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Project reporton

"Smart Ambulance and Traffic Analyser System"

Submitted in recognition to the partial fulfillment of the requirementsfor the Electronic Product Design (ENP359) lab work

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Shri Ramdeobaba College of Engineering and Management,Nagpur

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Certificate

This is to certify that the project titled "Smart Ambulance and Traffic Analyser System"has been Successfully completed by the following students under the guidance of Prof. **.P.A.Dwaramwar** in recognition to the partial fulfillment of the requirements for the Electronic Product Design (ENP359) course work of Sixth Semester , Electronics Engineering during academic year 2024-2025.

Students Name and Signature

Guided By

Prof.P.A.Dwaramwar

1. Abstract

In today's world time is a jewel and we need to save time in order to achieve more in life. Similarly, time plays an important role at each second when it is a cost of a life. During emergency situations there are many chances that the patient does not get proper treatment at times and causes loss of human life. This generally happens due to traffic jams and ambulances getting stuck in traffic.

Our system is a solution to this problem that is 'Smart Ambulance and Traffic Analyzer System'. Our system analyzes traffic and smartly manages traffic when an ambulance is encountered. The basic idea behind it is clearing the traffic for ambulance when the ambulance is unable to find a way. The system analyzes the scenario and give a green signal to the signal which has ambulance in it. It can be a life-saver when situations are tight and each second costs.

The implementation includes two model:

1.1. Basic Model: The basic model is implementation of a just traffic manager. Which counts vehicles on each side and automatically manages traffic and its counter.

1.2. Advanced Model: The advanced model implements the traffic according to the detection of ambulance and signals a green light on detection to it.

The technologies involved for the system development are python, yolov8, open cv modules, ultralynitics modules and a general basic coding.

Also, in order to detect ambulance, we need a create a custom model for ambulance detection which is created on google collaborative sheets. These are the general technologies used in creation of this project.

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2. Introduction

In today's bustling urban landscapes, navigating through congested traffic poses a significant challenge for emergency responders, especially ambulances rushing to save lives. The Smart Ambulance and Traffic Signal Analyser System introduces a novel solution aimed at revolutionizing emergency response systems. By integrating cutting-edge technology, including the YOLOv8 model-based object detection, this project seeks to identify ambulances amidst traffic, ensuring swift and efficient navigation during critical moments.

The urgent need for such innovations arises from the pressing demand for expedited emergency services. Time is of the essence in life-threatening situations, and delays caused by traffic congestion can have dire consequences. The Smart Ambulance and Traffic Signal Analyser System addresses this critical issue head-on, striving to streamline ambulance navigation and potentially save countless lives in the process. At its core, the system leverages advanced object detection techniques to recognize ambulances amidst complex traffic scenarios. The YOLOv8 model, renowned for its accuracy and efficiency, serves as the backbone of this innovative approach. By swiftly identifying ambulances, the system enables real-time adjustments to traffic signals, clearing the path and ensuring unimpeded passage through congested areas. Furthermore, the integration of intelligent traffic signal analysis adds another layer of sophistication to the system. By analysing traffic patterns and congestion levels in real-time, the system optimizes signal timings to facilitate smoother passage for emergency vehicles.

The significance of the Smart Ambulance and Traffic Signal Analyser System extends far beyond its technological prowess. At its essence, it embodies a commitment to safeguarding lives and prioritizing the well-being of communities. By empowering emergency responders with the tools, they need to navigate through challenging environments, the system epitomizes the intersection of innovation and social impact.

In conclusion, the Smart Ambulance and Traffic Signal Analyser System represents a paradigm shift in emergency response capabilities. By harnessing the power of advanced object detection and intelligent traffic analysis, it stands poised to revolutionize the way we approach emergency situations in urban settings. Through its implementation, we pave the way for safer, more efficient emergency response systems, ultimately saving lives when every second counts.

3. Literature Survey, Motivation & Problem Statement

3.1. Literature Survey

3.1.1. "Attention-YOLOV4: A real-time and high-accurate traffic sign detection algorithm" by Li, Y.; Li, J.; Meng, P.: Li et al. (2022) introduce Attention-YOLOV4, a novel traffic sign detection algorithm designed for real-time and high-accuracy performance. The proposed algorithm builds upon the YOLOv4 architecture, incorporating attention mechanisms to improve detection accuracy and robustness, particularly in challenging traffic scenarios. By leveraging attention mechanisms, the algorithm focuses on relevant regions of interest within the image, enhancing the detection of traffic signs while reducing false positives. The paper provides a detailed description of the Attention-YOLOV4 algorithm and evaluates its performance through extensive experiments. Results demonstrate that the proposed algorithm achieves real-time performance while surpassing existing methods in terms of accuracy and efficiency..[1]

3.1.2. A novel lightweight real-time traffic sign detection integration framework based on YOLOv4" by Gu, Y.; Si, B.: Gu and Si (2022) present a novel framework for real-time traffic sign detection, leveraging the YOLOv4 model. The proposed framework focuses on achieving lightweight and efficient traffic sign detection, catering to the requirements of real-time applications. By integrating YOLOv4 into the framework, the authors aim to enhance the accuracy and speed of traffic sign detection while minimizing computational resources. The paper provides insights into the design and implementation of the framework, highlighting its effectiveness in detecting traffic signs in various environmental conditions[2]

3.1.3. Gupta, A.; Anpalagan, A.; Guan, L.; Khwaja, A.S. Deep learning for object detection and scene perception in self-driving cars: Gupta et al. (2021) provide an extensive survey on the utilization of deep learning techniques for object detection and scene perception in the context of self-driving cars. The paper offers a comprehensive overview of recent advancements in deep learning algorithms applied to various tasks crucial for autonomous driving systems, such as object detection, classification, and scene understanding. Through their survey, the authors identify and discuss key challenges and

open issues in the field, including but not limited to data availability, model interpretability, robustness, and safety concerns[3]

3.1.4. "Object detection using YOLO: Challenges, architectural successors, datasets and applications" by Diwan, T.; Anirudh, G.; Tembhurne, J.V.: Diwan et al. (2022) present a comprehensive review of object detection techniques utilizing the You Only Look Once (YOLO) architecture. The paper examines the challenges associated with object detection tasks, such as accuracy, speed, and scalability, and explores the evolution of YOLO-based architectures to address these challenges. The authors discuss various architectural successors to YOLO, highlighting their advancements in terms of accuracy, speed, and efficiency. Furthermore, the paper provides insights into popular datasets used for training and evaluation of YOLO-based models, along with applications across diverse domains, including autonomous vehicles, surveillance, and augmented reality.[4]

3.2.Motivation:

3.2.1. To serve as a system in order to save human life in emergency system there is lack of services

3.2.2. Encountered various instances where due to traffic patient losses his/her life

3.2.3. At some signals the timer is still on even there is no traffic engagement and eventually everyone is wasting their time.

3.2.4. Also can adjust signals according to squares and different locations in concern with their respective traffic

3.2.5. No need of new implementation , can be done by using change in pre existing system.

3.3.Problem Statement

Traffic camera [13]

Ambulance[11]

Smart ambulance and traffic analyser SYSTEM

Green signal [12]

3.3.1. To implement a custom model which determines ambulances and not vehicles which a predefined models does.

3.3.2. Collection of data for custom model training and testing.

3.3.3. Validate each image and prepare data set for each type of class primarily a ambulance

3.3.4. Creation of bounding boxes on each image and storage of co-ordinate of target class in a separate file.

3.3.5. Create a program for ambulance detection and count number of vehicles on each side of signal.

4. Working Principle

4.1. A basic model which will count vehicles on each side and if a signal is encountered with no traffic engagement the remaining time of that signal will be transferred to signal with most number of vehicles

4.2. While the basic model is running as soon as an ambulance is encountered all signal except the one which includes the ambulance are stopped and the ambulance is passed

4.3. Further the basic model starts running itself unless another ambulance is detected.

4.4. The ensures smooth flow of ambulance in even intense traffic and congested situations.

5. Software Description and Flowchart

5.1. Python

5.1.1. Python is a versatile, high-level programming language.

5.1.2. Renowned for its simplicity, readability, and extensive libraries.

5.1.3. Supports a wide range of applications including web development, data analysis, artificial intelligence, and automation.

