OUTPUTS
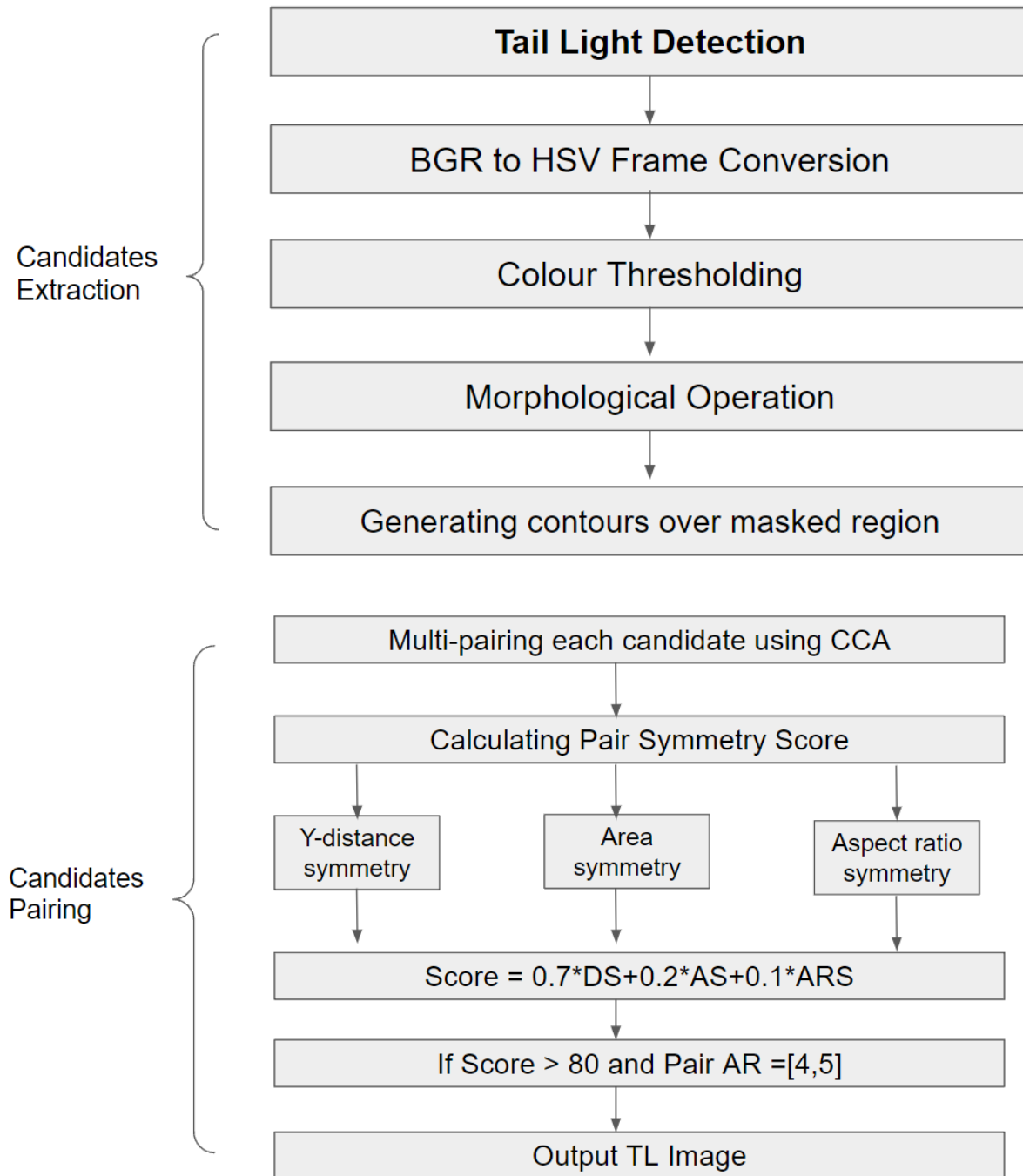
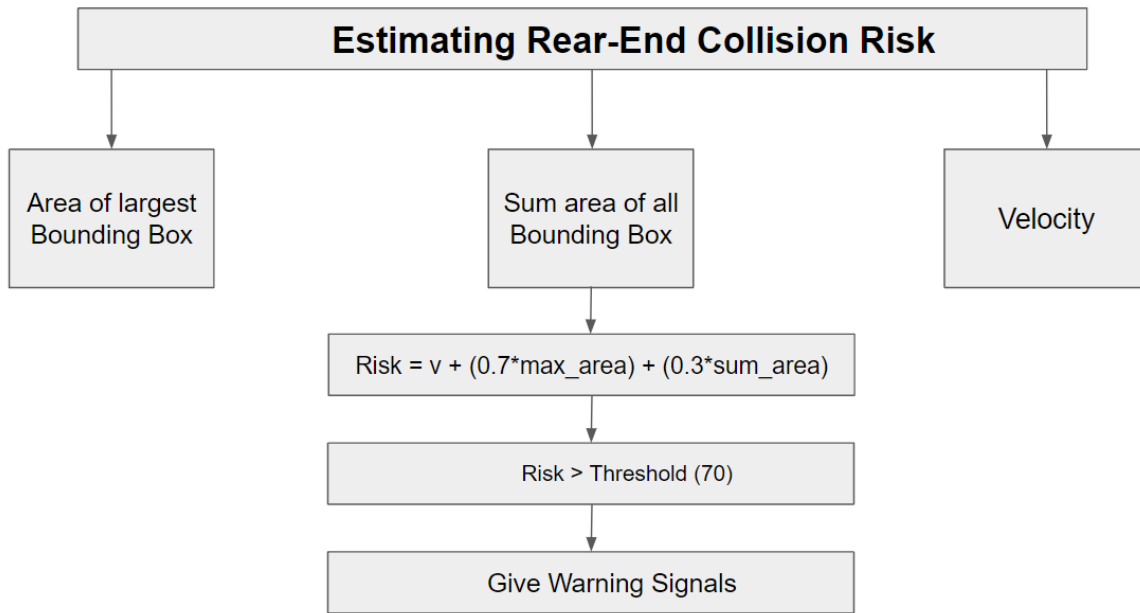## Approach:

1. Extract the taillight region from the image.
2. Taillight sources have a white region in the middle surrounded by red part.
3. Taillight pairing under certain constraints.
4. Estimation of collision risk and predictive brake warning in form of sound and on the display screen.
5. Almost similar procedure for headlight detection. ROI and constraints will change.
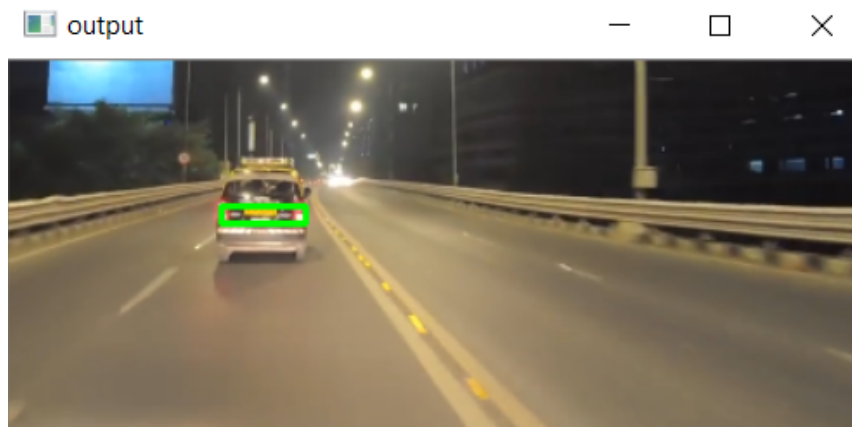
Reference Image:

1. **Block Diagram:**
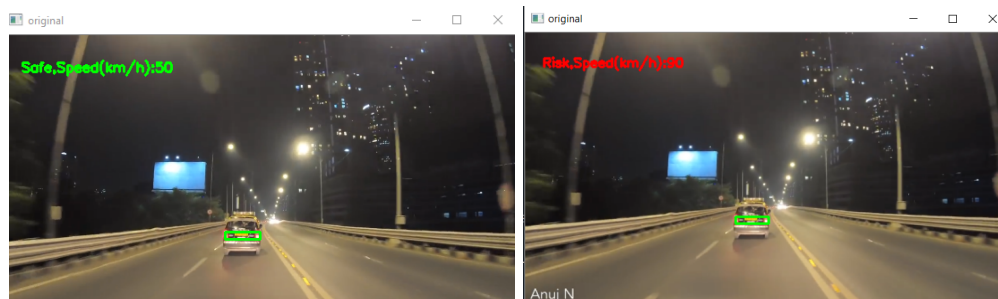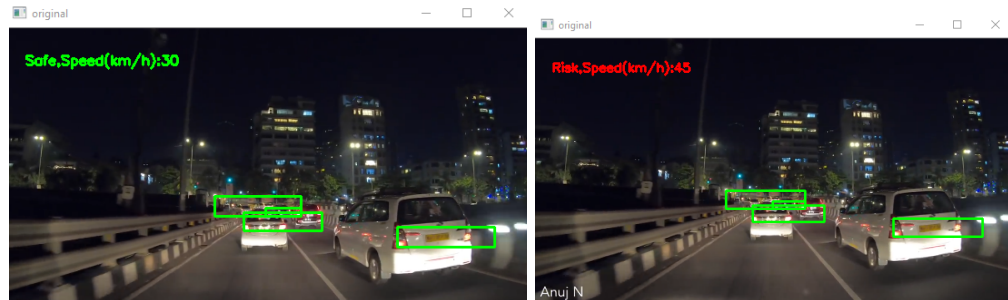
```
                    ┌─────────────────────────────────────┐
                    │        Tail Light Detection         │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │     BGR to HSV Frame Conversion      │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
   Candidates       ┌─────────────────────────────────────┐
   Extraction       │         Colour Thresholding         │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │        Morphological Operation       │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │  Generating contours over masked region │
                    └─────────────────────────────────────┘


                    ┌─────────────────────────────────────┐
                    │   Multi-pairing each candidate using CCA │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │     Calculating Pair Symmetry Score   │
                    └─────────────────────────────────────┘
                         │           │            │
                         ▼           ▼            ▼
   Candidates      ┌──────────┐ ┌──────────┐ ┌──────────────┐
   Pairing         │Y-distance│ │   Area   │ │ Aspect ratio │
                   │ symmetry │ │ symmetry │ │  symmetry    │
                   └──────────┘ └──────────┘ └──────────────┘
                         │           │            │
                         ▼           ▼            ▼
                    ┌─────────────────────────────────────┐
                    │     Score = 0.7*DS+0.2*AS+0.1*ARS     │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │     If Score > 80 and Pair AR =[4,5]  │
                    └─────────────────────────────────────┘
                                     │
                                     ▼
                    ┌─────────────────────────────────────┐
                    │           Output TL Image            │
                    └─────────────────────────────────────┘
```

Estimating Rear-End Collision Risk

- Area of largest Bounding Box
- Sum area of all Bounding Box
- Velocity

Risk = v + (0.7*max_area) + (0.3*sum_area)

Risk > Threshold (70)

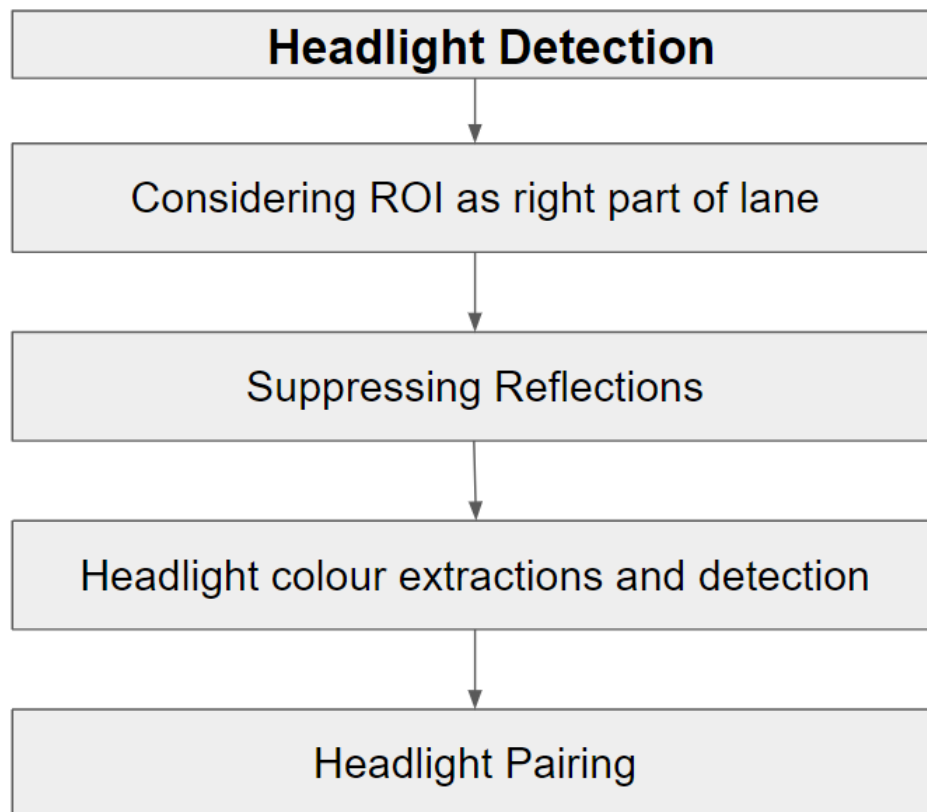Give Warning Signals

Outputs:

1. **Taillight detection**

2. **Collision risk warning**

2. Headlight Detection:

Block Diagram

Headlight Detection

Considering ROI as right part of lane

Suppressing Reflections

Headlight colour extractions and detection

Headlight Pairing

Output: