



VEDA Final Project

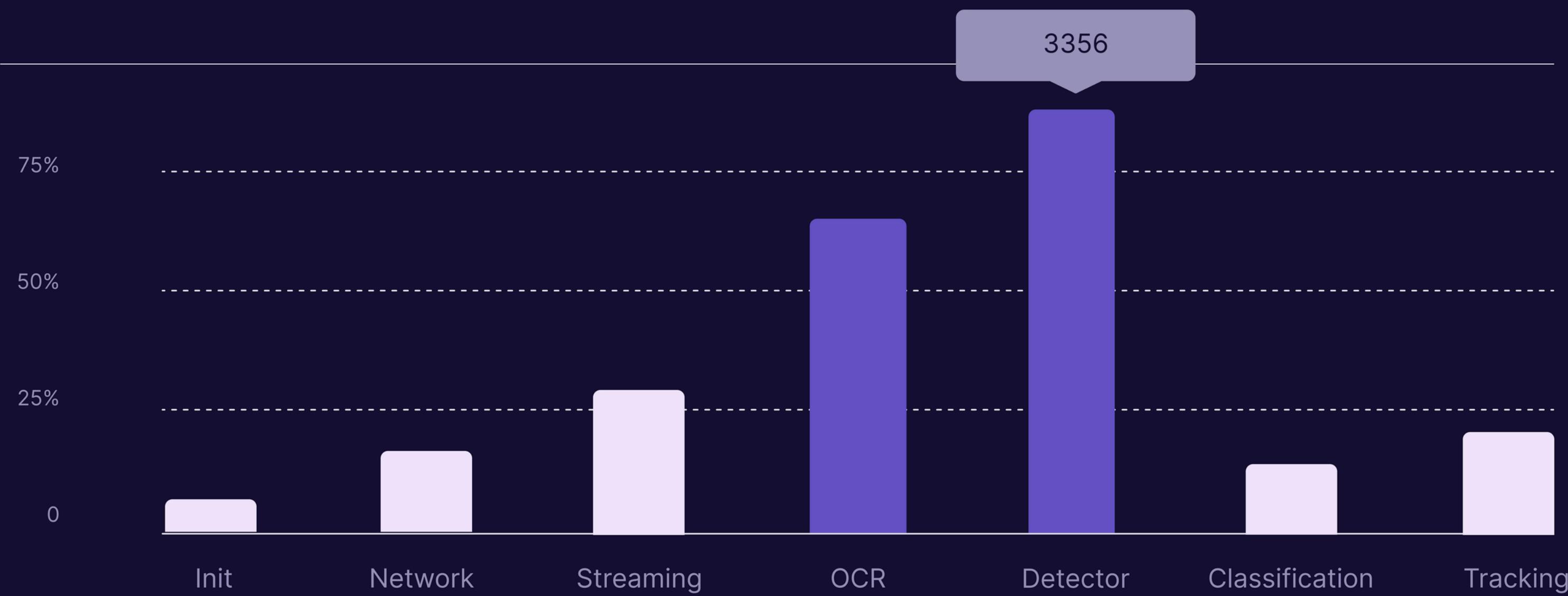
B반 1조
(주)에이치브이테크

김규진 김태훈 김한빈 장윤재 조세기

Optimization

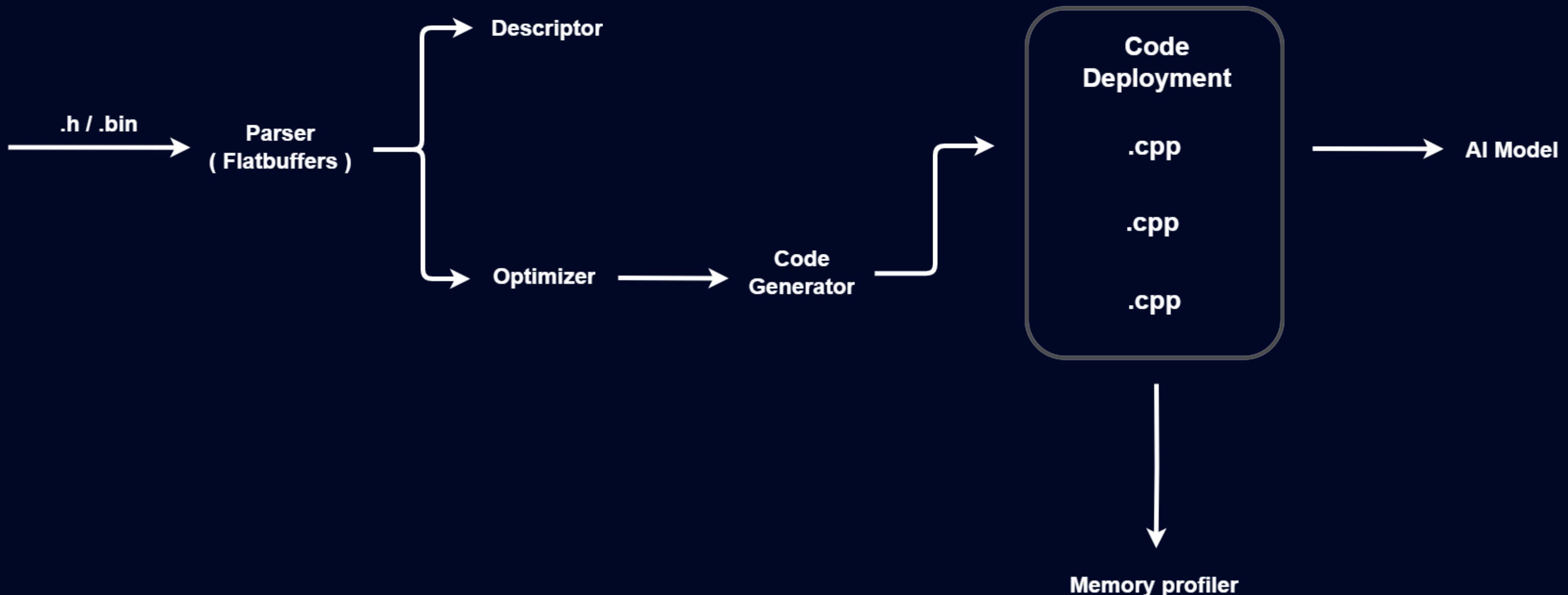
Usage

Raspberry 5 Memory



Optimization

Tiny Engine



Optimization

Tiny Engine

OpenCV (MobileNetV2)

```
Output: 0.795192
VmRSS : 58MB
Execution time : 2169.65 ms
Cpu Usage : 75.25%
CPU monitoring thread has been terminated
```

TinyEngine (MobileNetV2)

```
Inference executed successfully.
Output: 0.795192
VmRSS : 167MB
Execution time : 154.7272 ms
Cpu Usage : 215.09%
CPU monitoring thread has been terminated
```

Optimization

Tiny Engine



Algorithm

CCTV (surveillance + record)



Algorithm

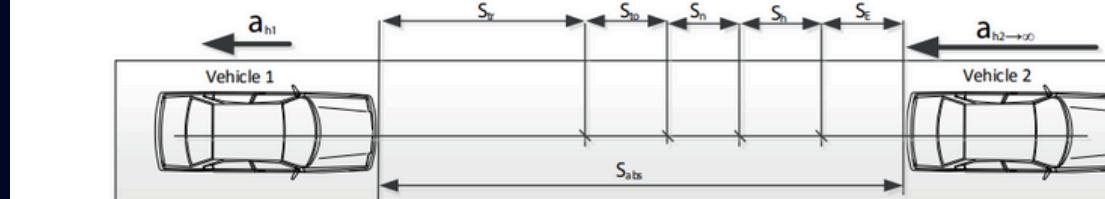
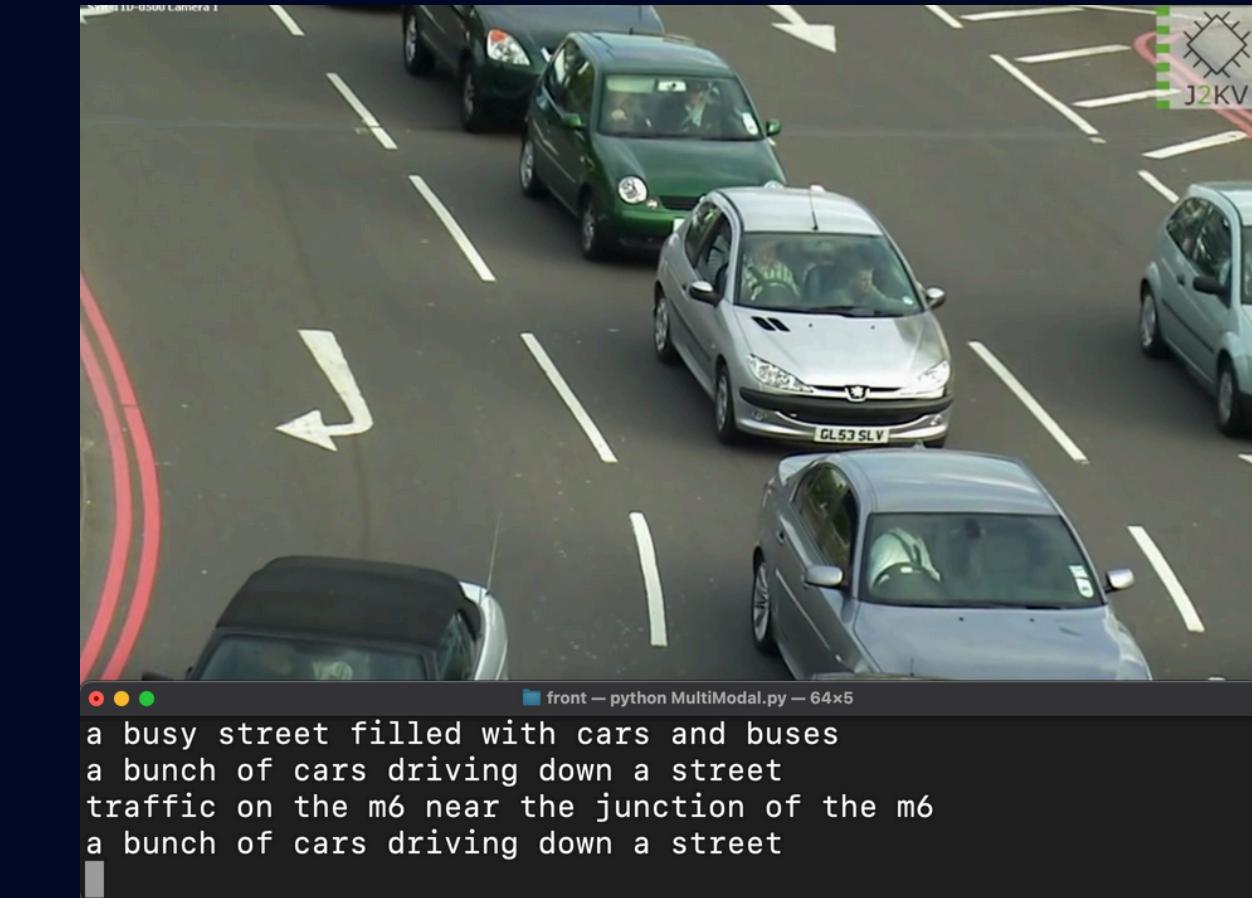
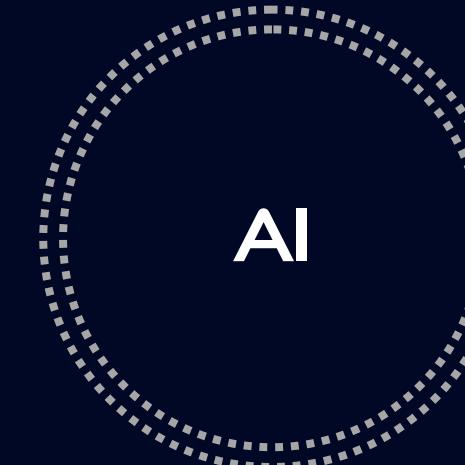


Figure 2 Diagram for determining the absolutely safe distance

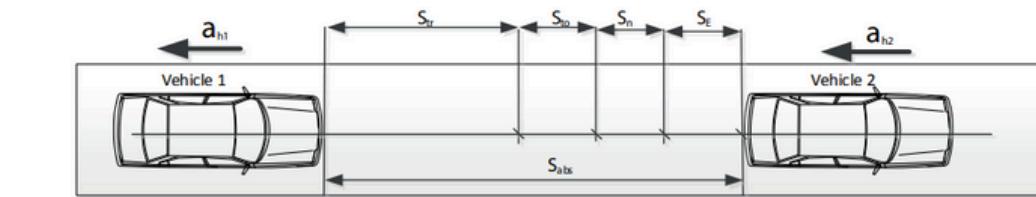


Figure 3 Diagram for determining the relatively safe distance

2 Definitions of the safe distance

The aim of the tests realised in the driving simulator was to determine the behaviour of young drivers in situations of sudden braking by the preceding vehicle. The test was realised on a straight section of the road on a motorway. The test road had two traffic lanes and an emergency lane. The road situation is shown in the diagram in Figure 1. Between these vehicles was a safety distance S .

