



Enhancing Road Safety and Accident Detection Using YOLO

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Abstract: Speed is one of the causes of car accidents. If emergency services receive emergency information and arrive at the scene in time, many people will be saved. This project includes helmet detection and sending challan systems. In recent years, motorcycle accidents have increased in some countries because drivers around the world often ignore safety precautions, which leads to accidents and deaths. Drivers who do not wear helmets are at the greatest risk of brain injuries; There is a law in India that requires only bike riders to wear helmets, not passengers. Anyone riding a motorcycle without a helmet can have an accident or suffer a head injury. It should be mandatory for everyone to wear a helmet; In this "automatic helmet inspection and penalty", passengers without helmets are detected and the license plate number of the motorcycle is recorded. A penalty message is sent to the person not wearing a helmet. This is because more and more people are now riding motorcycles on the highway, causing more accidents and injuries. Cyclists not wearing protective helmets are one of the main causes of accidents. You can check if they are currently wearing helmets by looking at CCTV footage from surrounding buildings or walkways. It is important for people to interact with one of these systems to see people who are not wearing helmets. The system classifies the features of products based on the information collected about them. The system now uses deep learning for the you-will-only-see-once (YOLO)-Darknet policy to detect the helmet.

Index Terms – Helmet detection; Image processing, YOLO, Database, CNN.

I. INTRODUCTION

Over the years, motorcycle accidents have increased in many countries. Although many motorcyclists do not wear helmets, helmets are the most important safety equipment. The main purpose of a helmet is to protect the driver's head in the event of an accident. If not used by the passenger in an accident, it can be fatal. The "Enhancing Road Safety and Accident Detection Using YOLO" project aims to solve these important problems by developing real time protective helmets. The system uses the YOLO (You Look Only Once) algorithm to detect whether the driver is wearing a helmet. The project integrates many important components such as a camera, YOLO, Database and SMTP server to capture events and send instant alerts. It would also be impractical for the police to check every motorcycle to see if the driver is wearing a helmet. Therefore, there should be an automatic electronic system to monitor the motorcycle, detect whether the driver is wearing a helmet and penalize those who are not wearing a helmet. Video surveillance can detect when a motorcycle helmet is worn and allows better training and management of managers to increase road safety. Also, the materials used to create the technology is limited in terms of traffic and speed changes. The multi task learning (MTL) described in this study can identify and track different motorcycles and record the helmets worn by the riders.

II. Problem Statement

Motorcycle accidents are on the rise globally, posing a significant road safety challenge. A considerable portion of these incidents involves motorcyclists who disregard essential safety measures, such as wearing helmets. The failure to comply with helmet regulations significantly increases the risk of traumatic brain injuries during accidents, with severe injuries or fatalities being more likely when riders are unprotected. Furthermore, the issue is compounded by delayed medical intervention, especially in remote areas where ambulance response times are longer. This delay can lead to preventable deaths, as timely medical attention is crucial for minimizing injury severity. There is a pressing need to enforce helmet-wearing rules by identifying motorcyclists who neglect to wear helmets. Effective enforcement through measures like sending penalty (challan) messages to violators can raise awareness and ensure greater compliance with safety regulations. Additionally, ensuring that accident victims receive immediate medical attention is critical to improving survival rates and recovery outcomes. Prompt notification of relevant authorities and accident investigation units is also essential for a more efficient response. Quick identification and investigation can reduce the time required for inquiries, enabling faster resolutions and strengthening enforcement actions aimed at preventing further accidents.

III. LITERATURE SURVEY

1. Safeguarding of motorcyclists through helmet recognition:

The motorcycle is the most widely used vehicle in India. Fatalities due to road accidents in India are significantly high. Motorcycles being an obvious choice as a convenient transportation mode, it has a major contribution to road accident casualties and injuries. Despite the Government traffic regulation, people still avoid using helmets. The impetuous or deliberate nature of people could be the reason for avoiding helmets. The proposed system is an effort to create awareness in society by endorsing the use of helmets and leading people to safety.