5.1.4. Clear and concise syntax makes it suitable for both beginners and experts.

5.1.5. Compatible with various operating systems including Windows, macOS, and Linux.

5.1.6. Large community support and active development[5]

5.2.Goggle Collaborative

5.2.1. Google Colab, short for Google Colaboratory, is a cloud-based platform designed for running Python code.

5.2.2. It offers free access to GPU and TPU resources, enabling faster computation for machine learning and deep learning tasks.

5.2.3. Users can write and execute Python code in interactive notebooks, which are stored on Google Drive.

5.2.4. Google Colab integrates seamlessly with popular machine learning libraries such as TensorFlow, PyTorch, and scikit-learn.

5.2.5. Collaborative features allow multiple users to work on the same notebook simultaneously, making it ideal for team projects and educational purposes.

5.2.6. With its web-based interface, Google Colab is accessible from any device with an internet connection, eliminating the need for local installation or setup.

5.2.7. Google Collab notebooks can be easily shared and published, facilitating collaboration and knowledge dissemination within the community.[6]

5.3.Labellmg

5.3.1. LabelImg is an open-source graphical image annotation tool used for labeling object bounding boxes in images.

5.3.2. It provides a u ser-friendly interface for annotating objects of interest within images with bounding boxes.

5.3.3. LabelImg supports various annotation formats such as Pascal VOC and YOLO, making it compatible with popular deep learning frameworks.

5.3.4. With LabelImg, users can annotate images by drawing bounding boxes around objects of interest and assigning corresponding labels.

5.3.5. It is widely used in computer vision and machine learning research for creating annotated datasets for training object detection models.

5.3.6. LabelImg is platform-independent and can be easily installed and used on Windows, macOS, and Linux systems.

5.3.7. Its intuitive interface and simplicity make it suitable for both beginners and experienced users in the field of computer vision and machine learning.[7]

