Meet The Team

Team name:
intelAgent

A team of four Jadavpur University CSE UG4 students have come together to tackle an important challenge of road safety. Introducing the minds behind the impactful ***Securos App***, that accurately identifies helmet use and mobile phone violations in CCTV footage on roads and can alert the responsible authorities.

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Problem Statement

Mobile phone distractions among drivers and pedestrians contribute significantly to road accidents, claiming 1,997 lives in India in 2021. **Riding a motorbike/cycle without a helmet** caused ~47,000 deaths in India in the same year. Evidently, accidents and injuries are caused by people not wearing helmets or using mobile phones while driving. But existing CV applications only address one of the two equally life-threatening issues.

Our objective is to design and implement a computer vision solution that can **analyze CCTV video footage in real-time and accurately determine whether people in the scene are adhering to safety regulations by wearing helmets and refraining from using mobile phones or going hands-free while driving**. The proposed solution is versatile enough to **work in diverse environments,** such as traffic intersections, highways, city roads. It will also alert local traffic police about the law breakers.

Assumptions

- The scene is well lit (natural/artificial) and picture resolution is clear
- Cameras should be strategically placed to cover all the accident-prone areas on the road
- Roadside cameras should be installed at suitable height to clearly see all drivers and pedestrians
- There should be minimum to no overlap between people and obstructions for accurate alerts.

Theme:

- **Smart City**
- **Security**

Our Approach

Key Features:

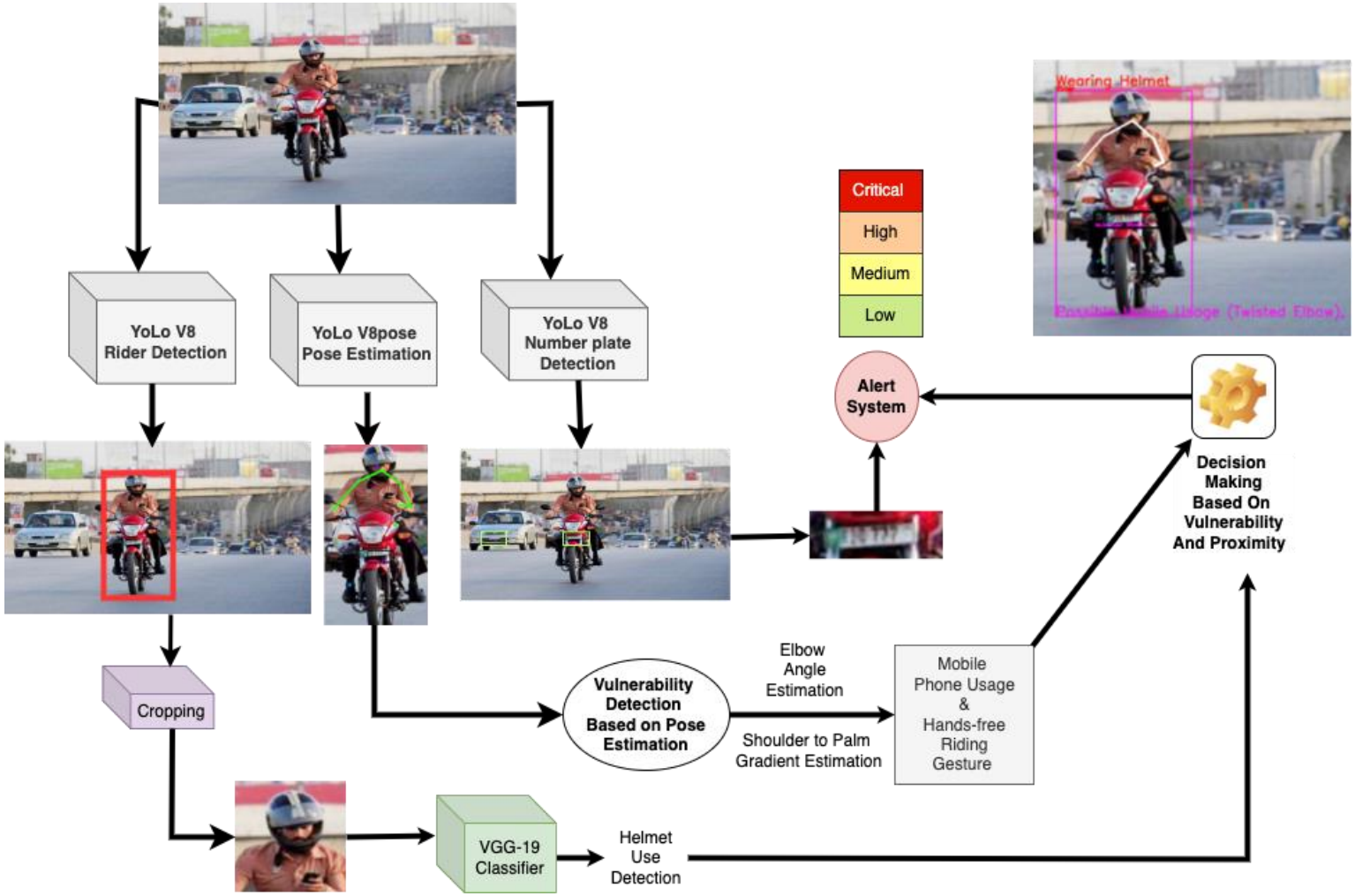
1. **Rider Detection:** YOLO model is fine-tuned to detect bikes and identify the rider's face and body parts within the video footage
2. **Helmet Detection:** VGG-19 model is fine-tuned to search whether those detected riders are wearing helmets.
3. **Phone/Hands-free driving Detection:** We use a pose detection model to check
   a. whether the rider is using a phone
   b. whether the rider's hands are off the bike handle
4. **Number plate Recognition:** Using a ANPR model we collect the bike's number plate info in case of HIGH risk
5. **Decision making and Alerting mechanism:** Whenever a HIGH risk person is detected, then system will send the bike's number plate info and alert the traffic police.