2. Automatic Detector for Bikers with no Helmet using Deep Learning:

This method is state-of-the-art that can use only one single CNN network to detect the bounding box area of the motorcycle and rider and then classify whether the biker is wearing or not wearing a helmet at the same time.

3. Helmet Detection using Deep Learning-Based Object Detection Techniques:

Helmet detection using deep learning is essential for improving road safety by ensuring compliance with helmet regulations. By detecting helmets in real time, these systems help law enforcement monitor traffic and promote safer riding practices. Advanced models like YOLO, Faster R-CNN, and SSD are widely used for their accuracy and ability to handle various lighting conditions and helmet designs. However, challenges such as reliance on diverse datasets, occlusion, and low-resolution images persist. Ongoing research focuses on addressing these issues through techniques like data augmentation and transfer learning.

4. Helmet Detection on Two-Wheelers and Automated Penalty System using AI:

The core idea is to develop a helmet detection system, addressing the issue of headgear noncompliance, which is a leading cause of fatalities in road accidents. Research shows that manual observation is inefficient and time-consuming. This project aims to establish an automated detection mechanism by utilizing machine learning algorithms and pre-built libraries. The system identifies whether a rider is wearing a helmet and communicates penalty details to the authorities for enforcement. Motorcycle accidents, especially in developing countries, often result in fatalities due to helmet non-use. This study proposes an AI-based method for automatically detecting helmets and generating alerts based on license plate recognition.

IV. SYSTEM ARCHITECTURE

1. Start Realtime Video.
2. Extract Image from Video convert them to gray scale.
3. Detect if helmet is worn or not.
4. Use Yolo Algorithm to detect helmet.
5. If helmet is not there sending alert to owner over the email for challan.
6. Send Image of violation over the email.