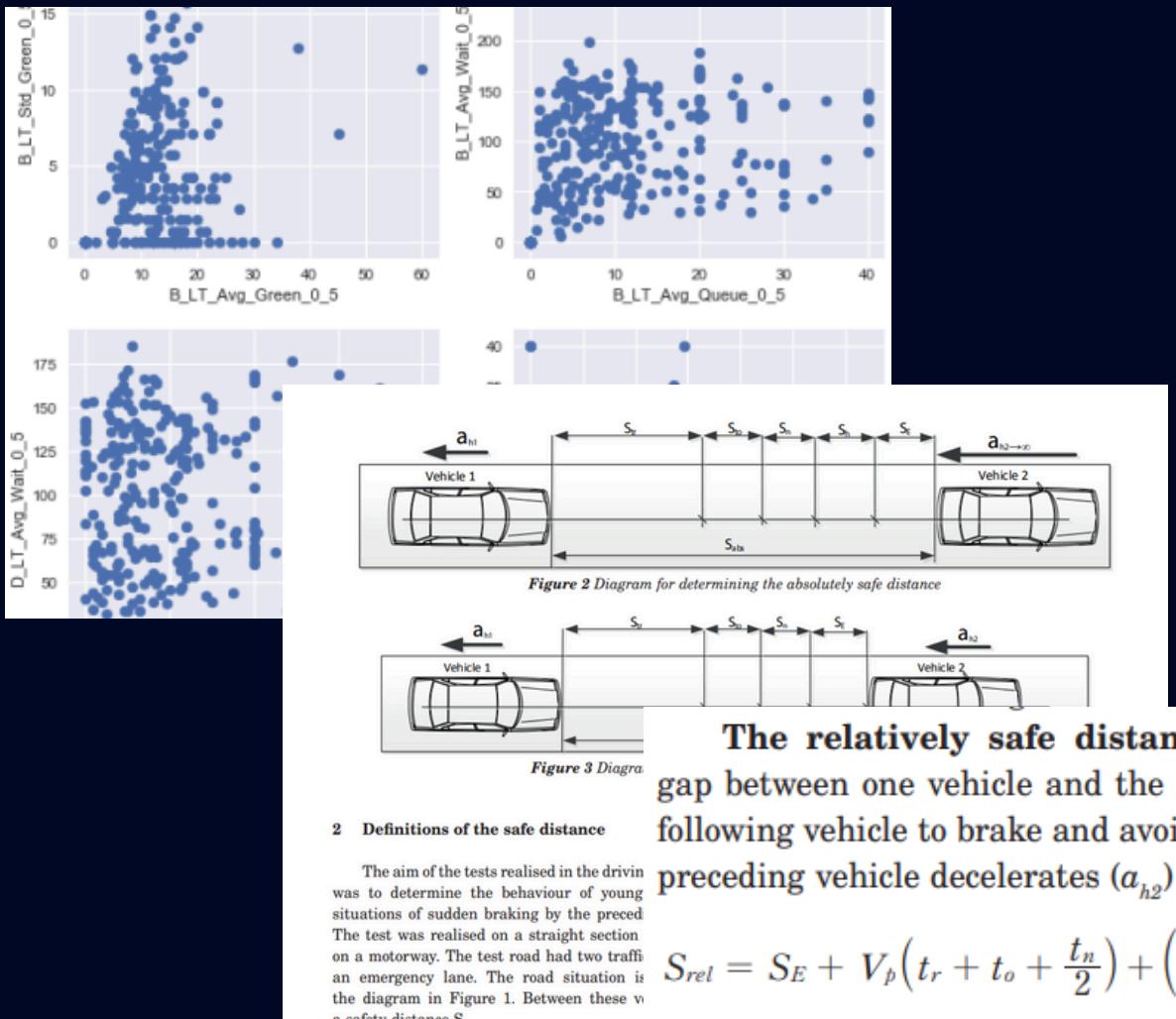
It is possible to determine the absolutely safe distance according to:

$$S_{abs} = S_E + S_{re} + S_{to} + S_n + S_h, \quad (3)$$

where: S_{abs} - absolutely safe distance, S_E - minimum distance between the vehicles when stopped, S_{re} - driver reaction distance, S_{to} - brake activation delay distance, S_n - pressure build-up distance, S_h - braking distance for a value of α .

Algorithm

Parameter



The aim of the tests realised in the driving was to determine the behaviour of young situations of sudden braking by the preceding vehicle. The test was realised on a straight section on a motorway. The test road had two traffic lanes and an emergency lane. The road situation is shown in the diagram in Figure 1. Between these two vehicles there is a safety distance S .

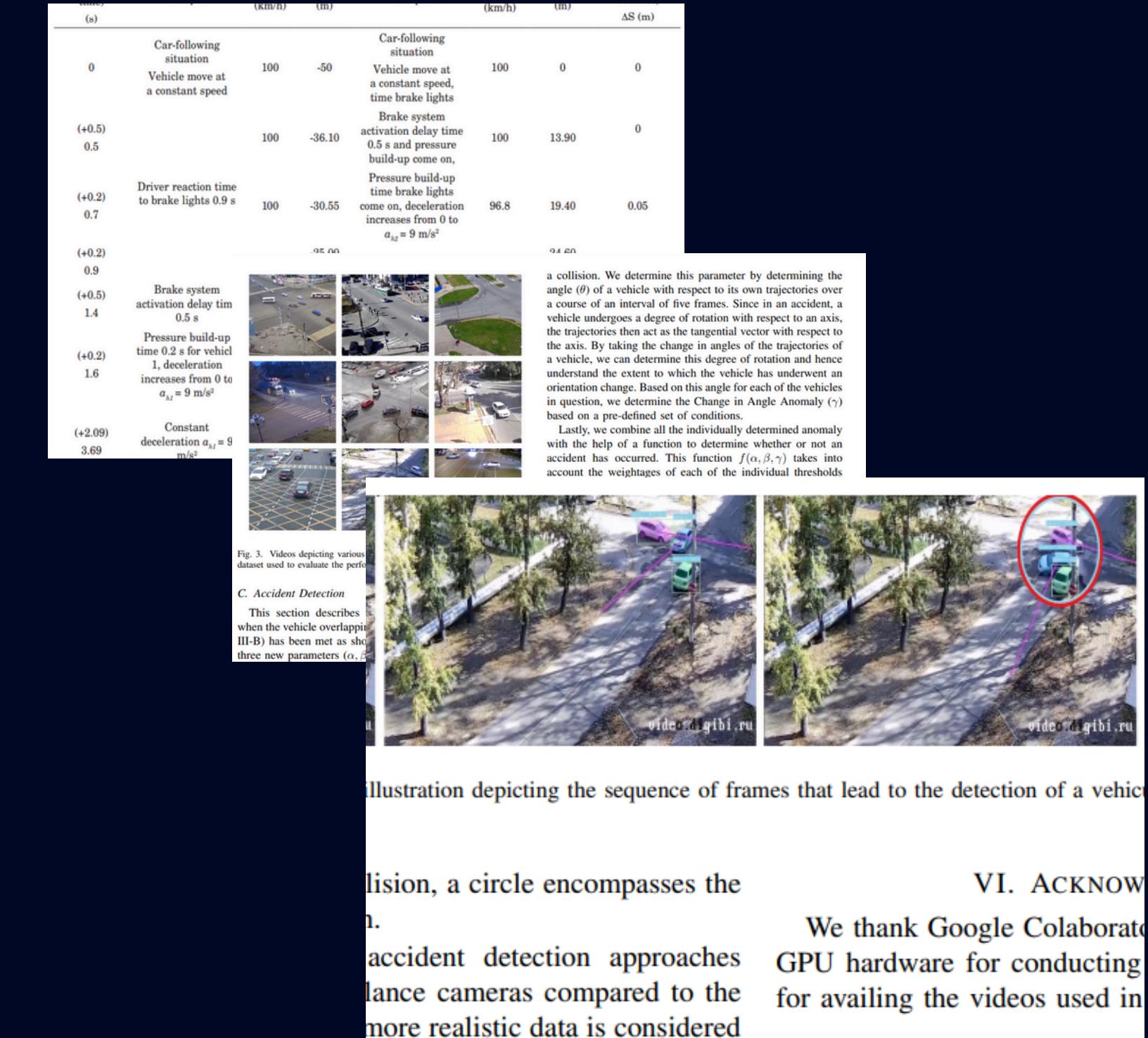
The relatively safe distance is defined as the gap between one vehicle and the next that enables the following vehicle to brake and avoid a collision when the preceding vehicle decelerates (a_{h2}) to stop:

$$S_{rel} = S_E + V_p \left(t_r + t_o + \frac{t_n}{2} \right) + \left(\frac{V_p^2}{2a_{h1}} - \frac{V_p^2}{2a_{h2}} \right), \quad (4)$$

where: V_p - initial driving speeds of vehicles 1 and 2, a_{h1} - deceleration of the following vehicle (Vehicle 1), a_{h2} - deceleration of the preceding vehicle (Vehicle 2).

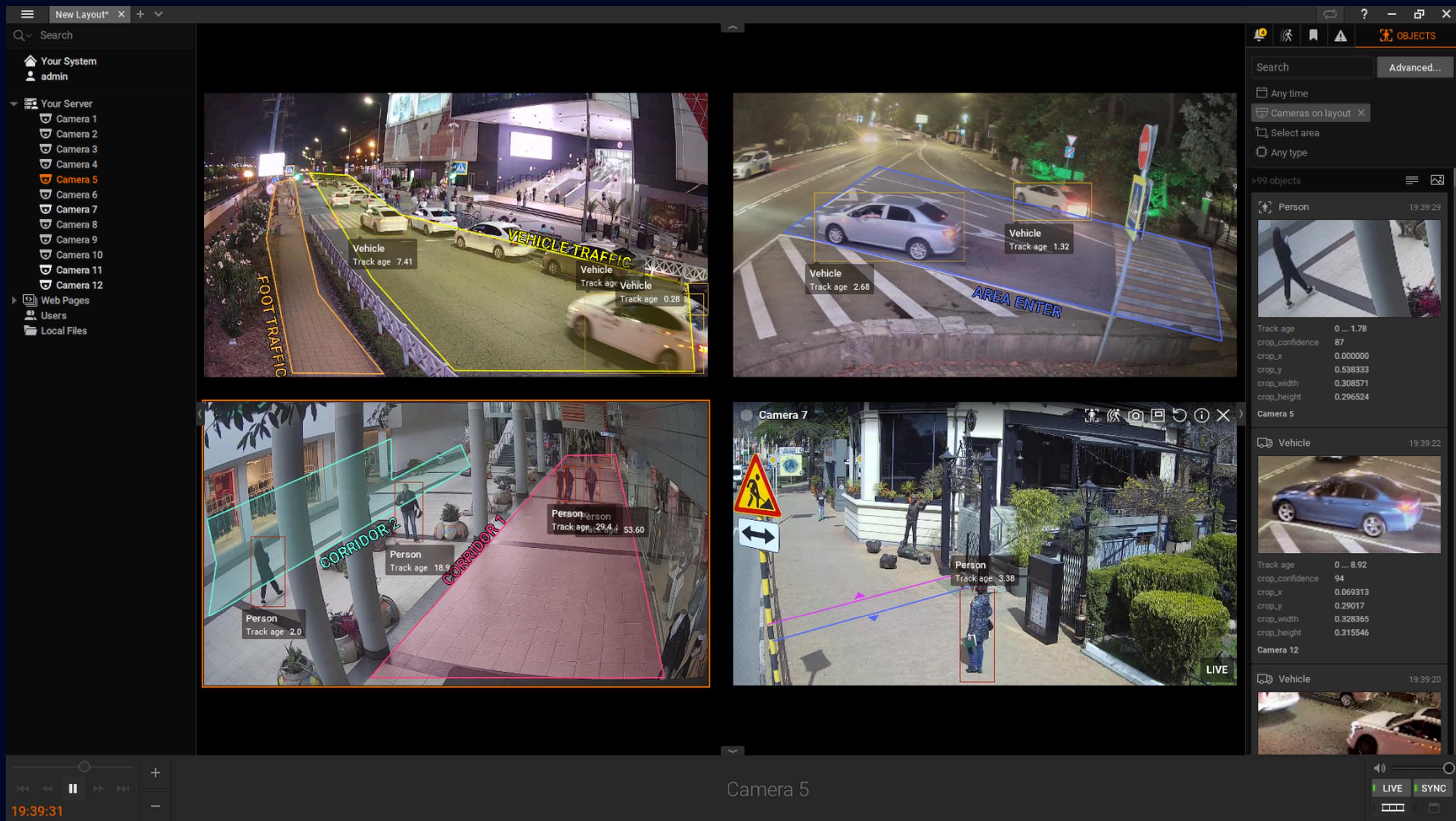
If assumed that the both analysed vehicles can obtain identical deceleration during braking ($a_{h1} = a_{h2}$), one obtains:

$$S_{rel} = S_E + V_p \left(t_r + t_o + \frac{t_n}{2} \right) = S_E + V_p T_R. \quad (5)$$