Technology Stack: Python, OpenCV, OpenVINO

	App Logic
01	The app first detects the **presence of bike riders** in the scene from the CCTV footage using YoloV8
02	Then it crops the head part of the rider and **classifies helmet usage** using VGG-19
03	Using YoloV8-Pose we perform **keypoint estimation** on the rider body part, and **pose estimation** on the upper body to check the orientation of the hands
04	We perform **mobile detection** based on elbow angle estimation, and detect **No-hands driving** from shoulder-to-palm gradient
05	In case of safety violation by the rider, an alert will be issued for the number plate of that vehicle using YoloV8 for **ANPR**

Risk Levels	Helmet	Mobile	Hands-free
Low	Yes	No	No
Medium	Yes	Yes	Yes
High	No	No	No
Critical	No	Yes	Yes

Flow of Securos



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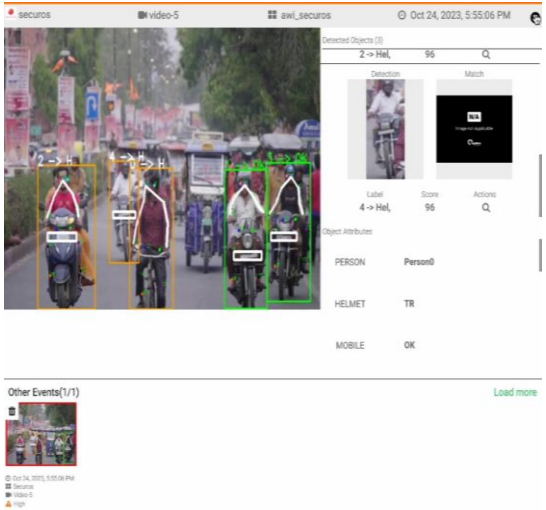
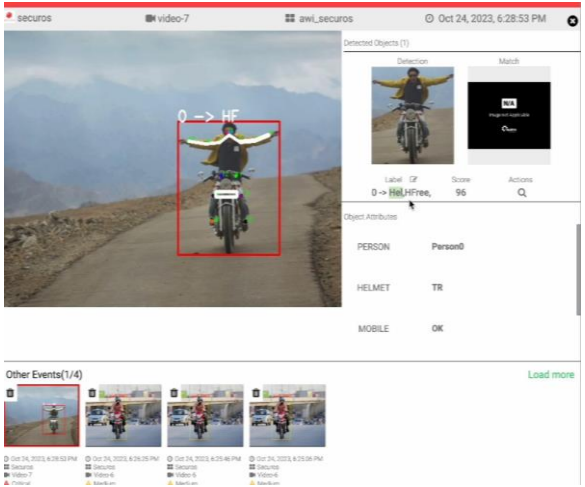
Details about the models

Models	Model Name	Framework	Input Format and Shape (HWC)	Output Shape	Custom Tweaks
Rider Detector	Yolo V8	OpenVINO	640 x 640 x 3	640 x 640 x 3	Finetuned in 70 epochs to detect bikes and identify the rider's face and body parts
With/Without Helmet Classifier	VGG-19	OpenVINO	64 x 64 x 3	2 classes	Fine-tuned for 20 epochs to detect helmet on riders head
Rider Pose Estimator	Yolo V8 Pose	OpenVINO	640 x 640 x 3	640 x 640 x 3	Pre-trained on COCO128-pose
ANPR	Yolo V8	OpenVINO	640 x 640 x 3	640 x 640 x 3	Finetuned in 50 epochs on custom traffic dataset

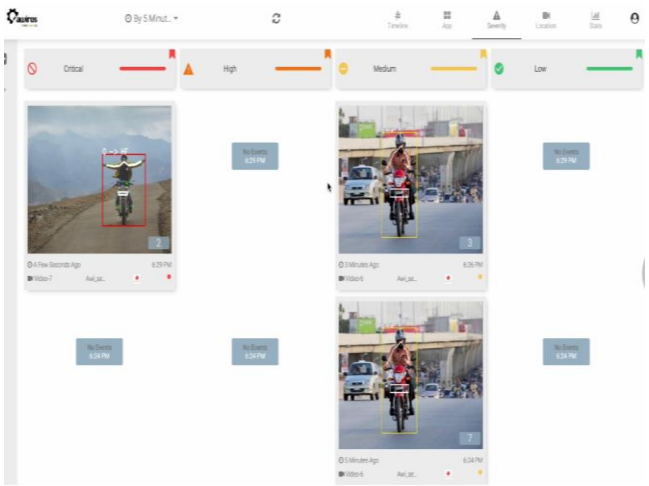
Securos App In Action



Securos in action on live road traffic



Detecting critical safety violations- no helmet, both hands-free



Categorizing CCTV footage into different risk levels depending on vulnerability

Link to the video - https://drive.google.com/file/d/1dcfHOPBleJuvrLrgsjL3Ri-LP-n5s74P/view?usp=sharing

Thank You

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