

# AI영상분석을 이용한 교통량 분석 및 데이터 구축 솔루션 소개

## Introduction of Traffic Analysis and Data Construction Solution Using AI Image Analysis

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Electron

PCN

2025-02-28 19:28:26  
26.02-004

Line 1

[26] Pickup\_Truck-4

[92] General-3

No	Date & Time	Lane	Class ID	Classification	Confidence	Speed
445	2025-02-28 19:28:26	line-1	1	Motorcycle-1	0.74	35
446	2025-02-28 19:28:35	line-1	1	Motorcycle-1	0.81	69
447	2025-02-28 19:29:51	line-1	4	Pickup_Truck-4	0.89	60
448	2025-02-28 19:33:04	line-1	4	Pickup_Truck-4	0.89	60
449	2025-02-28 19:34:19	line-1	4	Pickup_Truck-4	0.87	46
450	2025-02-28 19:34:33	line-1	1	Motorcycle-1	0.81	100
451	2025-02-28 19:34:50	line-1	3	General-3	0.78	87

Electron

PCN

No. Ruas 2200513

Arah Cikampek

2025-02-28 12:00:57

Line 1

[311] [310] Motorcycle

[308] Motorcycle

IPCIend Sudirman

Arah Jakarta

No	Date & Time	Lane	Class ID	Classification	Confidence	Speed
172	2025-02-28 16:10:01	line-1	1	Motorcycle-1	0.61	41
170	2025-02-28 16:09:56	line-1	4	Pickup_Truck-4	0.36	19
171	2025-02-28 16:09:56	line-2	4	Pickup_Truck-4	0.36	19
160	2025-02-28 16:07:32	line-1	1	Motorcycle-1	0.63	31
161	2025-02-28 16:07:32	line-1	1	Motorcycle-1	0.72	39
162	2025-02-28 16:07:34	line-1	1	Motorcycle-1	0.63	28
163	2025-02-28 16:07:35	line-1	1	Motorcycle-1	0.76	33

# History – PCN co.,Ltd

- Company History

Established May-1-2000

- Business

AI CCTV Traffic Analysis and Data Construction Monitoring system. Release 2022



# AI-based real-time vehicle detection traffic control system

- ROI 영역 설정을 통한 사용자가 원하는 영역에 대한 모델 분석 진행

Set ROI area to conduct model analysis of user-desired areas

- 검지 라인을 통한 차량 정보 시각화 및 DB 저장

Visualize vehicle information via detection line and store DB

- 통계 버튼을 통해 일별 교통량, 평균 속도, 점유율 확인 가능

Daily traffic, average speed, and occupancy can be checked through the statistics button

## Traffic Jam



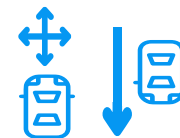
2022 ITS Performance  
(Average Acc 97%)

## Speed



2022 ITS vehicle speed acc  
(Average speed Acc 96%)

## Occupancy



2022 ITS Occupancy  
(Average Acc 92%)

## Vehicle count



ICT Classification of Vehicles  
12-kinds

# AI-based real-time vehicle detection traffic control system

본사의 기술력은 주간/야간 모두 ITS 성능평가\* 기준 '최상급' 만족

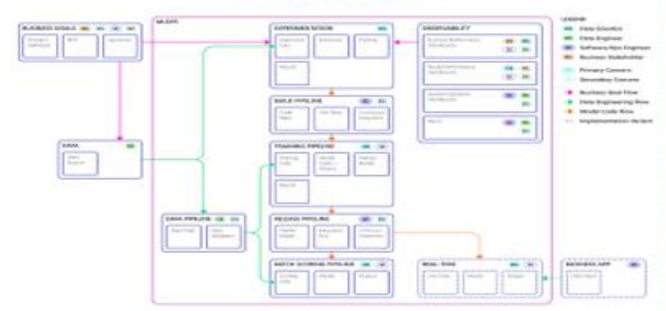
## Detection

지속적인 자체 데이터 생성



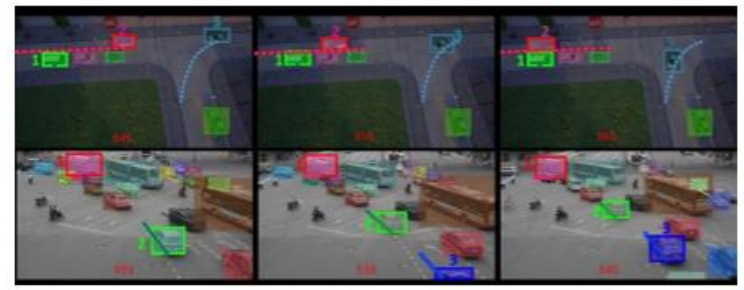
月  
6만 건 이상

MLOps 수준 2



## Tracking

Multiple Object Tracking



다중 객체 인식 모델 강화  
 - 다양한 각도, 위치에 따른 Object Tracking 기술력  
 - 한 대의 기존 CCTV로도 다중 객체 인식이 가능함  
 기존 인프라 활용 & 불필요한 카메라 대수 감소

4대 → 1대

## Counting

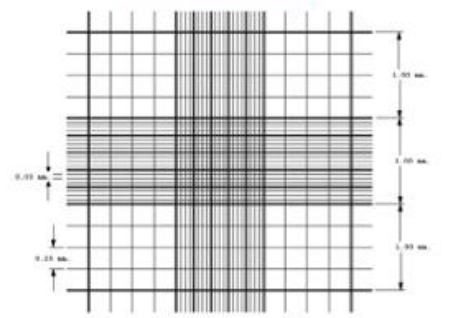
박스 영역

궤도 추적

ROI



Grid Counting



이 기준은 국가통합교통체계효율화법 제86조에 따라 지능형교통체계(Intelligent Transport Systems) 장비, 시스템, 서비스의 기능, 성능이 일정수준으로 유지되도록 유도하는 것을 목적으로 ITS 성능평가를 시행하는데 필요한 기준, 절차, 방법 등 필요한 사항을 규정함을 목적으로 한다.

# Entire System Block Diagram

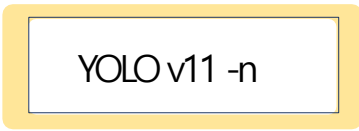
<HW Device >



- Vehide Image / Detection
- Image Data Analysys/Training
- Send DATA



Engine



- Detection
- Analysis
- Occupancy

DB



- Data Backup 24hr
- Client Transfer

Function



- Display Detect
- Config Env
- Display table/ Graph

< Client / Admin >



- Vehide Display / Function Display
  - Setting/ Configuration
- \*ROI,Line,RTSP,Jetson Control



- Display Detect stat
- Table / Graph
- Occupancy



- Display Detect vehicle
- Set Config Env
- Graph / Table/ Calc
- Config Jetson



\*Exe based  
Node.js / JavaScript

# Entire System Structure



**CCTV**

Internet LAN-RTSP



**AI-PC  
with GPU**

Internet LAN

**Tensorrt**  
**Web API** **FastAPI**

**Ubuntu**

**DataBase-24hr  
backup**  
-SQLite  
-PostgreSQL



**ELECTRON**

Windows/Ubuntu  
/Android/Iphone

**Monitor Tools -TMS system  
Function Display  
Configuration**

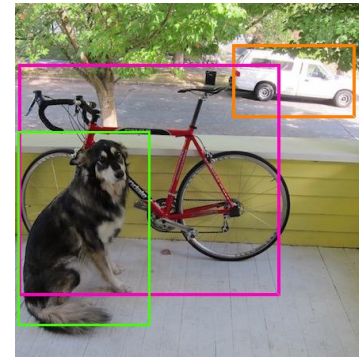
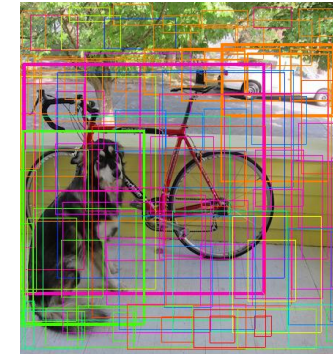
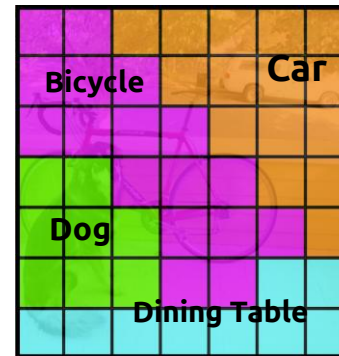
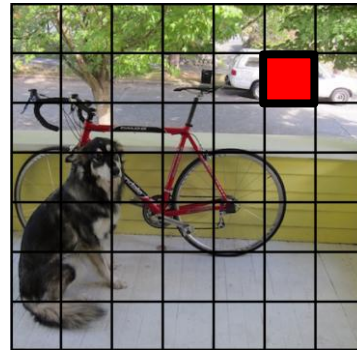
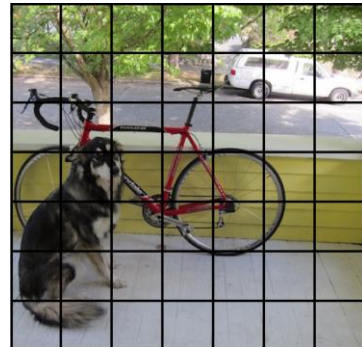
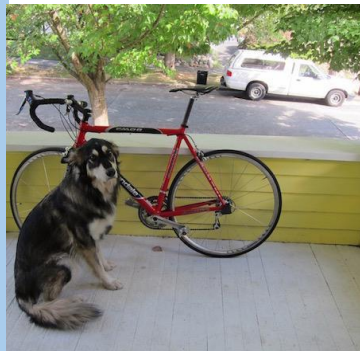
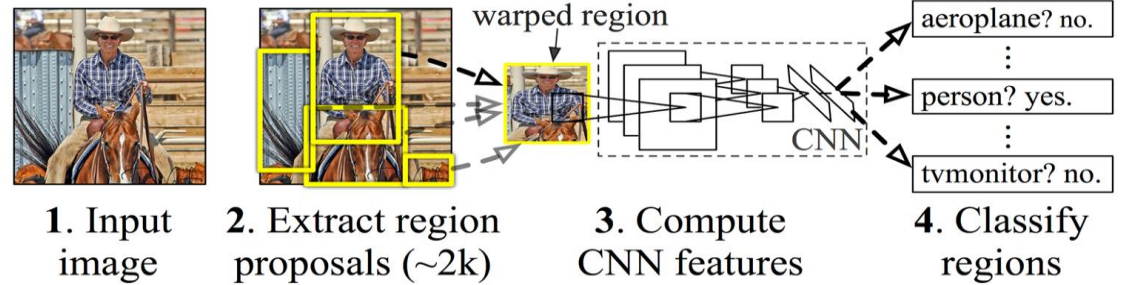
# AI Object Detection technique - YOLO v11



**YOLO v11**

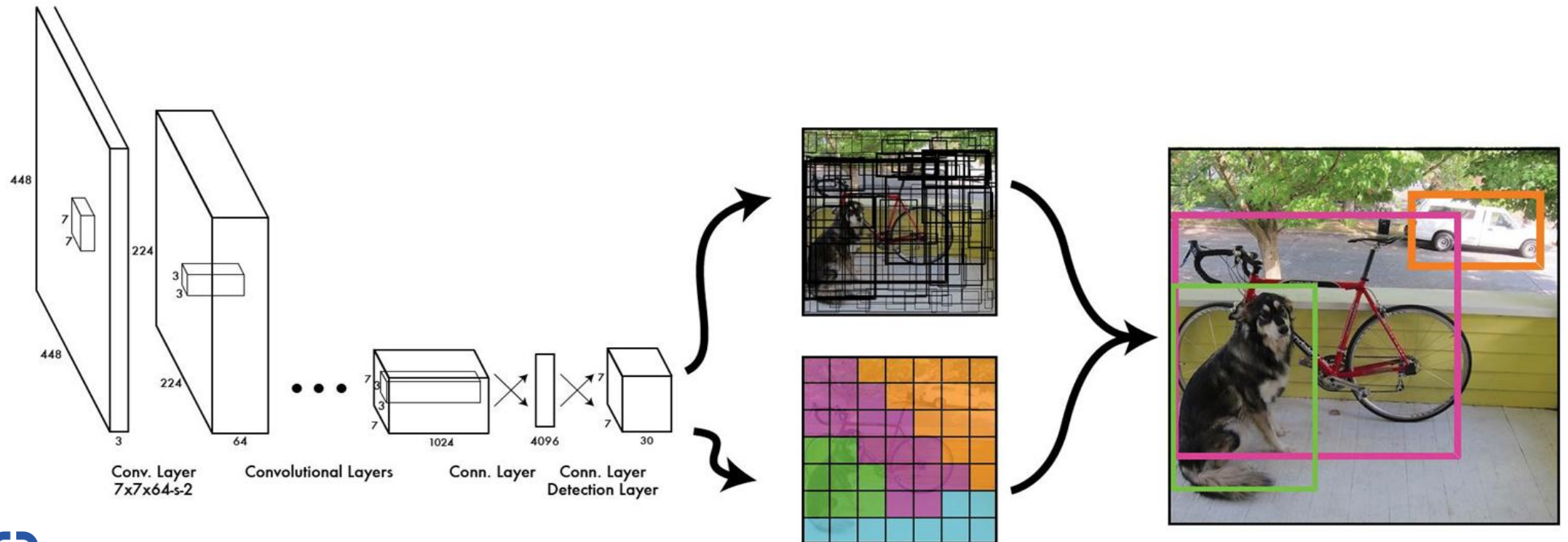
**Model - YOLO v11-n model**  
**Backbone - resnet18**

## R-CNN: Regions with CNN features



# AI Object Detection technique - YOLO v11

Thus we can train one neural network to be a whole detection pipeline



# AI Object Tracking technique - SORT advanced

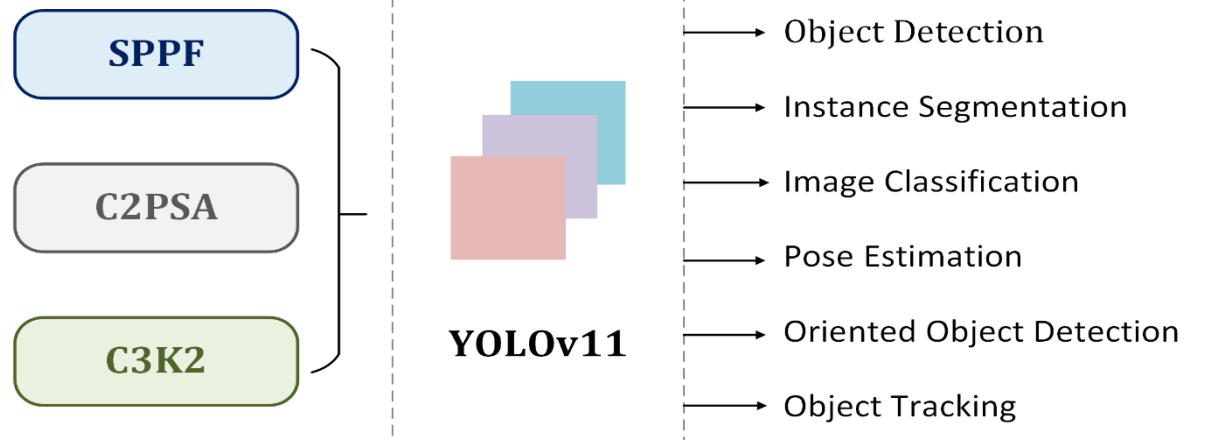


**YOLO v11**

**Optimizing Network**

**ONNX/TensorRT**

**Real time Object Tracking**  
**Backbone -resnet18-**  
**>CSPDarkNet**  
**FPN(Faster Rcn-Feature pyramid Network)**  
**Path Aggregation Network**

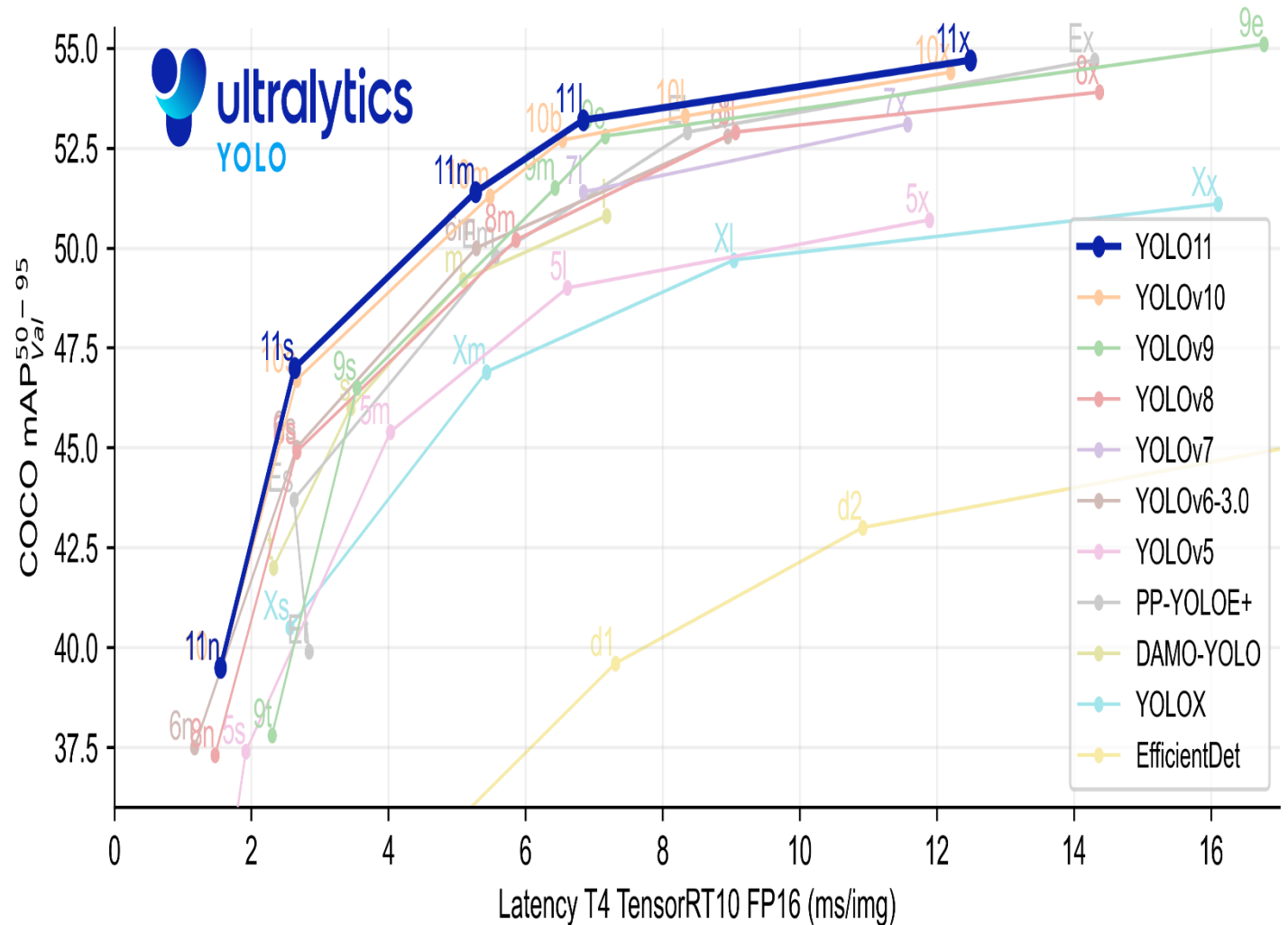


# AI YOLO v11 – performance chart



## Yolo v11n

	mAP	Speed	
DPM v5	33.7	.07 FPS	14 s/img
R-CNN	66.0	.05 FPS	20 s/img
Fast R-CNN	70.0	.5 FPS	2 s/img
Faster R-CNN	73.2	7 FPS	140 ms/img
YOLO	69.0	45 FPS	22 ms/img



# H/W Enhancement for AI

## Edge Solution-Nvidia Jetson Xavier NX

## Server Solution – OnPromise/Cloud Nvidia GPU/Intel Core



CPU	Jetson Xavier NX
Memory	8GB or above
Storage	SSD 500GB
유선LAN	1Gbps
I/O PORT	USB 3.0 * 2개 이상, HDMI 1개, DC-in
OS	ubuntu 20.04 64bit PC
DB	PostgreSQL/MariaDB/



CPU	Intel 10세대 Core i3-10305
Memory	16GB
Storage	SSD 500GB, HDD 1TB
Graphic	NVIDIA Geforce RTX3060 8GB or above
유선LAN	10/100/1000 Mbps x 2 RJ45 Port
I/O PORT	USB 3.0 * 2개 이상, HDMI 1개, DC-in
PSU	700W Dual Power Supply
OS	ubuntu 20.04 64bit PC
DB	Sqllite/PostgreSQL/MariaDB/MySQL

# AI-based real-time vehicle detection – UI and client for Server Connect



**Server Front  
/Back**



**Electron API**

**Web API**

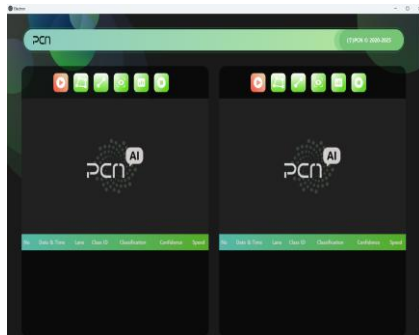
**Node.js 22**

**FastAPI**

**Python/C++**

# AI-based real-time vehicle detection – UI and client for Server Connect

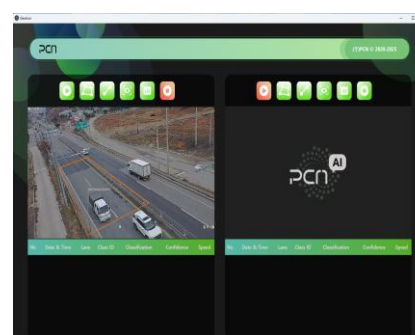
메인화면



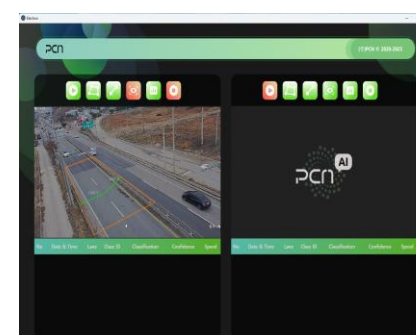
SETTING



ROI SETTING



LINE  
SETTING



ANALYSIS



프로그램 실행

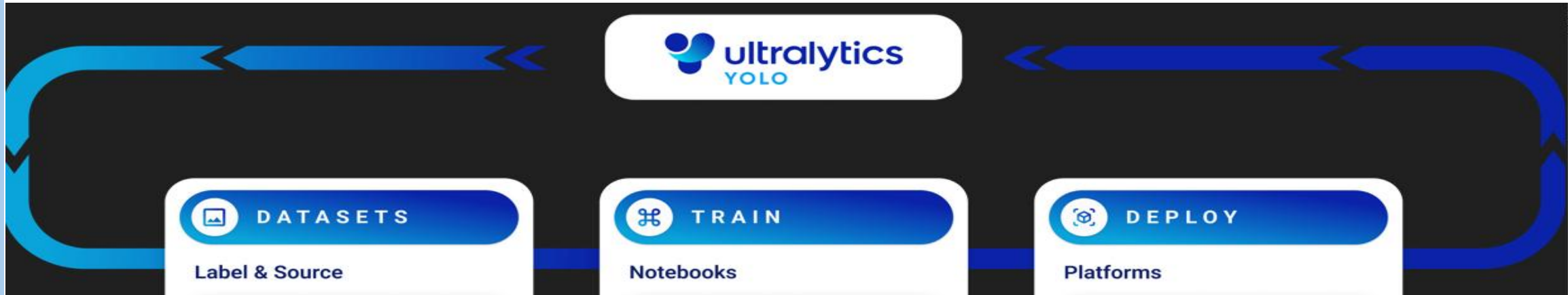
영상 정보 입력

분석 영역 선택

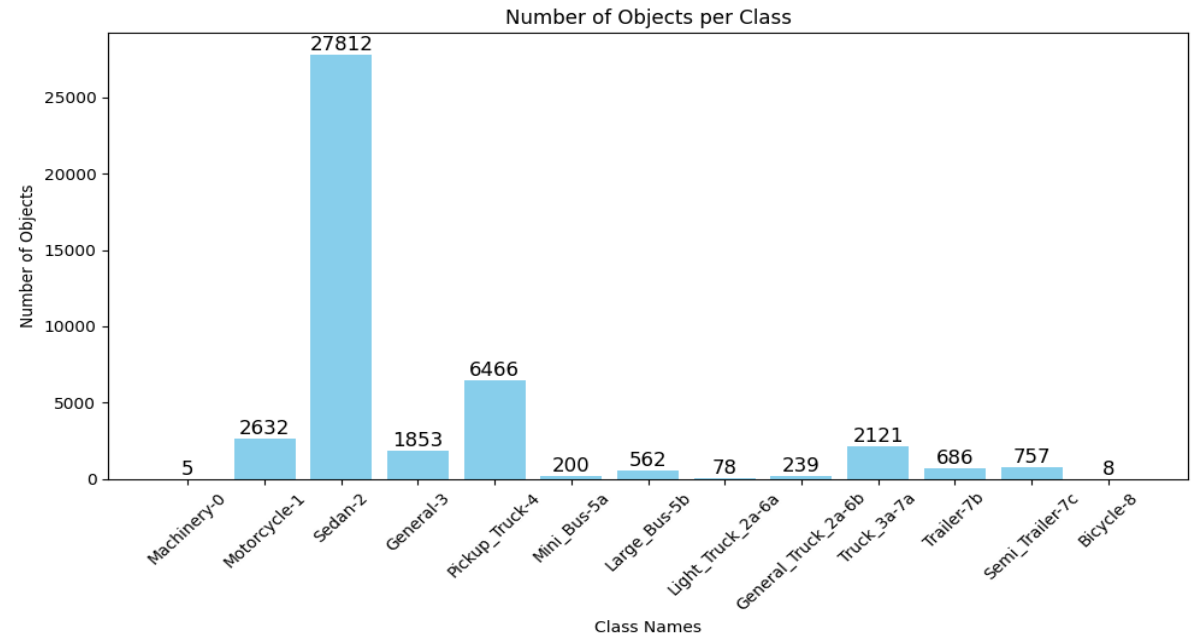
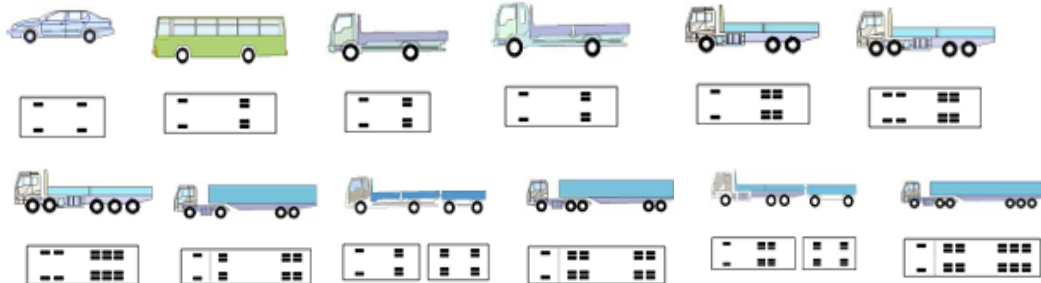
검출 구간 설정

분석 시작

# Reinforcement Training vehicle ImageDB gathering, annotation, training, deploying tools – UI and client for Server Connect

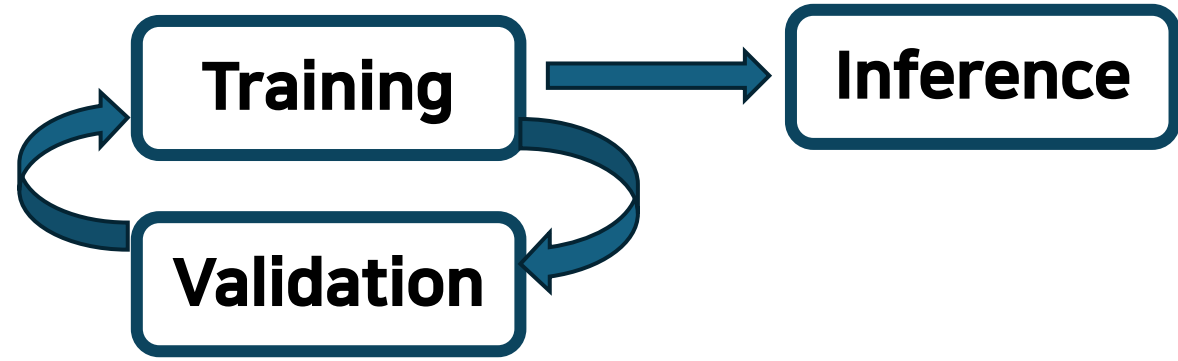
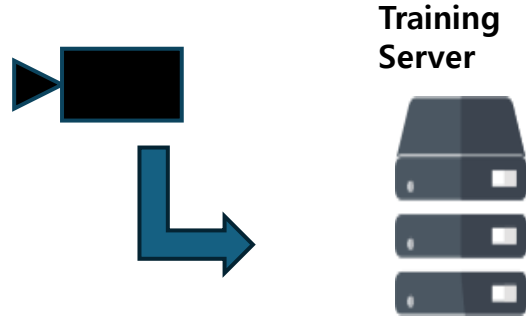


## 12-type vehicle image data



# Reinforcement Training vehicle ImageDB gathering, annotation, training, deploying tools – UI and client for Server Connect

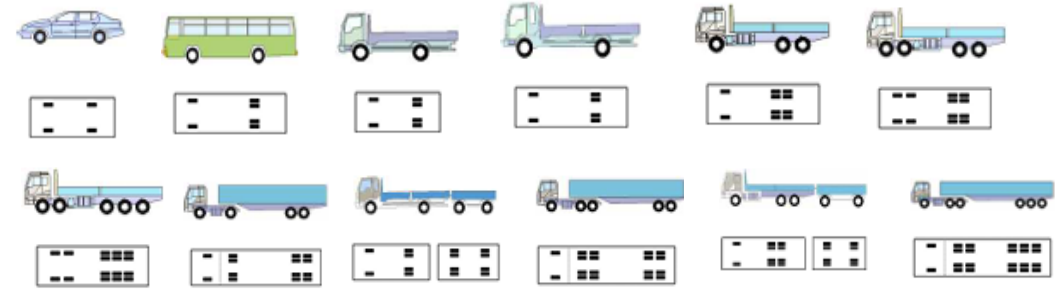
2 Axle Truck - S 0.88



repo structure

```
├── README.md
├── requirements.txt
├── test_image.png
├── code
│   ├── EDA
│   │   ├── highway_EDA.ipynb
│   │   ├── highway_train.csv
│   │   └── highway_valid.csv
│   ├── data_handling
│   │   ├── draw_bounding_box.py
│   │   ├── highway_dataset_preprocess.ipynb
│   │   ├── highway_images_folder_merge.ipynb
│   │   └── highway_labels_xml2txt.ipynb
│   └── train.ipynb # YOLOv8 모델 학습
├── models # 각 모델 폴더 하위 weights 폴더에 pt 파일 있음
├── train_aug_m71
├── train_back_m100
├── train_back_x100 # best model
└── train_de_m100
```

12-type vehicle image data



# TMS Monitoring

Admin Login screen

### ITS Operating system

**ID**

**PASSWORD**

#### 비밀번호 변경

일반회원이아이디	<input type="text" value="ADMIN"/>
기존 비밀번호 *	<input type="password"/>
비밀번호 *	<input type="password"/>
비밀번호확인 *	<input type="password"/>



**Develop Framework**

# TMS Monitoring

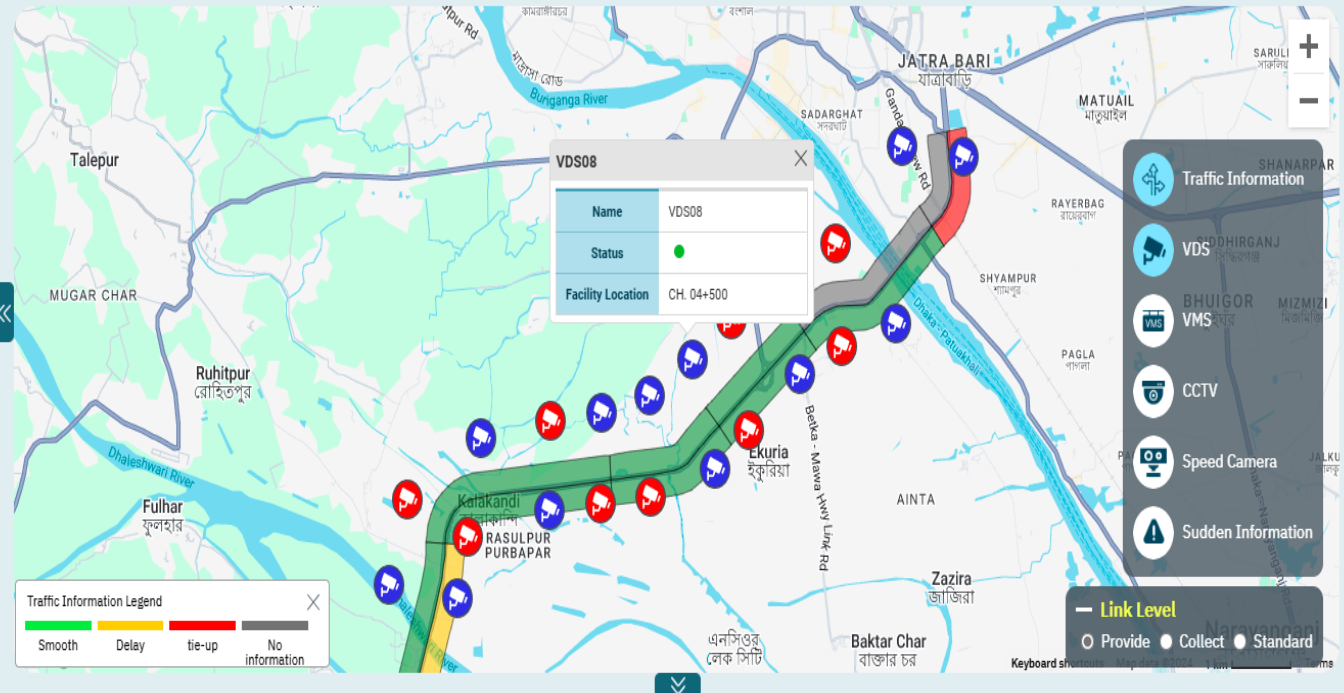
Main Menu screen

VDS Status VMS Status CCTV Status speed camera status Incident information

Total		Normal	Fault
60		36	24

No.	Facility ID	Name	Status	Installation Loca
1	<input type="checkbox"/> VDBD1301	VDS01	●	CH. 00+078
2	<input type="checkbox"/> VDBD1302	VDS02	●	CH. 00+078
3	<input type="checkbox"/> VDBD4001	VDS03	●	CH. 02+848
4	<input type="checkbox"/> VDBD4002	VDS04	●	CH. 02+848
5	<input type="checkbox"/> VDBD4003	VDS05	●	CH. 03+720
6	<input type="checkbox"/> VDBD4004	VDS06	●	CH. 03+720
7	<input type="checkbox"/> VDBD4005	VDS07	●	CH. 04+500
8	<input checked="" type="checkbox"/> VDBD4006	VDS08	●	CH. 04+500
9	<input type="checkbox"/> VDBD4007	VDS09	●	CH. 05+637
10	<input type="checkbox"/> VDBD4008	VDS10	●	CH. 05+637
11	<input type="checkbox"/> VDBD4009	VDS11	●	CH. 06+403
12	<input type="checkbox"/> VDBD4010	VDS12	●	CH. 06+403
13	<input type="checkbox"/> VDBD4011	VDS13	●	CH. 07+597
14	<input type="checkbox"/> VDBD4012	VDS14	●	CH. 07+597
15	<input type="checkbox"/> VDBD4013	VDS15	●	CH. 08+475
16	<input type="checkbox"/> VDBD4014	VDS16	●	CH. 08+475
17	<input type="checkbox"/> VDBD4015	VDS17	●	CH. 09+360
18	<input type="checkbox"/> VDBD4016	VDS18	●	CH. 09+360
19	<input type="checkbox"/> VDBD4017	VDS19	●	CH. 10+721



System/Facility Status Monitoring

No.	System	Status	Modification Date and Time
1	VDS Comm.	●	2024-09-03 07:40:50
2	VMS Comm.	●	2024-09-03 07:41:28
3	CCTV Comm	●	2024-09-03 07:41:19
4	Speed Enforc	●	2024-09-03 07:41:14
5	Packet Comr	●	2024-09-03 07:41:48
6	Data Process	●	2024-09-03 07:41:00
7	ITS Operatin	●	2024-09-03 07:41:30
8	Wall Screen	●	2024-09-03 07:41:30

Facility Total: 60

No.	VDS ID	VDS Name	VDS contr	Detection	Installatio	Manufact.	Model Nar	Set Date a	Installatio	Detection	Number o	Equipmen	Communi	Communi	X Coordin	Y Coordin	Availabilit	Registrati	Registran	Date of m	Modifier II
1	<input type="checkbox"/> VDBD1301	VDS01	VDS_01	CH. 00+07					78				10.10.30.1	6899	90.435422	23.702664	Used				admin
2	<input type="checkbox"/> VDBD1302	VDS02	VDS_02	CH. 00+07					78				10.10.30.1	6899	90.425151	23.703908	Used				admin
3	<input type="checkbox"/> VDBD4001	VDS03	VDS_03	CH. 02+84					2848				10.10.30.1	6899	90.424260	23.683056	Used				admin
4	<input type="checkbox"/> VDBD4002	VDS04	VDS_04	CH. 02+84					2848				10.10.30.1	6899	90.414049	23.692506	Used				admin
5	<input type="checkbox"/> VDBD4003	VDS05	VDS_05	CH. 03+72					3720				10.10.30.1	6899	90.415009	23.680305	Used				admin
6	<input type="checkbox"/> VDBD4004	VDS06	VDS_06	CH. 03+72					3720				10.10.30.1	6899	90.404693	23.688890	Used				admin
7	<input type="checkbox"/> VDBD4005	VDS07	VDS_07	CH. 04+50					4500				10.10.30.1	6899	90.407978	23.677105	Used				admin
8	<input checked="" type="checkbox"/> VDBD4006	VDS08	VDS_08	CH. 04+50					4500				10.10.30.1	6899	90.389941	23.678740	Used				admin
9	<input type="checkbox"/> VDBD4007	VDS09	VDS_09	CH. 05+63					5637				10.10.30.1	6899	90.399491	23.670488	Used				admin
10	<input type="checkbox"/> VDBD4008	VDS10	VDS_10	CH. 05+63					5637				10.10.30.1	6899	90.396464	23.683456	Used				admin



# TMS Monitoring

## System Management

System Management | Facility Management | Facility Control | Traffic Situation Management | History Inquiry | Statistics Inquiry | Basic Information Management

admin | Logout

VDS > Facility Management > VDS

소통정보 | CCTV | VMS | 돌발정보

Nimtola Bazar Point

Search

Search Word: Search | Used

List Total: 60

No.	VDS Name	VDS ID	Section Dir	Installation	Manufactur	Model Nam	Set Date an	Installation	Detection L	Number of I	Equipment	Communica	Comm
1	VDS01	VDBD1301	Mawa	CH. 00+078				78				10.10.30.14	8899
2	VDS02	VDBD1302	Dhaka	CH. 00+078				78				10.10.30.14	8899
3	<input checked="" type="checkbox"/>	VDS03	VDBD4001	Mawa	CH. 02+848			2848				10.10.30.14	8899
4	<input type="checkbox"/>	VDS04	VDBD4002	Dhaka	CH. 02+848			2848				10.10.30.14	8899
5	<input type="checkbox"/>	VDS05	VDBD4003	Mawa	CH. 03+720			3720			90.41404911	23.69250621	Used
6	<input type="checkbox"/>	VDS06	VDBD4004	Dhaka	CH. 03+720			3720			90.41500921	23.68030541	Used
7	<input type="checkbox"/>	VDS07	VDBD4005	Mawa	CH. 04+500			4500			90.40466361	23.66889071	Used
8	<input type="checkbox"/>	VDS08	VDBD4006	Dhaka	CH. 04+500			4500			90.40797801	23.67710571	Used
9	<input type="checkbox"/>	VDS09	VDBD4007	Mawa	CH. 05+837			5837			90.38994111	23.67874051	Used
10	<input type="checkbox"/>	VDS10	VDBD4008	Dhaka	CH. 05+837			5837			90.39949111	23.67048871	Used
11	<input type="checkbox"/>	VDS11	VDBD4009	Mawa	CH. 06+403			6403			90.39648431	23.66345671	Used
12	<input type="checkbox"/>	VDS12	VDBD4010	Dhaka	CH. 06+403			6403			90.39378181	23.66588681	Used
								6403			90.38275421	23.67449181	Used

Initialization | Search

Basic Information(Modification)

VDS ID	VDBD4001	Road direction	Mawa
VDS Name	VDS03	Installation Location	CH. 02+848
Manufacturer Name	Enter characters	Model Name	Enter characters
Installation date	년-월-일 ()	Installation Condition	2848
Detection Lane	Enter number	Number of Detection Lanes	Enter number
Equipment Number	Enter number	Communication IP	10.10.30.14
Communication Port	8899	Use Status	Used
X Coordinate	90.424260755	Y Coordinate	23.68305663

Initialization | Delete | Save

# TMS Monitoring

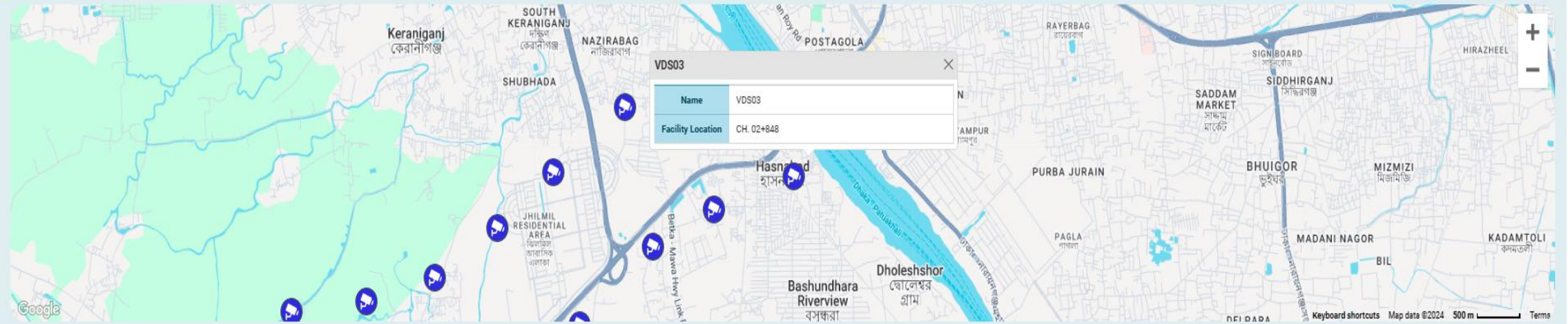
## System Control



- System Management
- Facility Management
- Facility Control
- Traffic Situation Management
- History inquiry
- Statistics Inquiry
- Basic Information Management

admin Logout

VDS Facility Management > VDS



Search

Search Word  Search  Initialization Search

List Total: 60

Excel Download

Basic Information(Modification)

No.	VDS Name	VDS ID	Section Dirr	Installation	Manufactur	Model Namr	Set Date an	Installation	Detection L	Number of I	Equipment	Communica	Communica	X Coordinat	Y Coordinat	Availability	Registrar	Registrant I	Date of moc	Modifier ID
1	VDS01	VDBD1301	Mawa	CH. 00+078				78				10.10.30.14	8899	90.4354223	23.7028642	Used				admin
2	VDS02	VDBD1302	Dhaka	CH. 00+078				78				10.10.30.14	8899	90.42515111	23.7039086	Used				admin
3	VDS03	VDBD4001	Mawa	CH. 02+848				2848				10.10.30.14	8899	90.4242807	23.8830566	Used				admin
4	VDS04	VDBD4002	Dhaka	CH. 02+848				2848				10.10.30.14	8899	90.4140491	23.8925082	Used				admin
5	VDS05	VDBD4003	Mawa	CH. 03+720				3720				10.10.30.14	8899	90.4150092	23.8803054	Used				admin
6	VDS06	VDBD4004	Dhaka	CH. 03+720				3720				10.10.30.14	8899	90.4046838	23.8888907	Used				admin
7	VDS07	VDBD4005	Mawa	CH. 04+500				4500				10.10.30.14	8899	90.4079780	23.8771057	Used				admin
8	VDS08	VDBD4006	Dhaka	CH. 04+500				4500				10.10.30.14	8899	90.3899411	23.8787405	Used				admin
9	VDS09	VDBD4007	Mawa	CH. 05+637				5837				10.10.30.14	8899	90.3994911	23.8704887	Used				admin
10	VDS10	VDBD4008	Dhaka	CH. 05+637				5837				10.10.30.14	8899	90.3984643	23.8834587	Used				admin
11	VDS11	VDBD4009	Mawa	CH. 06+403				6403				10.10.30.14	8899	90.3937818	23.8858868	Used				admin
12	VDS12	VDBD4010	Dhaka	CH. 06+403				6403				10.10.30.14	8899	90.3827542	23.8744918	Used				admin

Basic Information(Modification)

VDS ID:  Road direction:

VDS Name:  Installation Location:

Manufacturer Name:  Model Name:

Installation date:  Installation Condition:

Detection Lane:  Number of Detection Lanes:

Equipment Number:  Communication IP:

Communication Port:  Use Status:

X Coordinate:  Y Coordinate:

Initialization Delete Save



# TMS Monitoring

History Search



System Management

Facility Management

Facility Control

Traffic Situation Management

History inquiry

Statistics Inquiry

Basic Information Management

admin

Logout



VDS Status History

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Search Word:  Date(Searchable up to 2 months): 2024-07-24 00:00 ~ 2024-07-24 16:32 Per Page: 100

Initialization

Search

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No.	Collection Date and Time	VDS Name	VDS ID	VDS controller ID	Status	Installation Location	Installation Condition	Camera IP	Communication IP	Communication Port
1	2024-07-24 13:32:11	VDS42	VDBD3520	VDS_42	Normal	CH. 23+742	23742	10.10.200.133	10.10.30.17	6899
2	2024-07-24 13:32:11	VDS59	VDBD3537	VDS_59	Normal	CH. 31+770	31770	10.10.200.184	10.10.30.17	6899
3	2024-07-24 13:32:11	VDS56	VDBD3534	VDS_56	Normal	CH. 30+440	30440	10.10.200.175	10.10.30.17	6899
4	2024-07-24 13:32:11	VDS53	VDBD3531	VDS_53	Normal	CH. 29+797	29797	10.10.200.166	10.10.30.17	6899
5	2024-07-24 13:32:11	VDS50	VDBD3528	VDS_50	Normal	CH. 27+301	27301	10.10.200.157	10.10.30.17	6899
6	2024-07-24 13:32:11	VDS45	VDBD3523	VDS_45	Fault	CH. 25+645	25645	10.10.200.142	10.10.30.17	6899
7	2024-07-24 13:32:10	VDS41	VDBD3519	VDS_41	Normal	CH. 23+742	23742	10.10.200.130	10.10.30.17	6899
8	2024-07-24 13:32:10	VDS58	VDBD3536	VDS_58	Fault	CH. 31+100	31100	10.10.200.181	10.10.30.17	6899
9	2024-07-24 13:32:10	VDS55	VDBD3533	VDS_55	Normal	CH. 30+440	30440	10.10.200.172	10.10.30.17	6899
10	2024-07-24 13:32:10	VDS52	VDBD3530	VDS_52	Fault	CH. 28+075	28075	10.10.200.163	10.10.30.17	6899
11	2024-07-24 13:32:10	VDS49	VDBD3527	VDS_49	Fault	CH. 27+301	27301	10.10.200.154	10.10.30.17	6899
12	2024-07-24 13:32:10	VDS47	VDBD3525	VDS_47	Fault	CH. 26+500	26500	10.10.200.148	10.10.30.17	6899
13	2024-07-24 13:32:10	VDS46	VDBD3524	VDS_46	Normal	CH. 25+645	25645	10.10.200.145	10.10.30.17	6899
14	2024-07-24 13:32:10	VDS44	VDBD3522	VDS_44	Fault	CH. 24+550	24550	10.10.200.139	10.10.30.17	6899
15	2024-07-24 13:32:09	VDS43	VDBD3521	VDS_43	Fault	CH. 24+550	24550	10.10.200.136	10.10.30.17	6899
16	2024-07-24 13:32:09	VDS60	VDBD3538	VDS_60	Normal	CH. 31+770	31770	10.10.200.187	10.10.30.17	6899
17	2024-07-24 13:32:09	VDS57	VDBD3535	VDS_57	Fault	CH. 31+100	31100	10.10.200.178	10.10.30.17	6899
18	2024-07-24 13:32:09	VDS54	VDBD3532	VDS_54	Normal	CH. 29+797	29797	10.10.200.169	10.10.30.17	6899
19	2024-07-24 13:32:09	VDS51	VDBD3529	VDS_51	Normal	CH. 28+075	28075	10.10.200.160	10.10.30.17	6899
20	2024-07-24 13:32:09	VDS48	VDBD3526	VDS_48	Fault	CH. 26+500	26500	10.10.200.151	10.10.30.17	6899
21	2024-07-24 13:32:07	VDS36	VDBD3514	VDS_36	Normal	CH. 20+620	20620	10.10.200.115	10.10.30.15	6899
22	2024-07-24 13:32:07	VDS39	VDBD3517	VDS_39	Normal	CH. 22+510	22510	10.10.200.124	10.10.30.15	6899
23	2024-07-24 13:32:06	VDS21	VDBD4019	VDS_21	Normal	CH. 11+679	11679	10.10.200.70	10.10.30.15	6899
24	2024-07-24 13:32:06	VDS38	VDBD3516	VDS_38	Normal	CH. 21+770	21770	10.10.200.121	10.10.30.15	6899



Any Questions ?

Thanks for visit