urban areas, transportation emissions are particularly consequential as they are concentrated along the very corridors where people live, work, and travel.[cite arabian peninsula]

2 Background Research

3 Dataset

4 Methodology

5 Experimentation and Results

6 Discussion

7 Limitations

8 Future Work

9 Bibliography