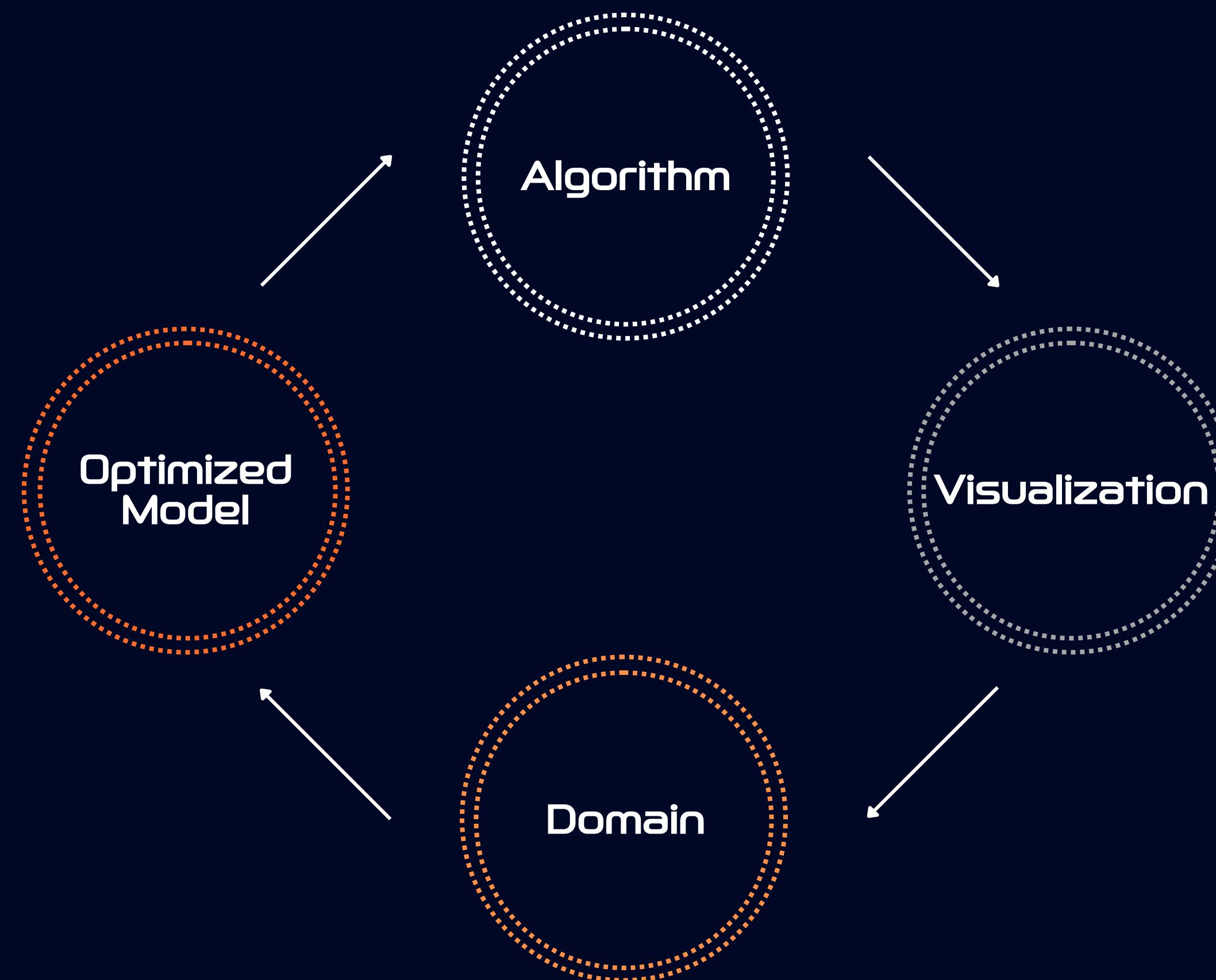


Visualization

VMS



Target





Traffic Monitoring System

Contents



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Features
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Development
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4

Q&A

How to operate

Video



SVE-110-4500 Camera 1

Cost : 4.321345
Cluster : 1
Node : 3

14

1

18

1

J2KV

13

Image Name: image_001
Class: car
OCR: CL535V
TimeStamp: 2024-12-13T09:36:00

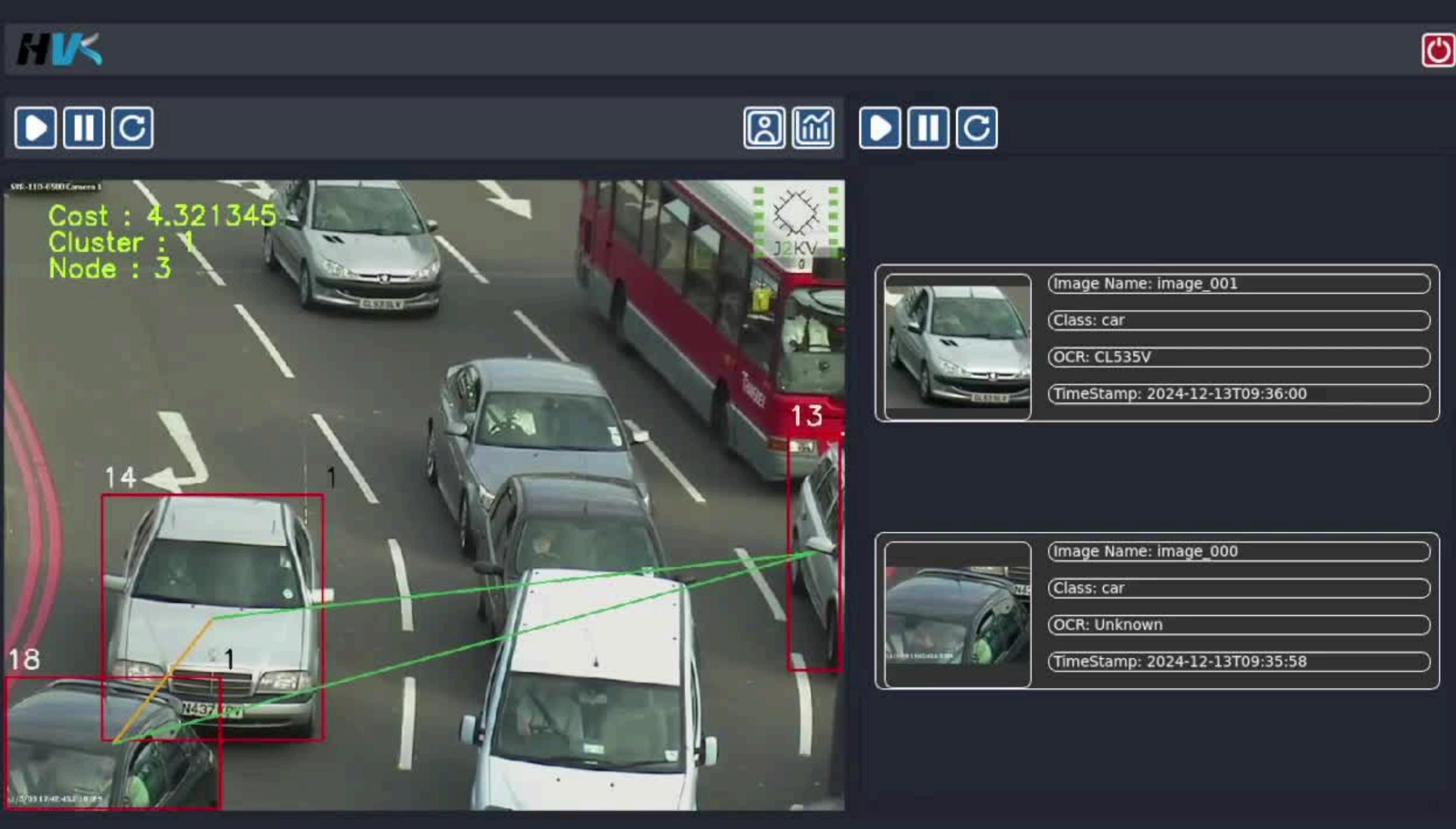
Image Name: image_000
Class: car
OCR: Unknown
TimeStamp: 2024-12-13T09:35:58

HK

Power icon

Control icons: play, pause, stop, zoom, etc.

Annotations: Red boxes highlight specific cars (e.g., white van, silver car). Green lines and numbers (1, 13, 14) indicate tracking paths or cluster assignments. A yellow box highlights a license plate area. A red timestamp at the bottom left shows 1/03 17:42:45.7 10/15.



01 Features Overview

주요 기능



Best Shot

The screenshot shows a live video feed from a camera labeled "SVR-11D-0500 Camera 1". Several cars are visible on the road. Four specific cars are highlighted with red boxes and numbered 101, 2, 98, and 2. To the right of the video feed, there are four detailed analysis windows for these cars:

- Car 101:** Image Name: image_040, Class: car, OCR: R35.PK, TimeStamp: 2024-12-13T11:20:35
- Car 2:** Image Name: image_045, Class: car, OCR: LBOGACO, TimeStamp: 2024-12-13T11:20:34
- Car 98:** Image Name: image_044, Class: car, OCR: Unknown, TimeStamp: 2024-12-13T11:20:34
- Car 2:** Image Name: image_043, Class: car, OCR: AUX, TimeStamp: 2024-12-13T11:20:32



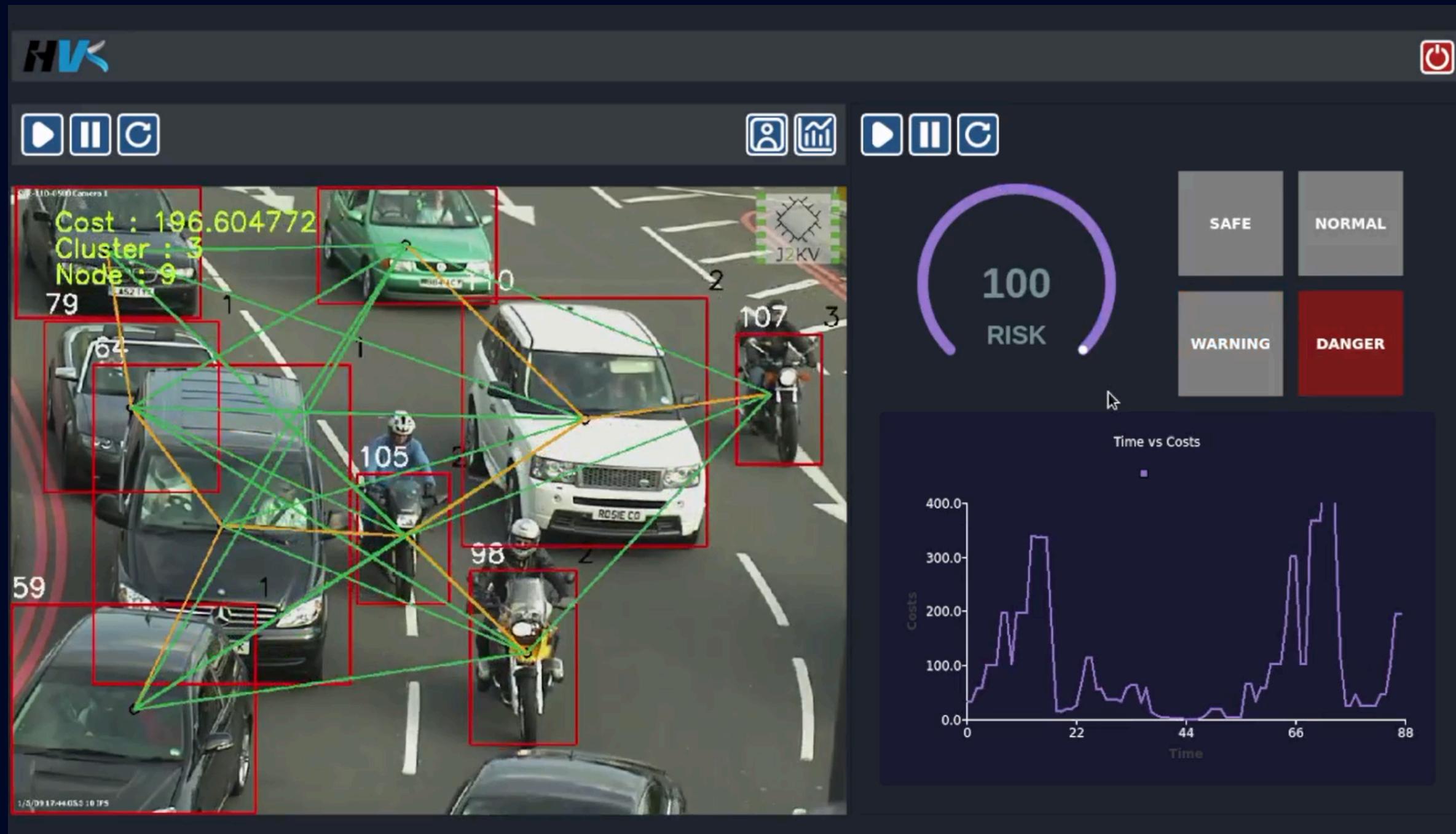
Class	Car
OCR	LB06AC0
TimeStamp	11:20:34

01 Features Overview

주요 기능



Risk Analysis



RISK LEVEL
&
GRAPH

01 Features Overview

주요 기능



HW Profiling

```
Total CPU Usage: 100.00%
Process "server" (PID: 10019)
CPU Usage: 400.00%, RES Memory Usage: 2.00MB
CPU Temperature: 73.80° C
CPU Clock Speed: 2.40 GHz
Fan RPM: 5921RPM
Humidity = 35.0%      Temperature = 24.2° C
Angle X=-2.88° Angle Y=0.08° Angle Z=2.88°
400,2,73.8,2.4,59,35.0,24.2,-2.88373,0.0800698,2.88484
```

```
Total CPU Usage: 100.00%
Process "server" (PID: 10019)
CPU Usage: 397.69%, RES Memory Usage: 2.00MB
CPU Temperature: 74.90° C
CPU Clock Speed: 2.40 GHz
Fan RPM: 5912RPM
Humidity = 35.0%      Temperature = 24.3° C
Angle X=-3.04° Angle Y=-0.70° Angle Z=3.12°
397.688,2,74.9,2.4,59,35.0,24.3,-3.04,-0.696079,3.11882
```

자동 스크롤

새 출

9600 보드레이트

CPU

&

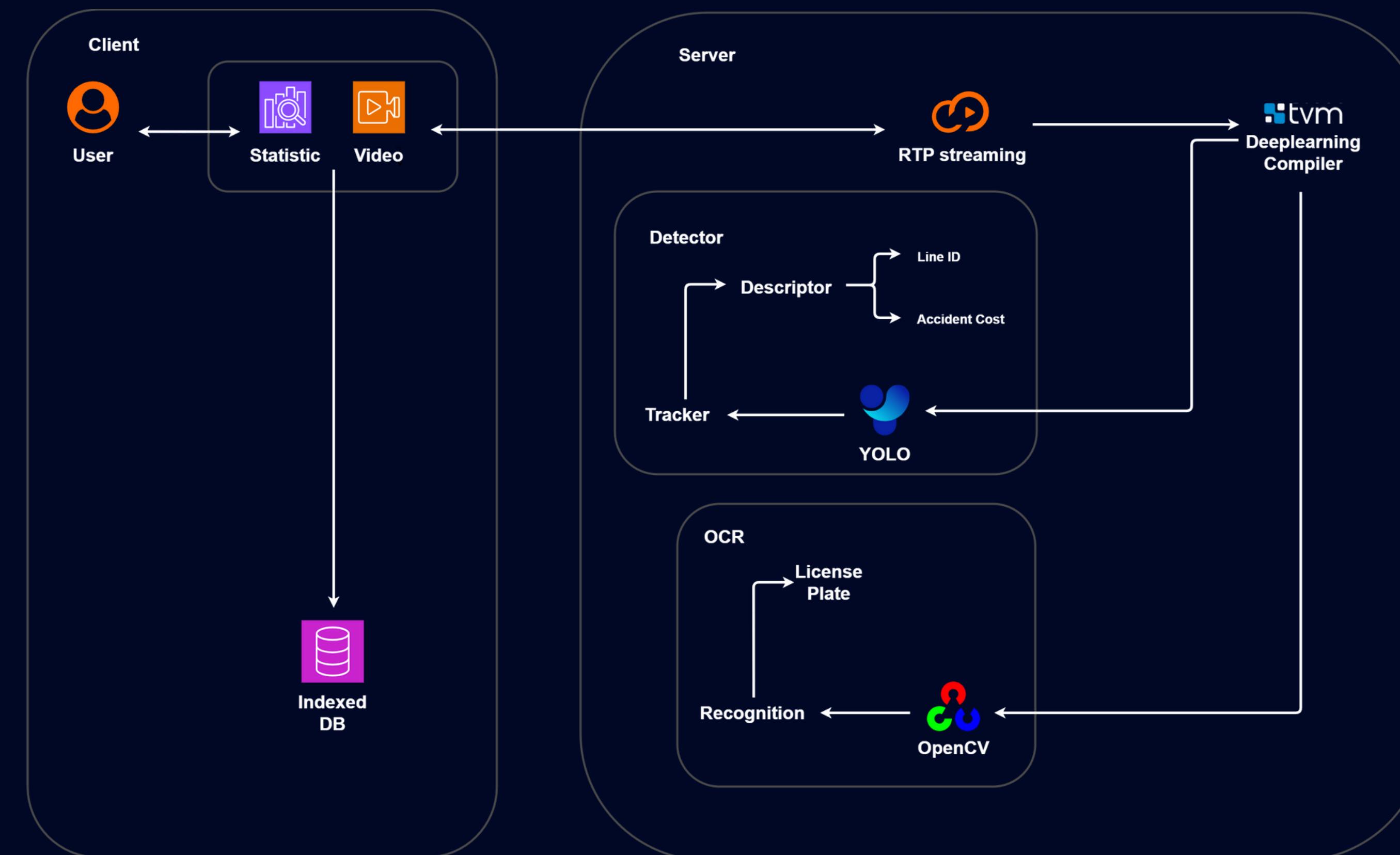
Memory

&

Environment

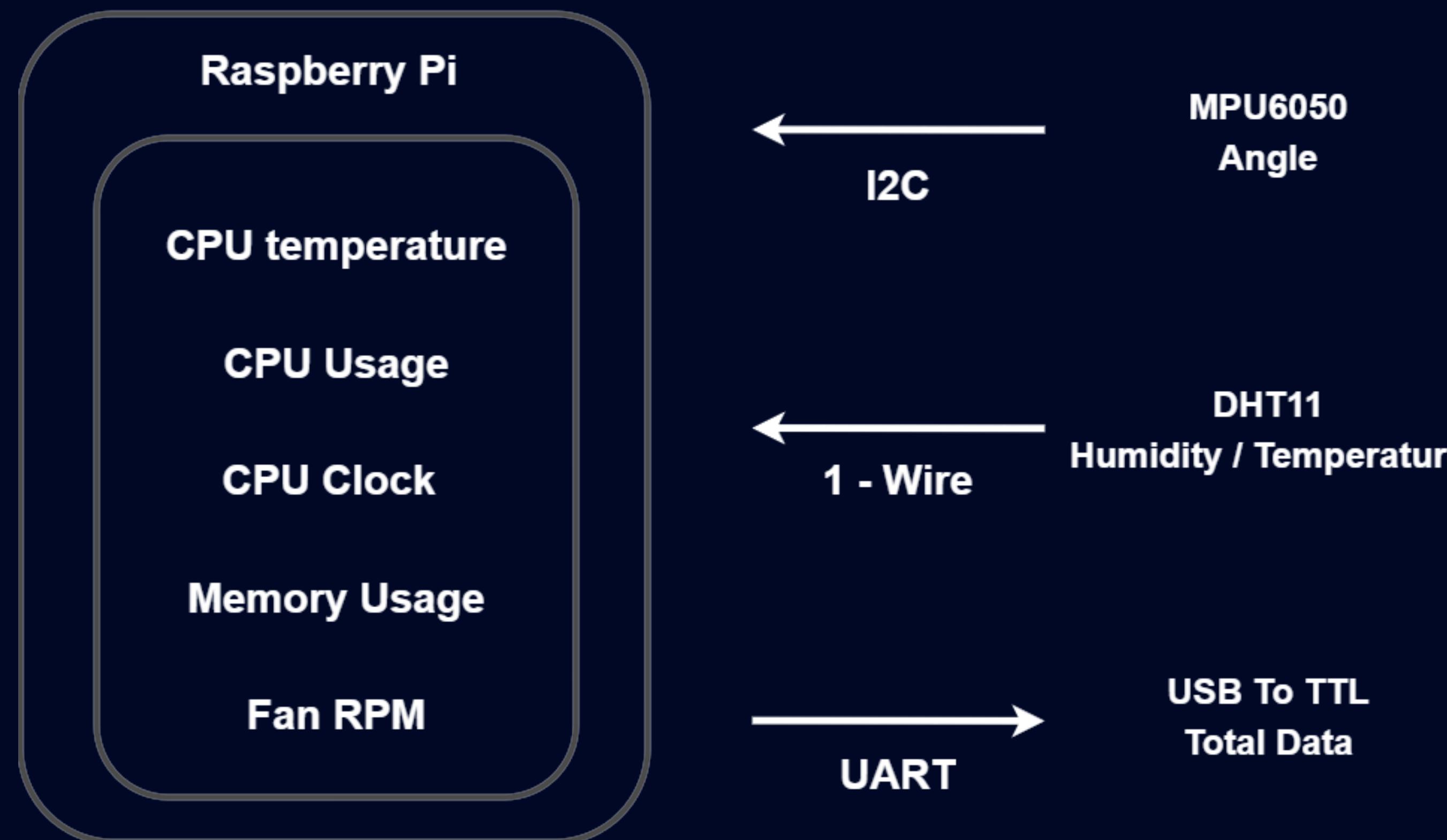
02 Development Process

시스템 구성 - Work Flow



02 Development Process

시스템 구성 - HW profiling



02 Development Process

영상 분석

Tracking

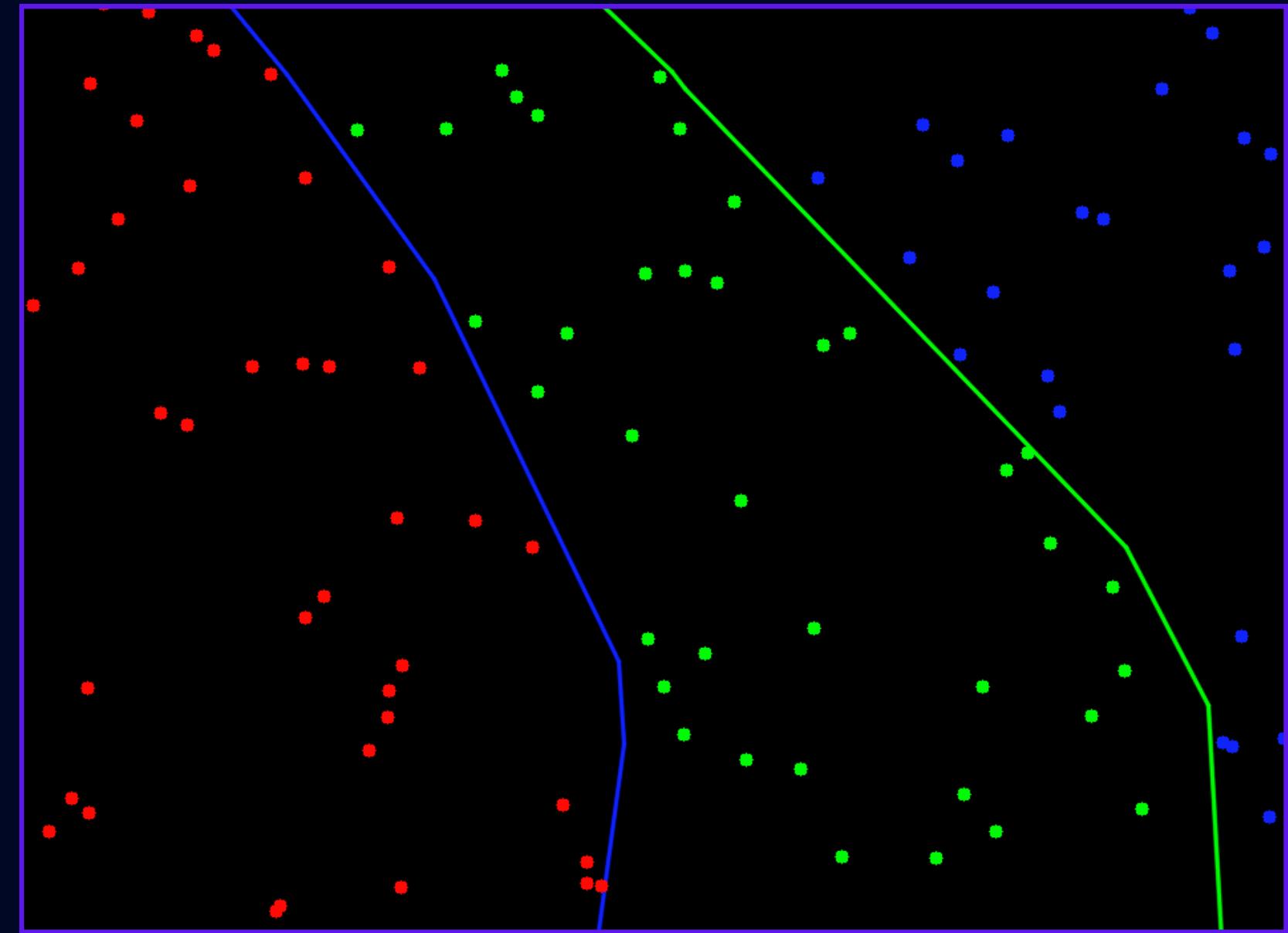


02 Development Process

영상 분석



Line Cross

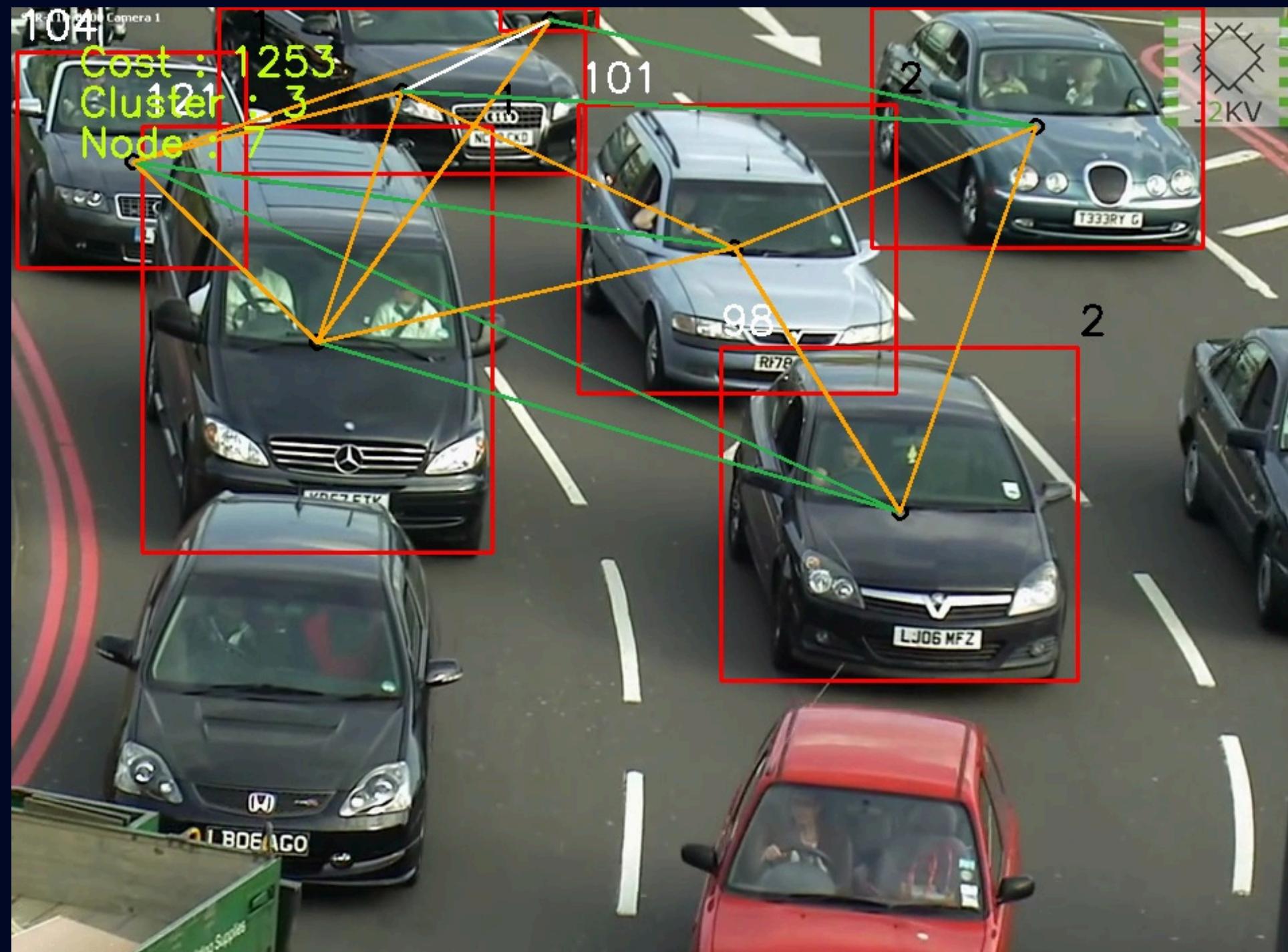


02 Development Process

데이터 분석



Sampling



Parameter

Node (Vehicle)

Parameter

Vehicle Coordinate

Distance

Parameter

Distance between Vehicle.

Cluster

Parameter

Clusters of vehicles



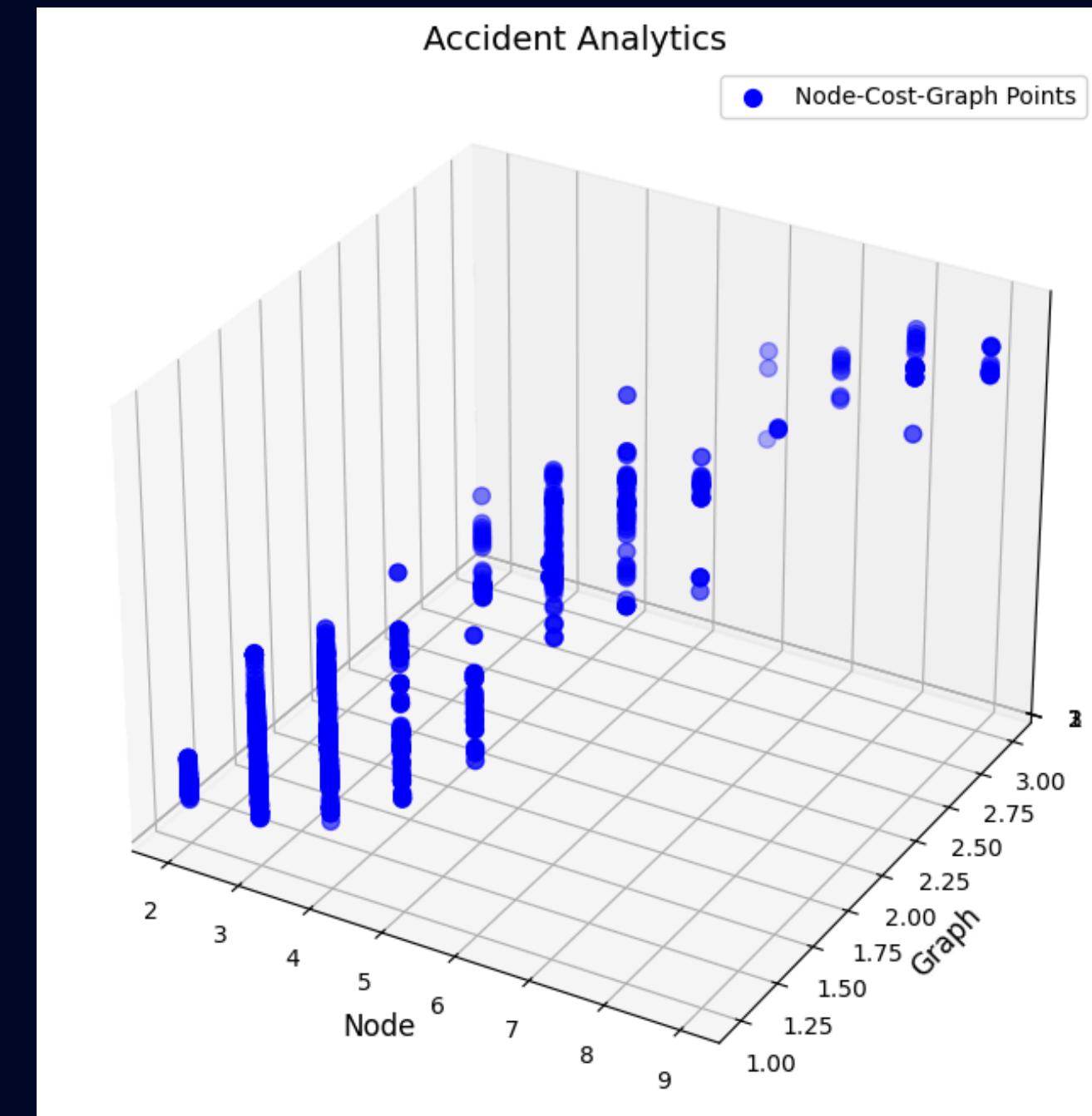
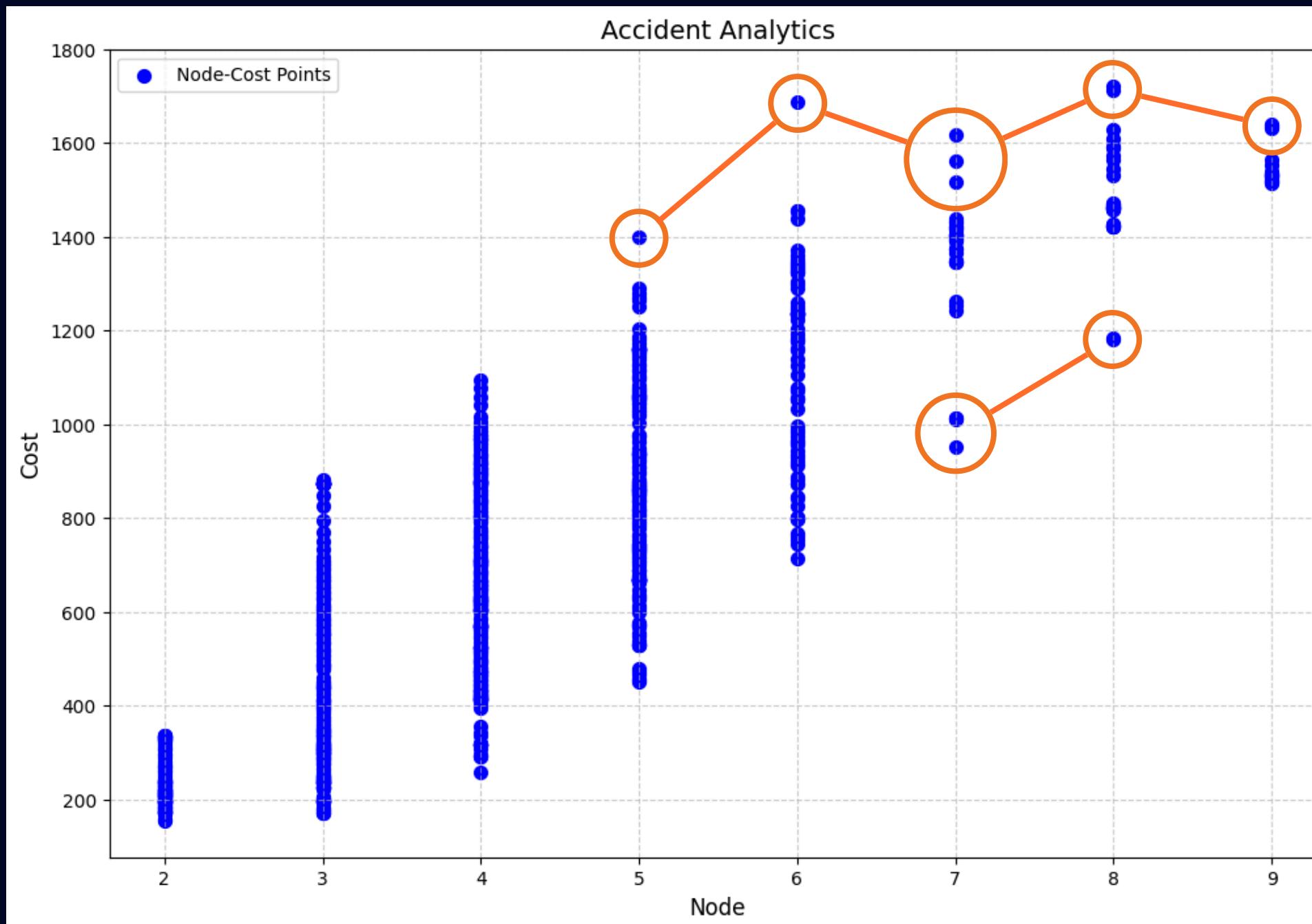
Risk

Parameter

Risk of vehicle clusters

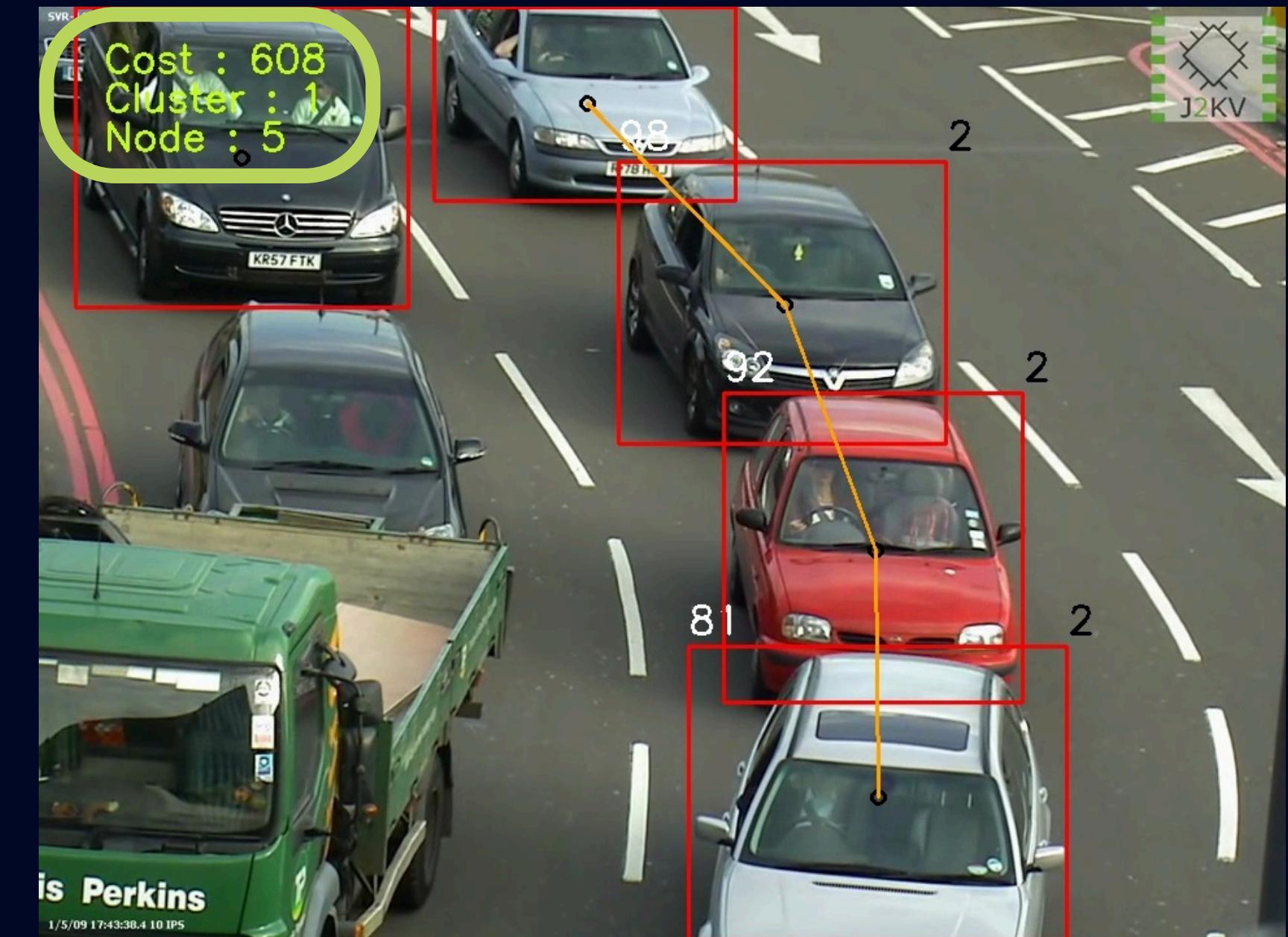
02 Development Process

데이터 분석 - Before



02 Development Process

데이터 분석 - Before



02 Development Process

데이터 분석 - Processing



Data Labeling

index	cost	graph	node	risk	C(1/cost * node * 100000)	G_final (0.5*e^n * log(graph+1))	res_final
820	1515	3	9	1	594.0594059	2439.27132	199.8654685
822	1516	3	9	1	593.6675462	2439.27132	199.8497294
823	1517	3	9	1	593.276203	2439.27132	199.8339994
821	1519	3	9	1	592.4950625	2439.27132	199.8025668
819	1522	3	9	1	591.3272011	2439.27132	199.7554862
816	1527	3	9	1	589.3909627	2439.27132	199.6771998
827	1528	3	9	1	589.0052356	2439.27132	199.6615697
830	1530	3	9	1	588.2352941	2439.27132	199.6303363
828	1531	3	9	1	587.8510777	2439.27132	199.6147331
829	1533	3	9	1	587.0841487	2439.27132	199.5835535
831	1533	3	9	1	587.0841487	2439.27132	199.5835535
832	1534	3	9	1	586.7014342	2439.27132	199.5679772
839	1539	3	9	1	584.7953216	2439.27132	199.4902293
840	1552	3	9	1	579.8969072	2439.27132	199.2891205
841	1564	3	9	1	575.4475703	2439.27132	199.104793
811	1633	3	9	0	551.1328843	2439.27132	198.0684324
812	1634	3	9	0	550.7955936	2439.27132	198.0536978
810	1636	3	9	0	550.1222494	2439.27132	198.0242523
809	1640	3	9	0	548.7804878	2439.27132	197.9654561
842	1181	3	8	1	677.3920406	897.3577699	117.6395013
843	1183	3	8	0	676.2468301	897.3577699	117.6170774
804	1423	3	8	1	562.1925509	897.3577699	115.1429002
805	1423	3	8	1	562.1925509	897.3577699	115.1429002
806	1423	3	8	1	562.1925509	897.3577699	115.1429002
807	1423	3	8	1	562.1925509	897.3577699	115.1429002
803	1424	3	8	1	561.7977528	897.3577699	115.133389
808	1424	3	8	1	561.7977528	897.3577699	115.133389
800	1427	3	8	1	560.6166783	897.3577699	115.1048909

Algorithm

가중치 기반 데이터 랭킹 산출 방법

$$K = (V, E) \quad K = \text{graph_cnt} \quad V = \text{node_cnt} \quad E = \text{edge_cnt} \quad w = \text{distance}$$

```
foreach(from, to, w) in E'_i
if(Find(from) ≠ Find(to)) { MSF ← MST + (from, to, w) }
```

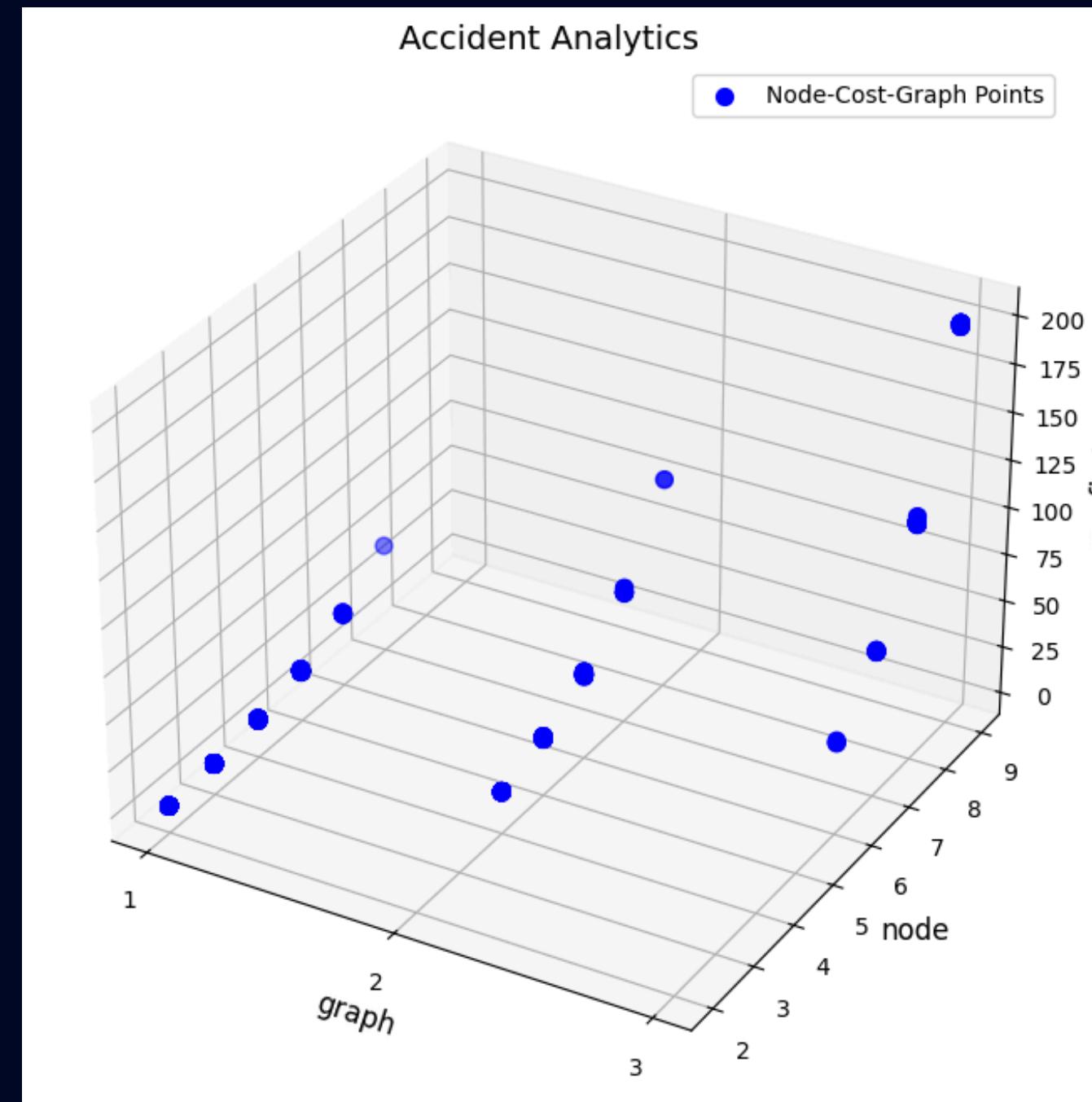
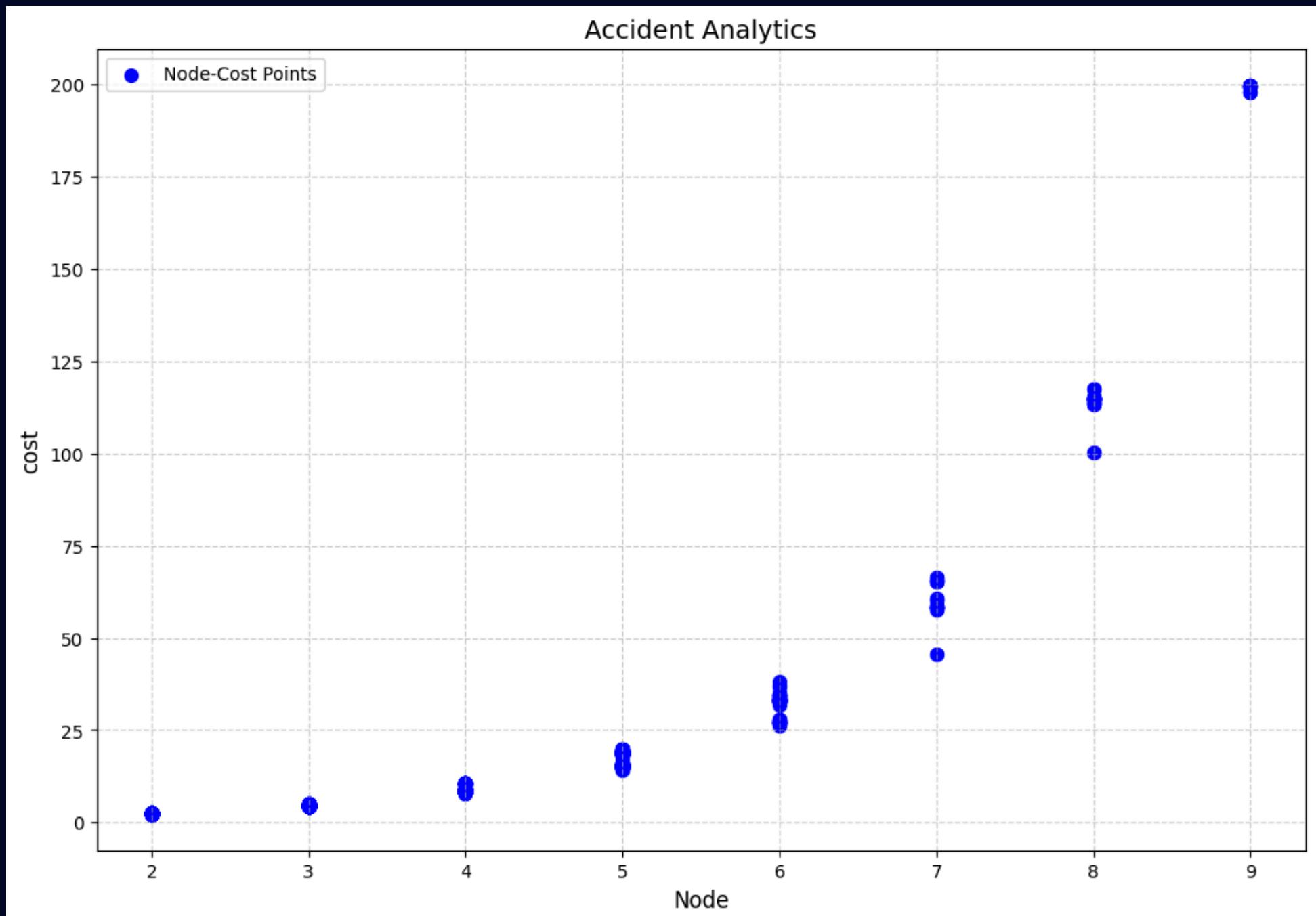
$$C_{\text{Correction Value}} = \frac{1}{cost} \times 100000$$

$$G_{\text{Correction weight}} = 0.5 \times \log(K + 1) \times \exp(V)$$

$$R_{\text{RiskValue}} = \sqrt{\log(\frac{1}{cost} \times 100000) \times \frac{\log(K + 1)}{2} \times \exp(V)}$$