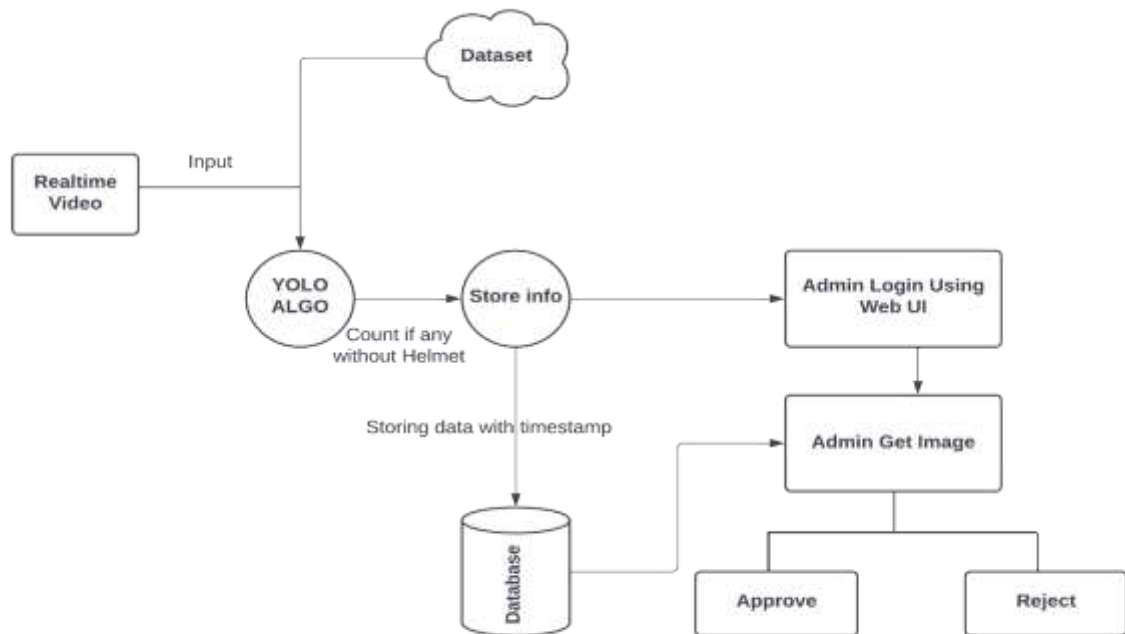


Fig 1. System Architecture

V. METHODOLOGY

The consensus-based framework consists of three stages. Since there is no ready data, the first step is to generate the necessary data to demonstrate our model. Then, make preliminary data, which is divided into three parts: data collection, data development, and data description. The resulting images have high resolution, multiple angles, and different backgrounds to create a more realistic image. The image collection is expanded by developing techniques such as zooming, dimming, and changing brightness to increase the variety and richness of the experimental data. The next step after image enhancement is image annotation, which will create a bounding box around the object and its label (with or without a helmet). After augmentation and annotation, a dataset of 2480 images were created; 80% of the images were randomly selected as the training dataset and the remaining 20% as the final set. During training, the image size will be reset and the batch size will be adjusted according to the memory limit of the GPU. This function will use the optimizer in training, with the learning rate set to 0.001 and other parameters kept the same as in the YOLO model.

➤ Technology

1. YOLO
2. CNN (Convolutional Neural Network)
3. Python

➤ Software Requirements

1. Operating System: Microsoft Windows 7 and Above
2. Programming Language: Python
3. IDE: Python IDLE
4. Platform: Jupiter notebook/Visual Studio Code

➤ Hardware Requirements

1. Processor: Intel Core I3 or Higher
2. RAM: 4 GB or Higher

VI. ALGORITHMS INFORMATION & ARCHITECTURE

YOLOv5 (You Only Look Once version 5) is a state-of-the-art, real-time object detection algorithm. It was introduced in 2020 and is an extension of the original YOLO model. YOLOv5 is widely known for its speed and accuracy in detecting objects in images or videos. Unlike its predecessors, YOLOv5 is written in PyTorch, making it more accessible and flexible for developers and researchers. YOLOv5 is highly efficient in terms of model size and inference speed, making it suitable for applications where computational resources are limited, such as mobile or embedded devices. It comes in four versions: small, medium, large, and extra-large, providing different trade-offs between speed and accuracy. YOLOv5 excels in tasks such as real-time surveillance,

autonomous driving, and medical imaging. It achieves high performance by using a single neural network to process the entire image at once, predicting bounding boxes and class probabilities simultaneously.