5.4.Flowchart

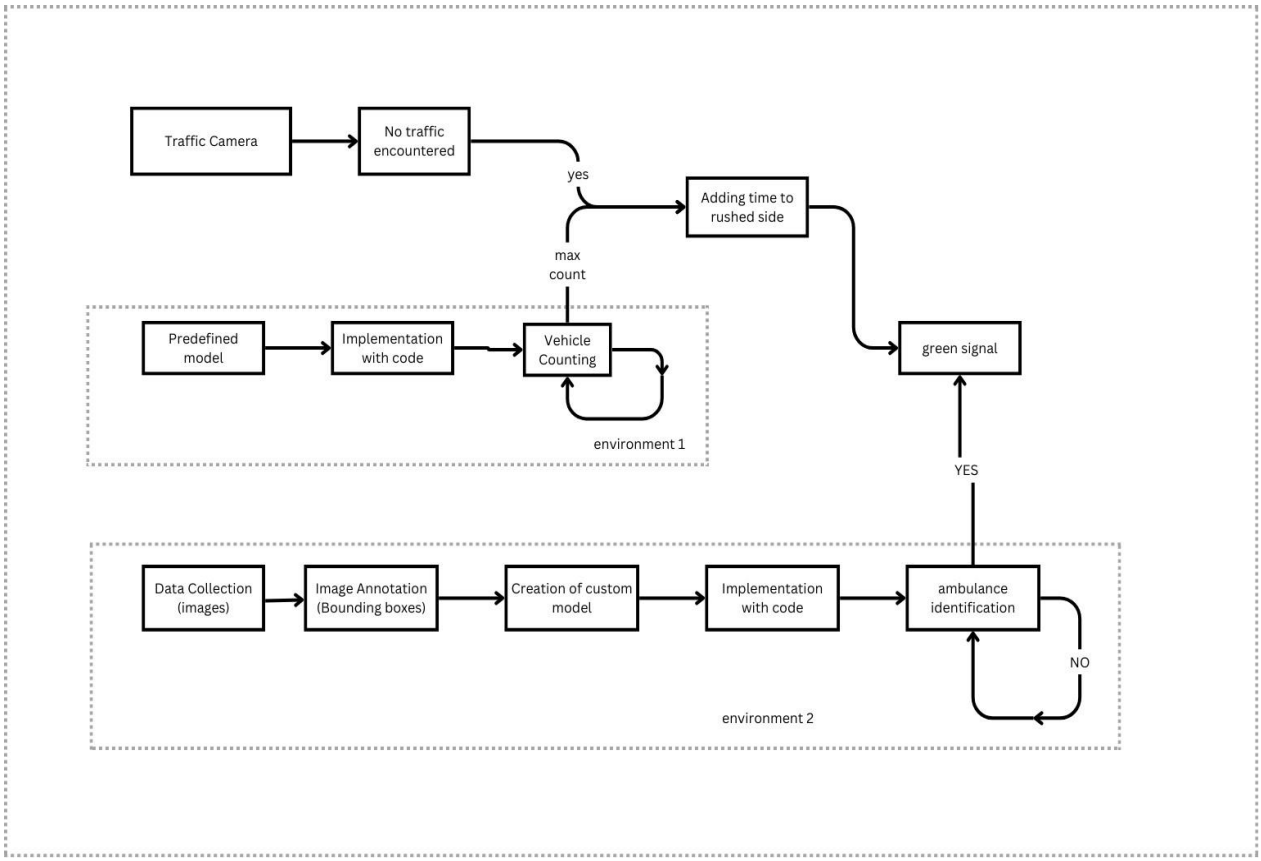


Fig5.4.1

6. Final Testing Result

fig 6.1

fig 6.2

fig 6.3

6.1. On actual implementation the model was successfully able to detect ambulances and function accordingly

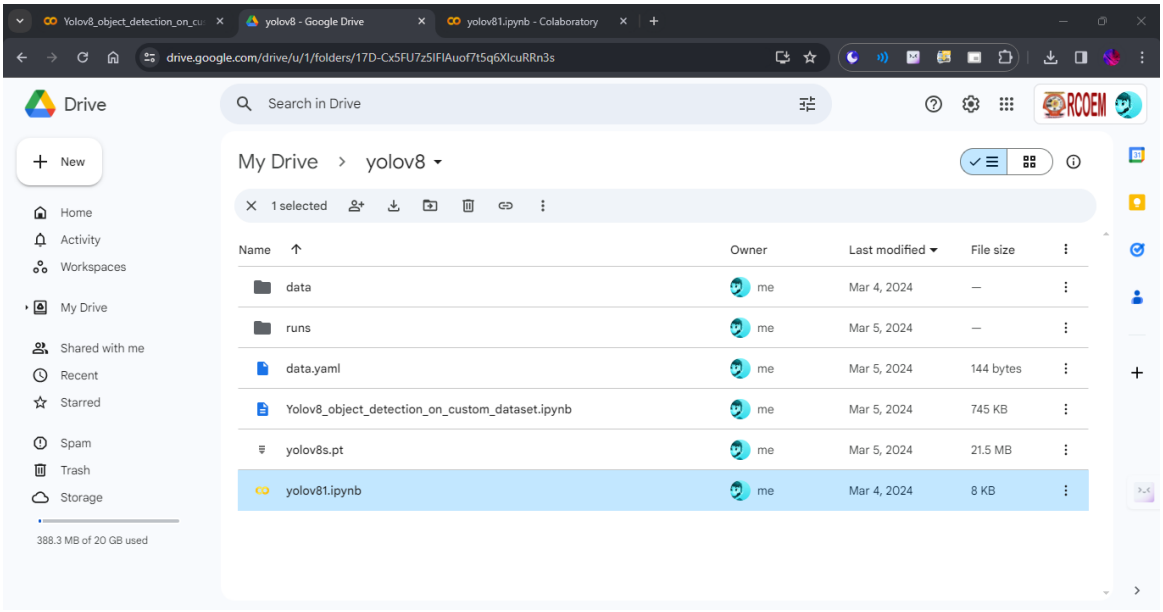
6.2. Similarly, the predefined model was able t identify vehicles and count them accordingly.