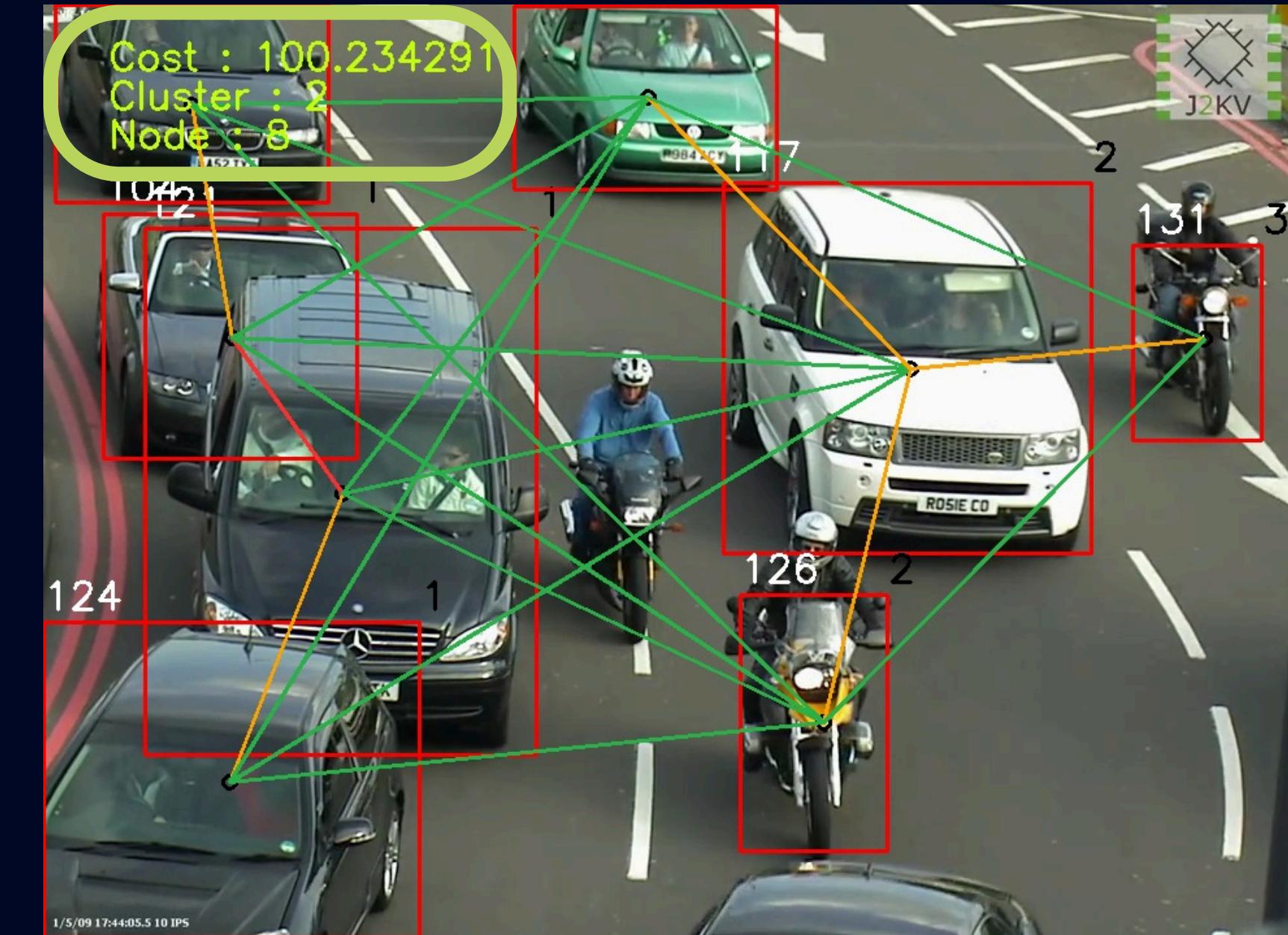
02 Development Process

데이터 분석 - After



02 Development Process

데이터 분석 - After

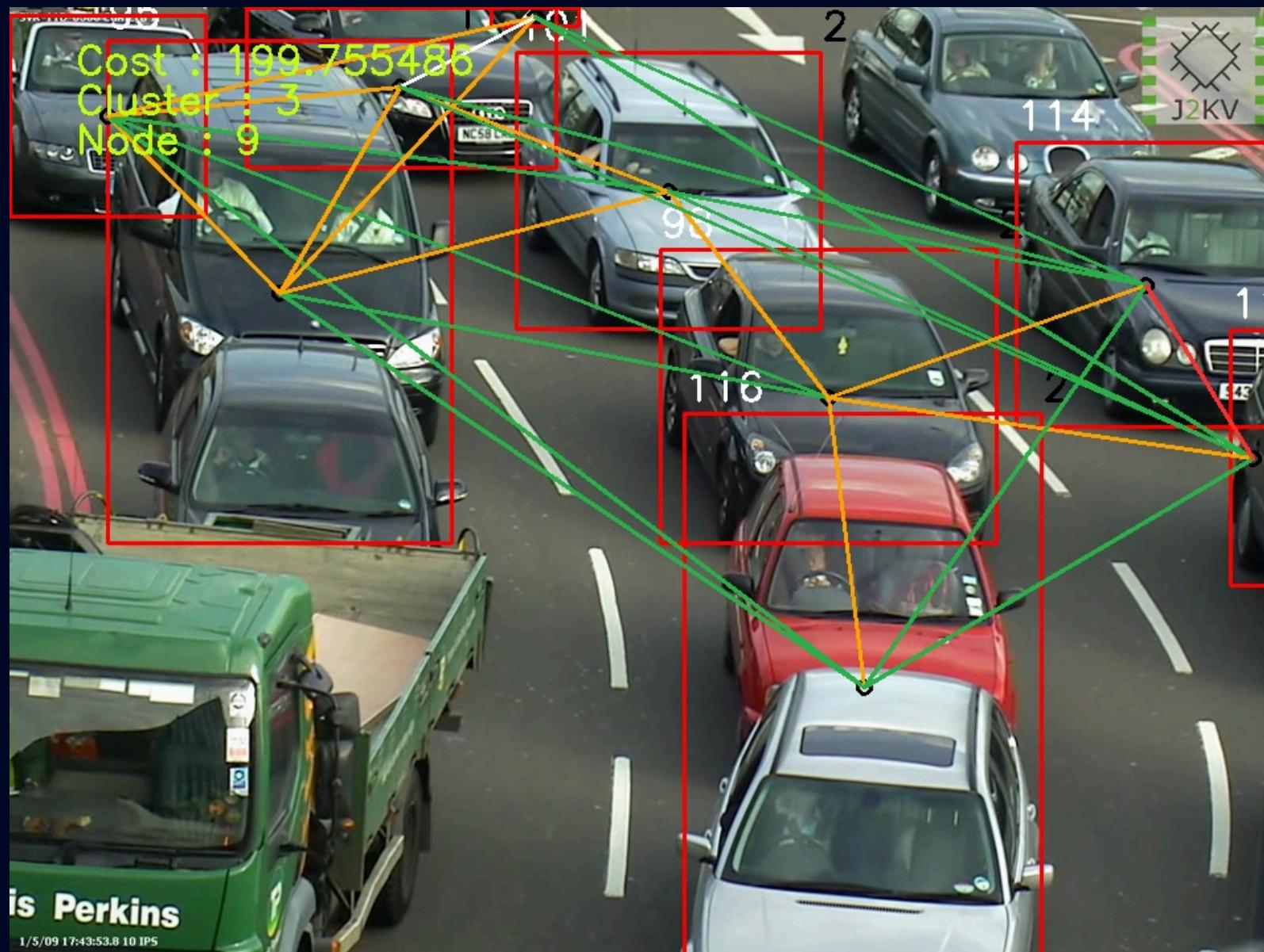


02 Development Process

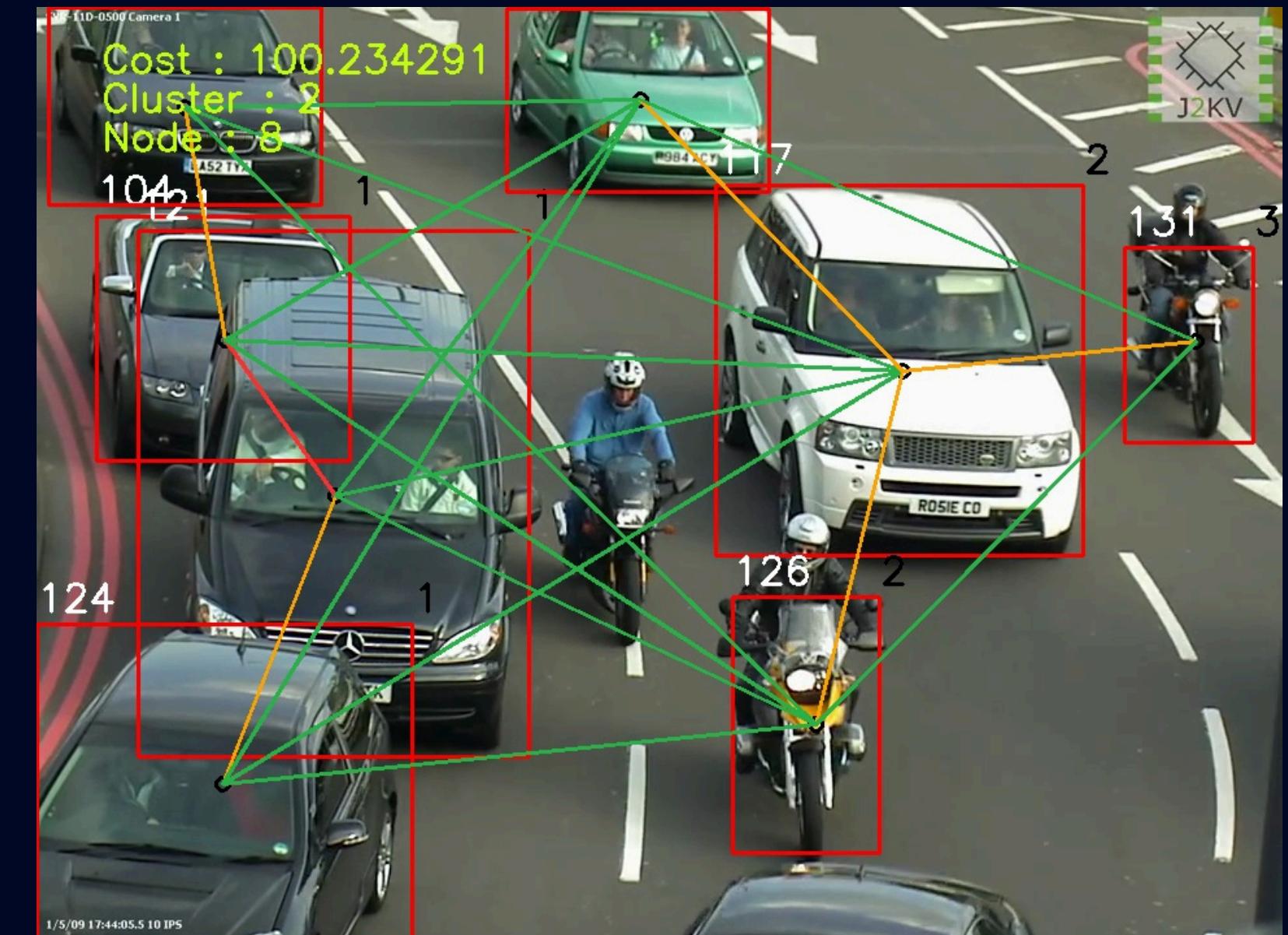
데이터 분석 - After



DANGER 0 - 4%
cost : 101 ~ 200



Warning 4 - 32%
cost : 20 ~ 100

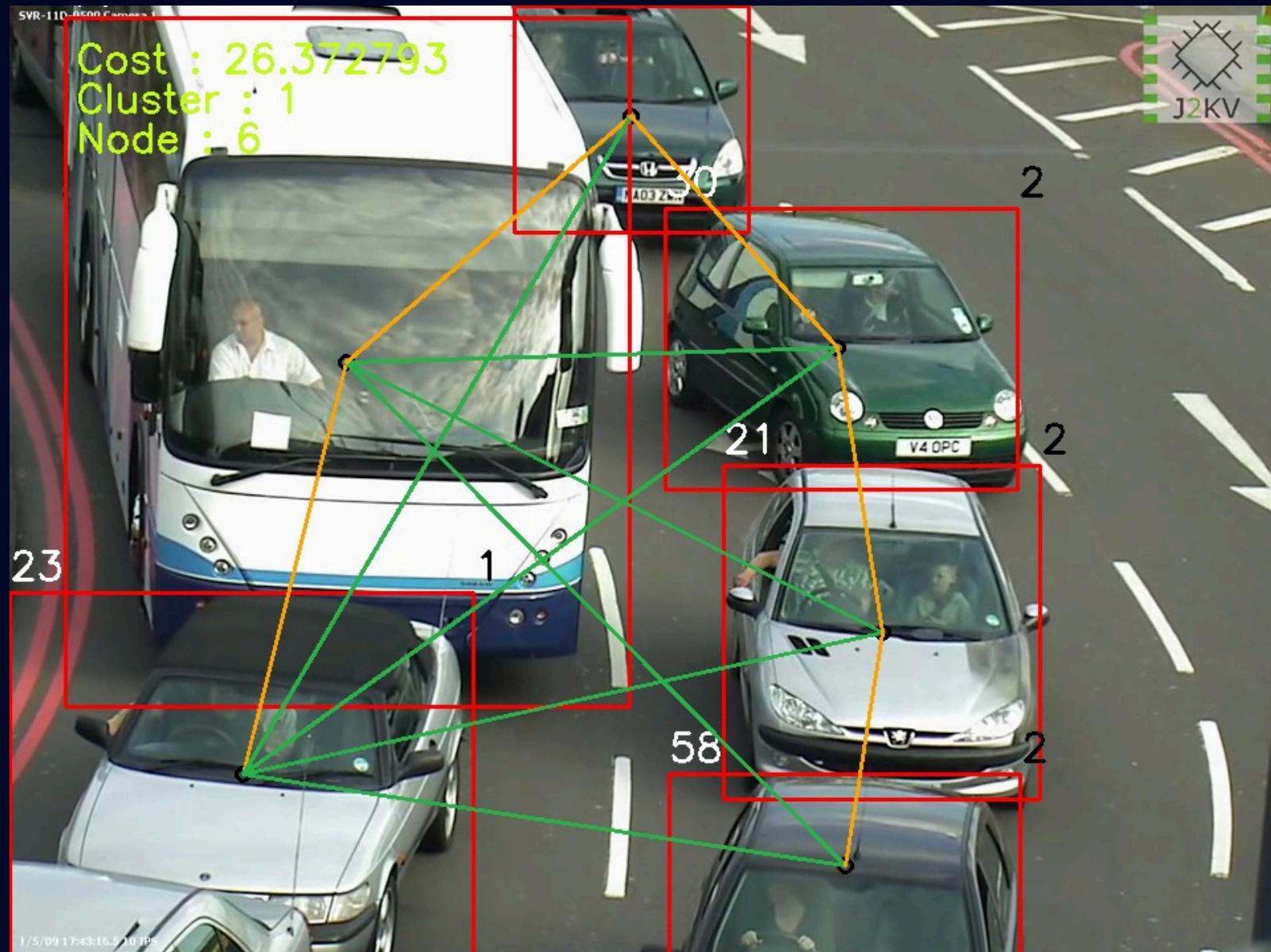


02 Development Process

데이터 분석 - After



Normal 32 ~ 60%
cost : 8 ~ 19



Safe 60 ~ 100%
cost : 0 ~ 7

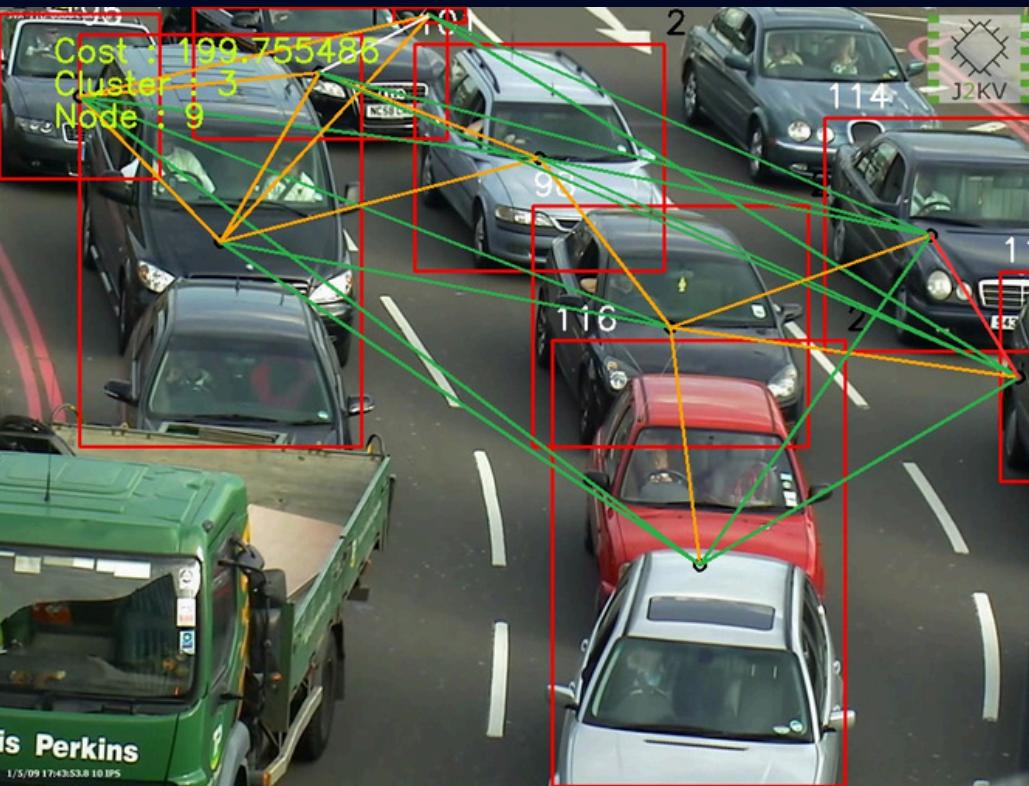


02 Development Process

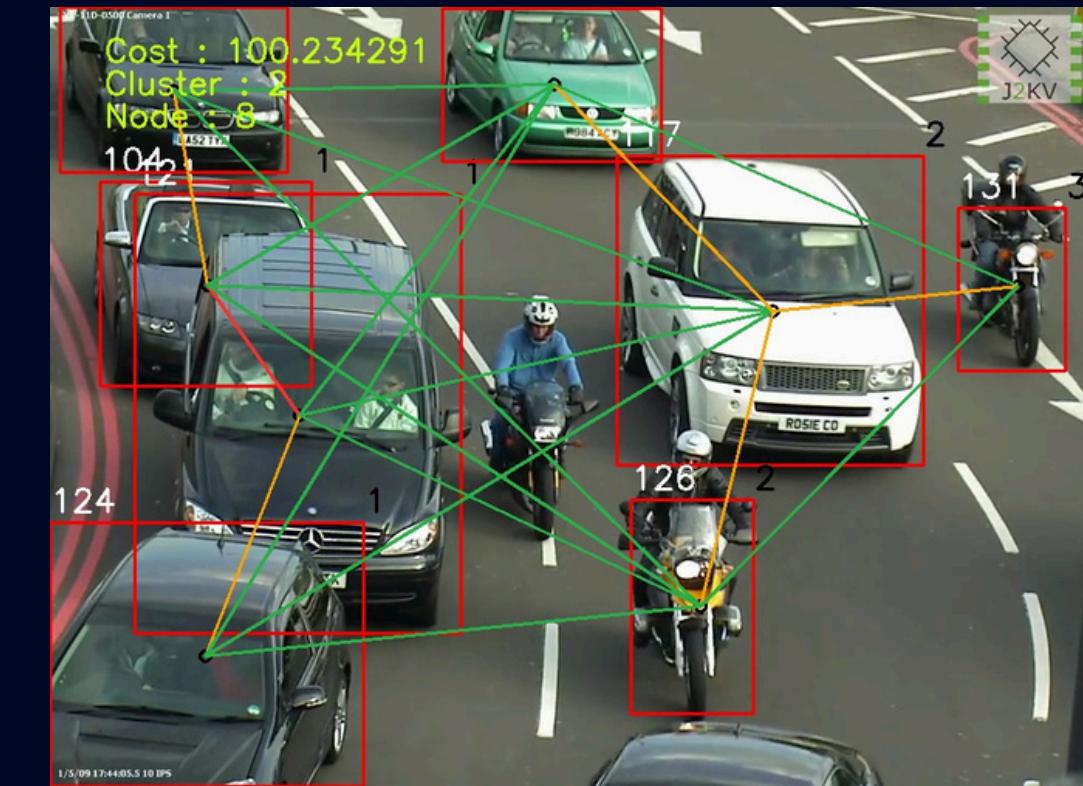
데이터 분석 - After



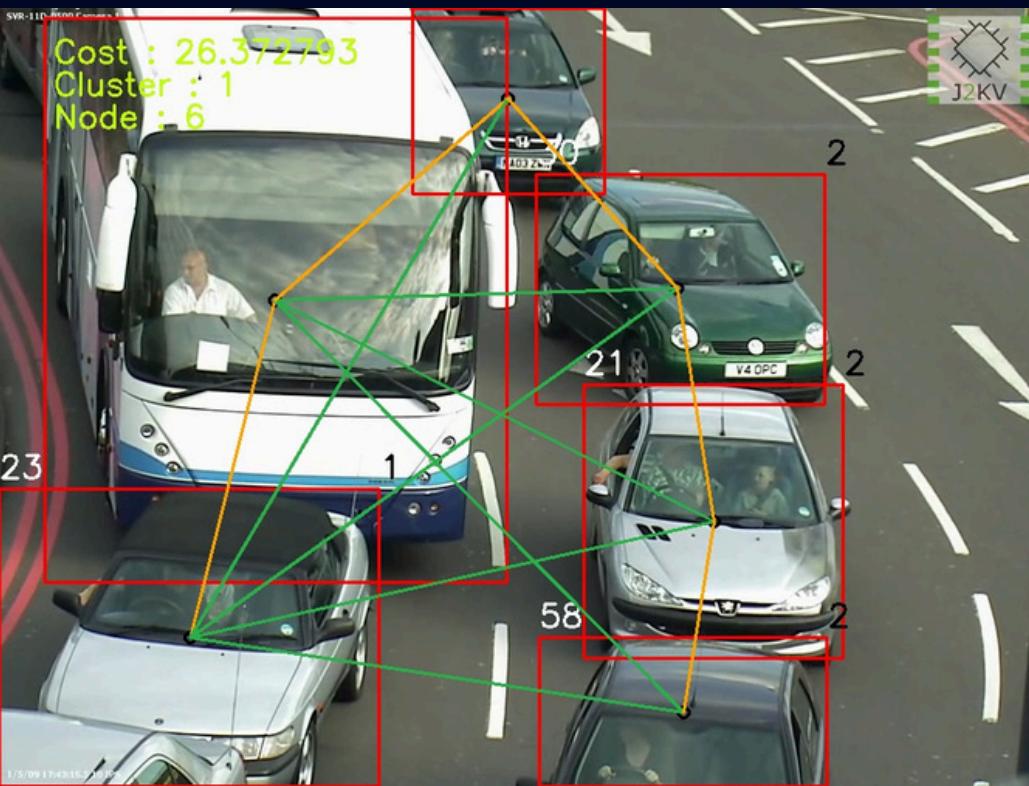
DANGER



Warning



Normal



Safe



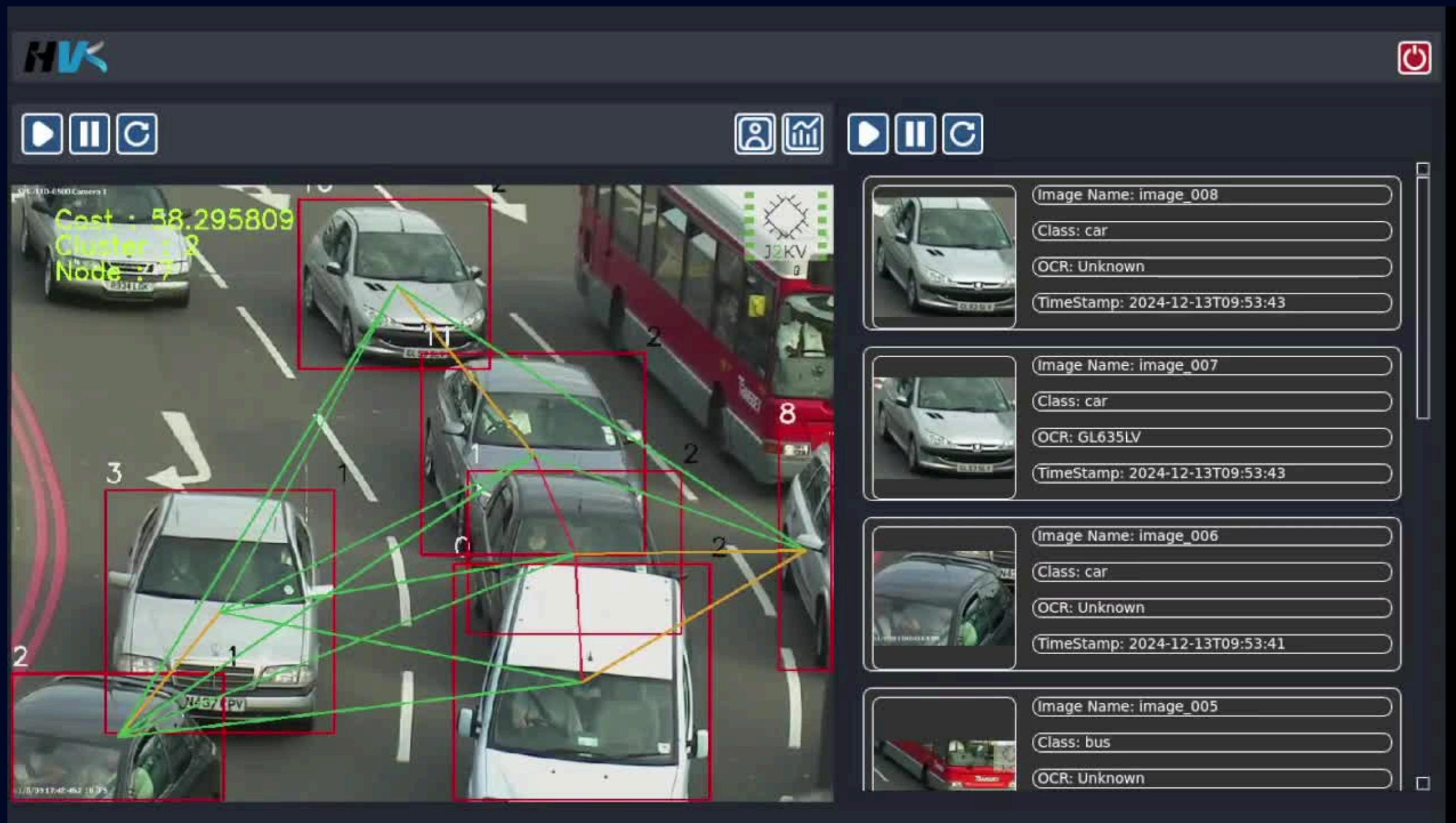
02 Development Process

요약



02 Development Process

목표



03 Team Role

파트별 담당



김규진



김태훈



김한빈



장윤재



조세기

기능부

통신부

통신부

클라이언트부

클라이언트부

AI

HTTP

RTP

지수 분석

UI/UX

데이터 전송

알고리즘

데이터 출력

Q&A

감사합니다