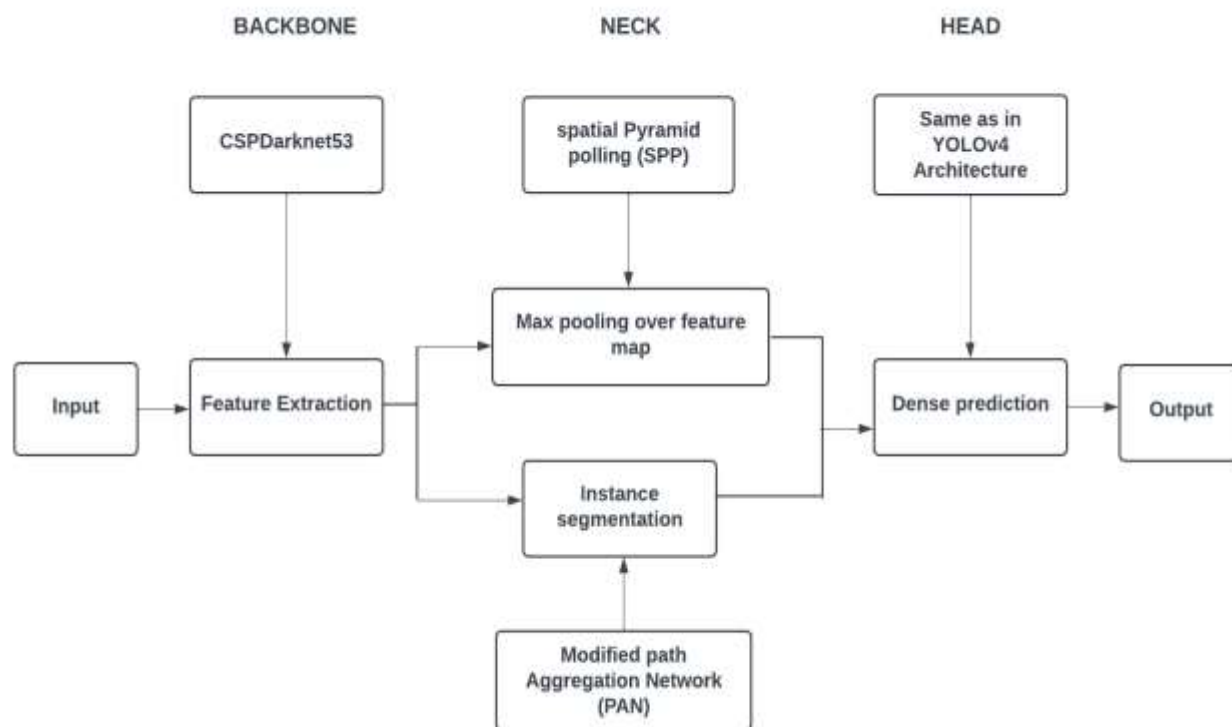


Fig 2. YOLO Architecture

VI. RESULTS



Fig 3. Image Capturing & Helmet Detection

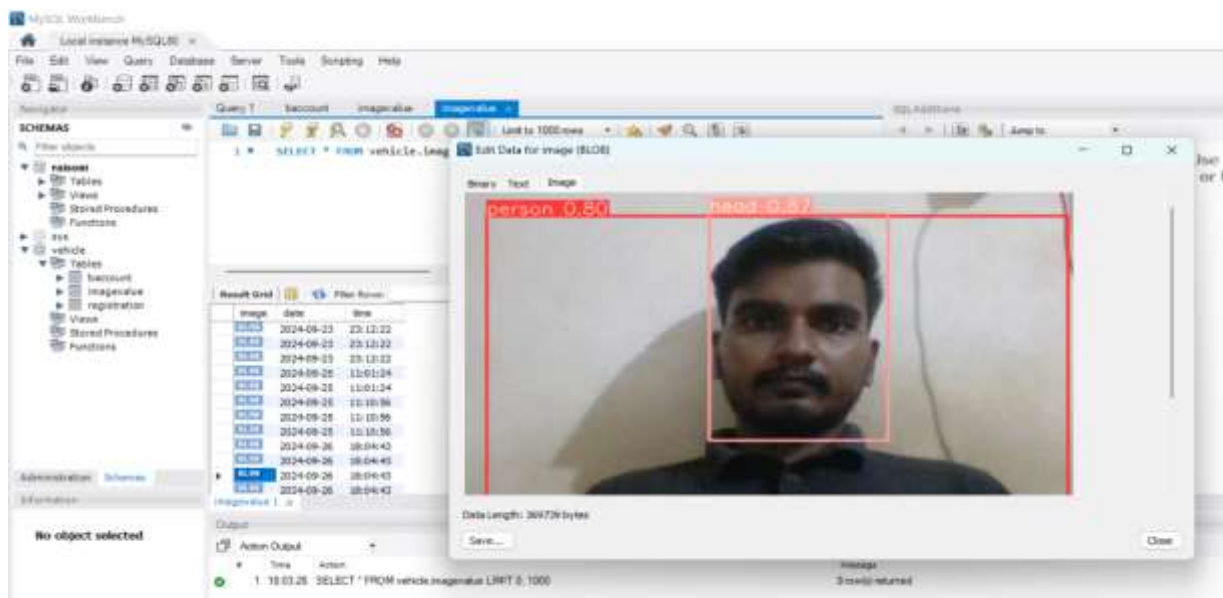


Fig 4. Image stored in database with time & date



Fig 5. Login Form



Fig 6. Sending challan

VI. CONCLUSION

This project focuses on reducing accidents caused by not wearing helmets by automatically issuing penalty notifications to riders who are found without helmets. It verifies whether traffic regulations are being followed and stores images of individuals violating the law. These images are then sent to authorities via email for further action. By detecting helmetless riders and sending penalty messages to traffic rule violators, the system eases the workload of law enforcement officers. Initial tests have shown excellent results, and multiple experiments confirm that the helmet detection system is both effective and efficient. Future developments will aim to enhance helmet detection in low-light conditions and complex environments. This project highlights the significant role technology can play in promoting safety and enforcing regulations.

VII. REFERENCES

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