6.3. Thus we have successfully identified ambulance and vehicles and managed traffic timings[5]

7. Outcomes

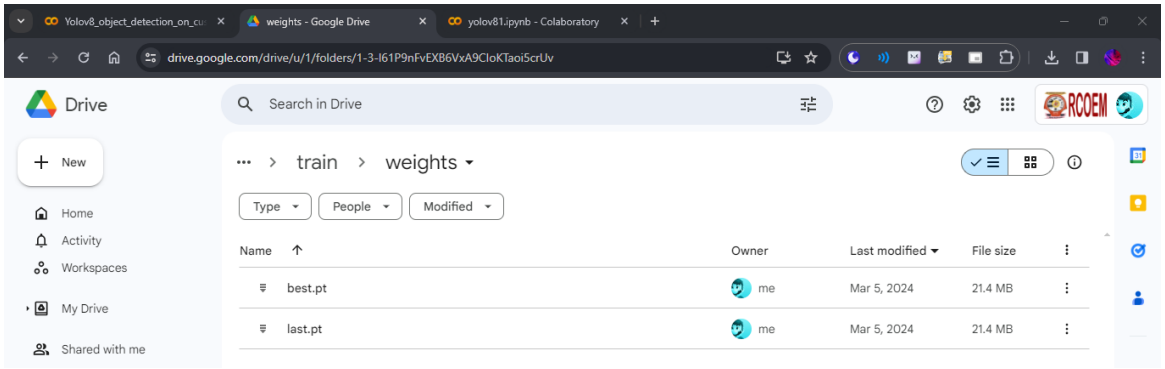
7.1. Files obtained on model training

7.1.1. We obtain multiple files on model training including performance matrix, testing images and model after training[10][6]



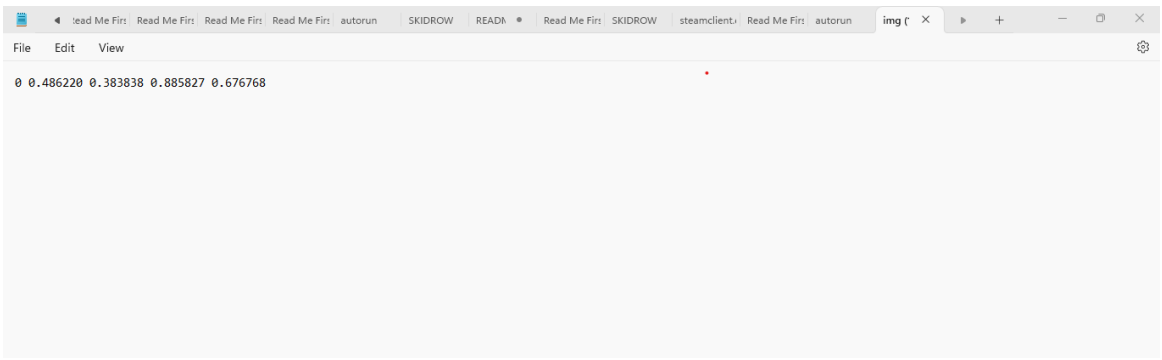
7.2. Model obtained as “best.pt” and “last.pt”

7.2.1. These models are obtained after implementation the best.pt contains the best trained model where as last.pt contains the most least trained for the best and worst performance comparison of the model in scenarios [10]



7.3. Co-ordinates of target saved on notepad

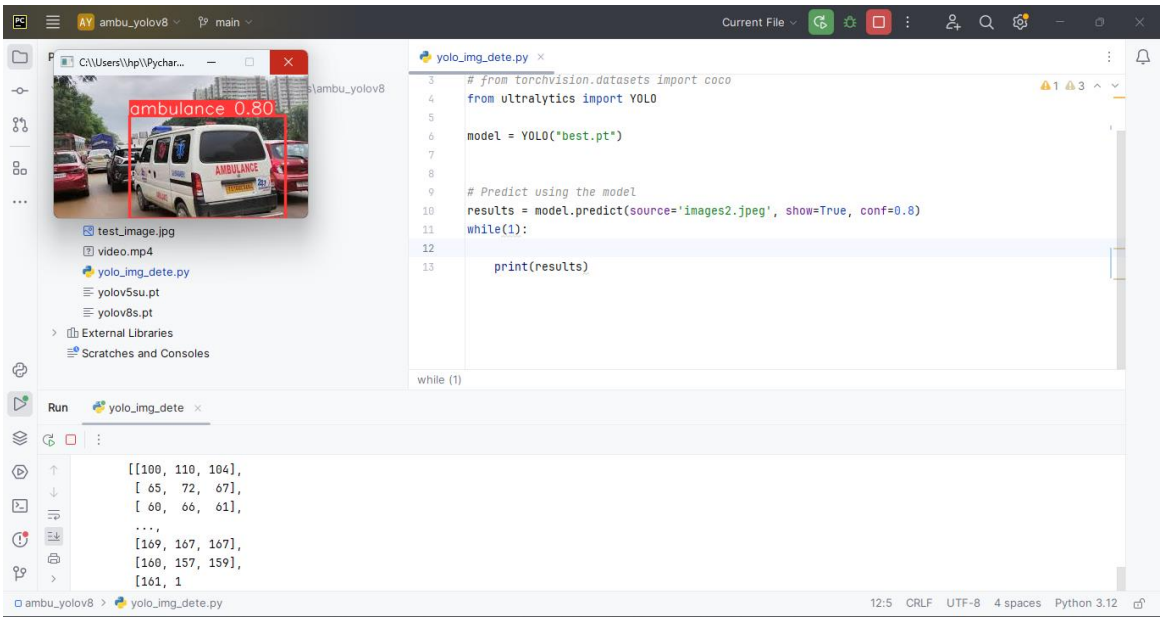
7.3.1. We also obtain a notepad file containing co-ordinates of the ambulance at each frame[10][6]



7.4. Code implementation on PyCharm

7.4.1. The code is implemented on PyCharm and the results are displayed including the co-ordinates of the ambulance

7.4.2. Also, multiple targets that is ambulance can be identified at each frame[5]



8. Conclusion and Future Scopes

8.1. Conclusion

8.1.1. The Smart Ambulance and Traffic Signal Analyzer System is a promising initiative aimed at enhancing emergency response systems by integrating cutting-edge technologies.

8.1.2. By leveraging the YOLOv8 model for object detection, the system enables efficient identification of ambulances amidst congested traffic, thereby expediting their navigation during emergencies.

8.1.3. Through the integration of real-time traffic signal analysis, the system optimizes ambulance routes, minimizing response times and potentially saving lives.

8.1.4. The project underscores the critical importance of innovation in addressing challenges within emergency services, ultimately leading to more effective and timely emergency response

8.2. Future Scopes

8.2.1. Enhanced Object Detection: Continuously refining and updating the object detection algorithms to improve accuracy, particularly in challenging scenarios such as low visibility or occluded environments.

8.2.2. Integration of Predictive Analytics: Incorporating predictive analytics capabilities to anticipate traffic patterns and optimize ambulance routes proactively, further reducing response times.

8.2.3. Implementation of Autonomous Driving: Exploring the potential for implementing autonomous driving technologies to further optimize ambulance navigation and reduce reliance on human drivers.

8.2.4. Scalability and Deployment: Ensuring scalability and ease of deployment across different urban environments, taking into account variations in traffic conditions and infrastructure.

9. References

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11. Ambulance link
12. Green light link
13. Traffic camera link